Financial Risk Management

WORKBOOK

The ICFAI University

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For any clarification regarding this book, the students may please write to the ICFAI University giving the above reference number of this book specifying chapter and page number.

While every possible care has been taken in type-setting and printing this book, the ICFAI University welcomes suggestions from students for improvement in future editions.

Contents

Preface

The ICFAI University has been upgrading the study material so that it is amenable for self study by the Distance Learning Students.

We are delighted to publish a Workbook for the benefit of the students preparing for the examinations. The workbook is divided into six parts.

Brief Summaries of Chapters

A brief summary of all the chapters in the textbook are given here for easy recollection of the topics studied.

Part I: Questions and Answers on Basic Concepts (with Explanatory Notes)

Students are advised to go through the relevant textbook carefully and understand the subject thoroughly before attempting Part I. Under no circumstances the students should attempt Part I without fully grasping the material included in the textbook.

Frequently used Formulae

Similarly the formulae used in the various topics have been given here for easy recollection while working out the problems.

Part II: Problems and Solutions

The students should attempt Part II only after carefully going through all the solved illustrations in the textbook. A few repetitive problems are provided for the students to have sufficient practice.

Part III: Applied Theory: Questions and Answers

All theory questions are applied in nature. Having understood the basics in the textbook, the students are expected to apply their knowledge to certain real life situations and develop relevant answers. To be able to answer the applied theory questions satisfactorily all the students are advised to follow regularly the Analyst magazine, business magazines and financial dailies.

Part IV: Case Studies: Problems and Solutions

A case study attempts to test the cognitive skills of the student in integrating various concepts covered in the subject with focus on quantitative aspects. Hence, students should attempt them only after they are thorough with the entire subject.

Part V: Caselets: Questions and Answers

A caselet also tests the cognitive skills of the student in integrating various concepts but with focus on qualitative aspects. Students are advised to try to answer the questions given at the end of the articles in the ICFAI Analyst to develop their skills further. The caselets given in this part also help students gain the adequate exposure on how current events of interest can be analyzed and interpreted.

Part VI: Model Question Papers (with Suggested Answers)

The students should attempt all model question papers under simulated examination conditions. They should self score their answers by comparing them with the model answers.

Please remember that the ICFAI University examinations are quite rigorous and demanding. The student has to prepare well for each examination. There are no short-cuts to success. We hope that the students will find this workbook useful in preparing for the ICFAI University examinations.

Work Hard. Work Smart. Work Regularly. You have a good chance to succeed. All the best.

Brief Summaries of Chapters

Introduction to Risk Management

- The terms Risk and Uncertainty are used interchangeably but they have a distinct meaning. Risk is a situation when there are a number of specific probable outcomes and it is not certain which one will happen. Uncertainty is where even the probable outcomes are not known.

- Risk management does not always mean risk reduction, but maintenance of risk at a desired level.

- There are various types of risks to which a business may be subjected.

- The tools available for managing the risk are: Avoidance, loss control, separation, combination and transfer.

- No foolproof system can ensure that risk is totally abolished and most of the techniques are based on past experiences.

Total Risk: Main Issues

- Risks can be divided into pure risks and speculative risks. Pure risks are those in which the management has no direct control while speculative risks are those in which the management can have full control.

- The main types of pure risks are property exposure, liability exposure, life and health exposure and financial exposure.

- Risks can also be divided into acceptable risks and unacceptable risks as well as static risks and dynamic risks.

- The main costs of risk are risk identifying costs, risk handling costs, actual losses, social costs, loss financing costs, loss control costs and residual uncertainty costs.

Corporate Risk Management

- Risk and return are two sides of the same coin. While an investor may be risk averse, every investor would like to get some positive return on his investments.

- Corporate risk management refers to the process of a company managing its risks at an acceptable level. It is a scientific approach to deal with various kinds of risks faced by a corporate entity.

- The main approaches to risk management are risk avoidance, loss control, combination, separation, risk transfer, risk retention and risk sharing.

- The risk management process consists of determining the objectives, identifying the risks, risk evaluation, development of policy, development of strategy, implementation and review.

- The main risk management tools are hedging, forwards, futures, options, swaps and hybrid debt securities.

Financial Engineering

- "Financial Engineering is a sophisticated management technique aimed to mange the risk and return of financial transactions. It involves the design, the development and the implementation of innovative financial instruments and processes, and the formulation of creative solutions to problems in finance".

- Objective of financial engineering is to decompose standard financial transactions into small elements and then synthesize these elements into innovative cross-market structures, or new combinations customized to the requirements of the parties involved.

- Financial Engineering is directed at the corporate and institutional level as well as the retail and customer level. Apart from this, financial engineering can be applied in a number of important areas like corporate finance, trading, investment and money management, and risk management.

- A financial engineer can make use of two kinds of tools to effectively deal with a problem – conceptual tools and physical tools. Conceptual tools are used to gain familiarity with the basics of finance, and physical tools are used to precisely implement the financial engineering process.

- The factors, which contributed to a heavy growth in financial engineering, can be divided into environmental factors and intrafirm factors.

- The environmental factors are those factors, which are external to the firm but still have an impact on the firm's performance. The firm has virtually no control over these factors. The environmental factors include price volatility, globalization of markets, tax asymmetries, technological advances, advances in financial theory, regulatory change and increased competition, and transaction costs.

- The intra firm factors consist of those factors, which are internal to the firm and impact the firm's performance. The firm has at least little control over these factors. These factors include liquidity needs, risk aversion among managers and owners, agency costs, greater levels of quantitative sophistication among investment managers, and more formal training of senior level personnel.

Introduction to Derivatives

- The derivatives market grew very fast in the last decade and is still growing at a fast pace.

- These markets have created an efficient system for transfer of risk throughout a global financial system.

- Unplanned trading in derivatives can prove very risky as was the case of Barings PLC and Sumitomo Corporation.

- Derivatives could either be traded in the organized exchanges or over the counter.

- Clearing houses offset customers dealings and assure the financial integrity of the transactions that take place in the exchange.

- The important features of derivatives are the relationship of the derivatives to the underlying assets, the facility to take short positions, the liquidity and low trading costs, the possibility of constructing a portfolio as required without owning the underlying assets.

- The participants in the derivatives market are hedgers, speculators and arbitrageurs.

- Trading in equity futures has started in India. At a reasonable good pace the derivatives market are growing in India.

Futures

- Futures contracts are legally binding agreements to buy or sell a predetermined quantity of a commodity of a specified quality at a predetermined future date and price.

- A long position means one agrees to buy and a short position means one agrees to sell.

- Futures are traded on organized exchanges with respective clearinghouses. Exchanges usually have two types of members namely floor brokers and floor traders.

- A futures contract should specify the exact nature of the asset, price, contract size, delivery arrangements, delivery months, tick size, daily fluctuation limits and trading units.

- There are three types of margins in futures market: Initial margin, maintenance margin and variation margin.

- There are various types of orders in the futures market which can be divided into market orders, market-if-touched, time orders, limit orders, market-on-close orders, stop-loss orders, exchange for physicals orders, discretionary orders, not held orders and spread orders.

- The settlement procedure can be by physical delivery, cash settlement, offsetting and exchange of futures for physicals.

- Basis means the difference between the cash price and the futures price of a commodity and the extent to which the cash price exceeds the future price at a point of time is called the cost of carry.

- The main motives behind using futures are hedging, speculation and arbitraging.

- Futures are of various types and depending on the underlying asset, can be divided into physical commodities, energy sources, foreign currency, interest earning assets or an index.

- Currency futures are binding obligations to buy or sell a particular currency against another at a designated rate of exchange on a specified future date.

- Currency risk can be hedged with the help of currency futures, where both the exporters and importers can hedge their positions by buying or selling futures.

- Interest rate future is an agreement to buy or sell a standard quantity of specific interest bearing instruments, at a predetermined future date and at a price agreed upon between the parties.

- Interest rate future can be both short-term as well as long-term. Their tremendous growth is attributed to the growth in the market for fixed income securities and increased fluctuation in interest rates worldwide.

- Short-term interest rate futures are mainly treasury bill futures and Eurodollar futures while long-term interest rate futures are mainly treasury bonds futures.

- Hedging with interest rate futures can be short-term hedging for borrowing decisions or long-term hedging for investing decisions.

- Index futures contract is an obligation to deliver at settlement, an amount equal to 'x' times the difference between the stock index value on the expiration date of the contract and the price at which the contract was originally struck.

- Index futures contracts are cash settled, listed on the exchange, offset prior to expiration, guaranteed by the stock exchange and carry margin requirements for both the buyer and the seller.

- Index futures are mainly used for stock index arbitrage, hedging positions and beta management.

- Portfolio insurance is a dynamic hedging strategy of buying and selling securities periodically to achieve desired results of maintaining expected losses at a certain predetermined limit.

- Commodity futures contracts are agreements to buy or sell a standard quantity of specific commodity, at a predetermined future date and at a price agreed upon between the parties.

- Commodity futures can be for agricultural commodities, metallurgical commodities and energy commodities.

- Commodity futures in India are very thinly traded and mostly limited to coffee. The trading of coffee futures is done through COFEI (Coffee Futures Exchange of India Ltd.).

Options

- An option is a contract where the seller gives the buyer the right but not the obligation to purchase a designated instrument or asset as a specific price which is agreed upon at the time of entering into the contract.

- A call option gives the buyer of the option the right to purchase the underlying asset and a put option gives the buyer of the option the right to sell the underlying asset.

- An option can be in-the-money, out-of-the-money or at-the-money, depending on whether the strike price is below, above or equal to the stock price respectively.

- Options can be American or European. While American options can be exercised on any day till expiration date, European options can only be exercised on the expiration day.

- The factors influencing the option price are the current price of the underlying asset, the strike price of the option, the time left to maturity, the volatility of the underlying asset, the risk-free rate of interest in the economy and the dividends (if any) expected during the life of the option.

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- There are four elementary trading strategies in options, namely long call, short call, long put and short put.

- Positions in options can be opened or closed with a purchase or sale.

- Margins are imposed on the option traders in accordance to the rules of the exchange to avoid defaults and losses.

- Other types of options are currency options, index options, futures options, borrowers options, lenders options, over-the-counter options, etc.

- The main trading strategies with options are covered call writing, protective put, straddle, strangle, strip, strap and spread (vertical, horizontal and diagonal).

- Various combinations of spreads are possible like bull and bear vertical spreads, horizontal or time spreads, horizontal or time reverse spreads, diagonal spreads, box spreads, butterfly spreads, ratio spreads, condor spreads and calendar spreads.

- Arbitrage with options involves buying calls and selling puts of the same stock with the same strike price and expiry date. The three main types of arbitrages involve synthetics, conversions and reversals.

- For non-dividend paying stocks, the calls should be exercised on expiration and the puts should be exercised immediately.

- For dividend paying stocks, if the dividend can be estimated with certain accuracy, the calls should be exercised immediately.

- Under the put-call parity principle, the value of the call + an amount of cash equal to $Xe^{-r(T-t)}$ should be equal to the value of the put + the underlying stock, or else it will give rise to arbitrage opportunities.

- The binomial pricing model is based on the construction of a binomial tree which represents the possible paths followed by the underlying asset price over the life of the option. It is used to estimate the fair value of a call or put option.

- Binomial trees can be of a single period (one-step binomial trees) or two-step binomial trees (more than one period).

- Black-Scholes option pricing model aims to establish a no-arbitrage portfolio to value the option when the stock prices are binomial, as both the stock price and option price are influenced by the same underlying source of uncertainty in the stock price movements.

- The assumptions of Black-Scholes model: Short selling of securities is permitted, there are no taxes and transaction costs, there are no dividend payments during the life of the option, no arbitrage opportunities are there, security trading is continuous, the risk-free rate of return is constant and the terms of exercise are European (exercise on maturity).

- The main advantage of Black-Scholes is the ease to use and its reasonable accuracy in pricing the option.

- The main disadvantages of Black-Scholes is its inability to compute the pricing of complex derivative products and the results being totally based on past data.

- Volatility is a measure of the market speed in relation to the variations in the stock prices.

- The main types of volatility are future volatility, historical volatility and implied volatility.

- The two main reasons for volatility are trading of the stock in the stock markets and insider information. However, various studies concluded that volatility is mainly because of trading in the stock markets.

- Options that are more complicated than the standard European and American options are known as exotic options.

- The main types of exotic options are Asian options, barrier options, bermudan options, binary options, chooser options, compound options, flex options, lookback options, rainbow options, exchange options and home-made artificial options.

- Options are used for reducing the variability of returns, betting on information and generating optimal portfolios.

- The risks associated with options are risks of buying options and risk of writing options.

- The risk of buying options involves the chance of a loss of the entire premium as the option is a wasting asset when it expires.

- The risks of writing options are the writer faces the risk of being assigned an exercise, the writer of the covered call foregoes the opportunity to benefit from an increase in the value and there are additional risks involved in multiple options transactions.

Financial Swaps

- Financial swaps means the agreed exchange of future cash flows with or without the exchange of cash flows at present. In other words, a financial swap is an agreement between two parties to exchange interest payments for specific maturity on an agreed upon notional amount.

- Broadly, financial swaps are classified as interest rate swaps and currency swaps.

- The swap markets have the following limitations: Difficulty to identify a party with opposite requirements for the swap, difficulty in termination of the contract, existence on inherent default risks, underdeveloped secondary markets for swaps, limited application of the theory of comparative advantage in real life situations, no exchange control in over the counter transactions.

- Interest rate swap is an agreement between two or more parties to exchange interest payments over a specific period of time on agreed terms.

- The conventions followed in interest rate swaps are as follows: actual/360, actual/actual, actual/365 and the payment convention for holidays is known as follows: modified following day, following business day and preceding business day.

- Other types of interest rate swaps are basis swap, forward swap, deferred rate swap, callable swap, putable swap, extendible swap, rate capped swap, zero coupon swap, forward swap, amortizing swap, amortized swap, accreting swap and roller-coaster swap.

- Swaptions are options on swaps that give the holder the right to enter into a swap at a future date. Swaptions can be either American or European and also either call swaptions or put swaptions.

- Commodity swaps are those swaps in which one of the parties pays a fixed rate for the commodity and the other party pays a market rate over the period of the swap.

- Equity swaps means an exchange of dividend earned and capital gains on a portfolio which is based on a stock index against periodic interest payments.

- The underlying motives for swaps are lower financing costs, reduced currency or interest risk management, facility to enter new markets and larger scale of operations.

- Currency swaps are contracts involving exchange of interest payments on a loan in one currency for fixed or floating interest payments on an equivalent loan in a different currency. These swaps may or may not involve initial exchange of principal.

- The basic steps in currency swaps are initial exchange of principal, exchange of interest payments and re-exchange of the principal at the end of the contract.

- The main different types of currency swaps are fixed-to-fixed currency swap, fixed-to-floating currency swap, circus swap, etc.

- The major bottlenecks in pricing a swap are arriving at the appropriate discount factor, valuation of two streams of cash flows and difficulty in calculating the first payment on the floating leg.

- The main swap risks are interest rate risks, currency exchange risks, market risks, credit risks, mismatch risks, basis risks, spread risks, settlement risks and sovereign risks.

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Accounting for Derivatives

- FASB requires the accounting of all derivatives in the balance sheet as assets or liabilities and as either balance sheet items or off-balance sheet items.

- SFAS was introduced to resolve inconsistencies in proper display of the derivative instruments in the financial statements, uniformity in disclosure as on and off-balance sheet items, uniformity in measurement and to give more clarity to the disclosure of derivatives.

- The following contracts are not subject to SFAS No. 133: Regular way security trades, normal purchases and normal sales, certain insurance contracts, certain financial guarantee contracts and certain contracts that are not traded in the exchanges.

- Other contracts that are not considered as derivative instruments are contracts indexed to the company's equity or classified in shareholders' equity and contracts issued in stock based compensation arrangements.

- Embedded derivatives which are accounted for are interest rate indexes, leveraged inflation indexed payments, calls and puts that do not accelerate the principal repayment, term extending options, equity-indexed interest payments, commodity indexed interest or principal payments, convertible debt conversion options and convertible preferred stock convertible options.

- Embedded derivatives that are not accounted separately are interest rate caps, floors and collars, non-leveraged inflation indexed interest payments or rentals, credit sensitive payments, plain-vanilla servicing rights, calls and puts that accelerate principal repayments, term extending options if the interest rate is concurrently reset approximately to the market rates, contingent rentals with variable interest rates.

- Gains or losses in fair value hedges are reported as follows for hedging instruments-in the earnings, for hedged items-in the earnings, for carrying amount-by adjusting gains or losses resulting from hedged risk, the differences being usually due to hedging ineffectiveness.

- A fair value hedge is effective if the principal and notional amount of the swap match, the fair value of the swap is zero at the beginning, the net settlements are computed as in interest rate swaps, there is no prepayment facility, the terms are typical to both the instruments, the maturity date of the instrument and of the swap match, there is no ceiling or floor on the variable interest rate of the swap and the time period between repricing is long enough to assume the market rates.

- Gains or losses in cash flow hedges are reported as follows the effective portion is reported in other comprehensive income, the derivative gains or losses are reported in the earnings, any other accumulated comprehensive component is reported in the earnings.

- The following are the salient points of the current rate method assets/liabilities are converted at the current exchange rates on the balance sheet date; equity is converted at historical rates; revenues and expenses are converted at weighted average rates; disposal of investment in foreign subsidiary becomes the part of gain or loss from the transaction and is eliminated.

- The following are the salient points of the remeasurement method assets/liabilities with historical balances are remeasured by the historical exchange rate method; monetary assets/liabilities are remeasured by the exchange rate on the date of the balance sheet; revenues and expenses are remeasured using the weighted average exchange rate for the period; for high inflation economies the currency of reporting should be the US$.

- There are pure tax havens and hybrid tax havens. The factors to be considered while selecting the tax haven are political and economic stability of the country, the tax structure, treaties that exist on tax, exchange controls, nature of legal, banking and accounting systems, communication facilities and the cost of forming a company.

Sensitivity of Option Premiums

- There are five measures of sensitivity: delta, gamma, theta, rho and vega.

- Delta is the ratio of change in the price of an option to change in the price of the underlying asset.

- Gamma is the rate of change of the option's delta with respect to the price of the underlying stock.

- Theta is a measure of sensitivity of the option with reference to the time to expiration.

- Rho is a measure of the sensitivity of the option value to change in the interest rates.

- Vega is the measure of sensitivity of option premiums with respect to volatility of the asset provided other factors determining the option premium are constant.

- Portfolio insurance or dynamic hedging is the process of reducing losses by buying put options on the stock in addition to the underlying stock or by creating put options synthetically.

Weather Derivatives

- Weather derivatives are the derivatives created based on the climate and weather of 10 large American cities.

- There are two indices of weather: Heating Degree Days (HDD) and Cooling Degree Days (CDD).

- HDD is either 0 degrees F if the weather is above 65 degrees F or 65 degrees F less the actual temperature, if the actual temperature is less than 65 degrees F.

- CDD is either 0 degrees F if the weather is below 65 degrees F or 65 degrees F less the actual temperature, if the actual temperature is more than 65 degrees F.

- Both can never be negative and the HDD is used to measure the index in the winter months, while the CDD is used to measure the index in the summer months.

- The value of the weather index is the cumulative total of the CDD or HDD multiplied by $100.

- Weather derivatives could be used in India as the weather tends to be quite erratic and a large majority of the population depends on agriculture for subsistence.

Value at Risk

- Value at Risk (VaR) is a statistical measure of the maximum potential loss from uncertain events over a particular time horizon measured in a probabilistic scale in units of currency. It is the probability of loss exceeding 1% on one of the days of the time period.

- The steps to calculate VaR are decide the confidence level that should not be exceeded, develop the probability statement, consider the market driven factors, determine the time horizon and calculate the loss in the given parameters.

- There are four ways of measuring VaR: Historical pattern of observations, Monte Carlo simulations, variance/co-variance methods and hybrid methods.

- The uses of VaR are as follows: Measurement of risk adjusted performance and compensation, identifying the effects caused by substantial future movements in the value of the portfolio, establishment of position limits, lowering project risks, assess the capital adequacy ratio for the economy, ALM, measurement of foreign currency exposures, interest rate changes, effectiveness of hedging, management of swap credit risks, evaluation of complex transactions to be undertaken in investment management overall.

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- The limitations of VaR are as follows: Extreme situations cannot be measured, the focus is on a single arbitrary point, it uses many assumptions, it may not build optimal decision rules, it is a statistical and not a managerial tool, it cannot capture model risks, volatility is not stable, price linearity may not be there, the distribution of values and correlation may not be stable, it is based on past data and intra-day positions are not considered. By conducting stress test in addition to normal AaR procedure we can get the VaR for extreme scenarios.

- Riskmetrics is a methodology created as a software to estimate the market risk based on the concept of VaR. It employs a comprehensive set of daily re-estimated volatilities and correlations across a broad range of instruments as input to estimate market risk.

Introduction to Insurance: Life and Non-Life

- Insurance is an *uberrimae fides* contract where one party agrees to compensate the other in consideration for a smaller sum.

- The elements of an insurance contract are insurable interest, utmost good faith, indemnity, subrogation, warranties, proximate clause, assignment and nomination.

- Insurance in India is divided into Life Insurance and General Insurance.

- Recently, the Government of India has opened the insurance sector to private parties. This is bound to bring more competition to the industry and better service to the public.

Part I: Questions on Basic Concepts

Introduction to Risk Management

1. Risk can be defined as

    a. Variance in the operating income due to expected changes in some factors

    b. Variance in the value of assets, liabilities and operating income due to unanticipated changes in some factors

    c. The actual and potential loss suffered due to changes in some factors

    d. Variance in the value of assets, liabilities and operating income due to unfavorable changes in some factors

    e. All of the above.

2. A risk manager normally tries to cover the risk to

    a. Earn more profits

    b. Reduce known losses

    c. Reduce the uncertainty of cash flows

    d. Both (a) and (c) above

    e. All of the above.

3. Which of the following is **not** a technique for measuring risk?

    a. Variance.

    b. Semi-variance.

    c. Range.

    d. Standard deviation.

    e. None of the above.

4. Which of the following statements is/are **true**?

    a. Risk is the possibility of a loss.

    b. Peril is a cause of a loss.

    c. Hazard is a factor that increases possibility of a loss.

    d. Both (b) and (c) above.

    e. All of the above.

5. The job of a Risk Manager involves identification of

    a. The nature of risk

    b. The remedial measures available for managing risk

    c. The cost of managing risk

    d. Both (a) and (b) above

    e. All of the above.

6. Which of the following is **not** a tool for managing risk?

    a. Avoidance.

    b. Separation.

    c. Transfer.

    d. Loss control.

    e. None of the above.

7. Insurance is a _____ technique for managing risk.

    a. Avoidance

    b. Loss control

    c. Separation

    d. Combination

    e. Transfer.

8. Insurance policy for vehicles covering third party risk is a _____ technique for managing risk.

    a. Separation

    b. Combination

    c. Transfer

    d. Risk financing

    e. None of the above.

9. The selection of suitable methods for risk management depends upon which of the following?

    a. Degree of risk acceptable to the management.

    b. Firm's expectation about the future outlook.

    c. Extent of managing risk depending on the level of operations of the firm.

    d. All of the above.

    e. None of the above.

10. Options/Futures are _____ techniques for managing risk.

    a. Loss control

    b. Hedging

    c. Transfer

    d. Combination

    e. Separation.

11. The objective function of the risk management policy of a banking firm is to

    a. Aim at profitability through price matching

    b. Ensure liquidity through maturity matching

    c. Eliminate risks originating due to exchange rate fluctuations

    d. Forecast the interest rate movements

    e. Only (a), (b) and (d) above.

12. Which of the following statements defines risk?

    a. Possibility of actual outcome being different from the expected outcome.

    b. There are a number of specific, probable outcomes, but it is not certain as to which one of them will actually happen.

    c. There are a number of probable outcomes, the outcomes being unknown and it is not certain as to which one of them will actually happen.

    d. Only (a) above.

    e. Both (a) and (b) above.

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13. Identify the **false** statement.

    a. Risk is generally measured using the concept of standard deviation.

    b. The degree of risk present in a particular situation is an absolute, independent amount.

    c. Degree of risk is dependent on the level of information available with the entity facing the risk.

    d. As the market value of a firm's shares is closely related to the profit earned by it, corporate risk can also be termed as the possibility of a company's actual Profits After Tax (PAT) being different from the expected PAT.

    e. Both (c) and (d) above.

Total Risk: Main Issues

14. Which of the following risks will **not** affect exchange risk?

    a. Inflation risk.

    b. Interest rate risk.

    c. Sovereign risk.

    d. Investment risk.

    e. None of the above.

15. Which of the following statements is **false**?

    a. A profitable firm will have little or no liquidity risk.

    b. Market risk is also known as price risk.

    c. Liquidity risk and incorrect capital structure are the prime reasons for financial risk.

    d. Liquidity risk may also refer to the possibility of a firm having excess funds but no profitable avenues for deployment.

    e. None of the above.

16. Which of the following is an internal business risk?

    a. Market collapse.

    b. Legal risk.

    c. Processing risk.

    d. Government policy.

    e. None of the above.

17. Which of the following statements is **true**?

    a. A firm that has borrowed money on a floating rate basis faces the risk of lower profits in an increasing interest rate scenario.

    b. In an increasing interest rate scenario, a firm having fixed rate assets will encounter a higher value for its investments.

    c. A firm that has fixed rate borrowing and floating rate investments has a higher risk than a firm having fixed rate borrowing and fixed rate investments.

    d. Both (a) and (c) above.

    e. All of the above.

18. When there is a counterparty failure in performing repayment obligation, it gives rise to low quality assets, which in turn leads to

    a. Financial risk

    b. Default risk

    c. Credit risk

    d. Market risk

    e. Legal risk.

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19. In non-acceptable risks

    a.   Potential loss is minimal

    b.   Potential gain is minimal

    c.   Potential loss is substantial

    d.   Potential loss and gain are substantial

    e.   Both (a) and (b) above.

20. Pure risks are the type of

    a.   Acceptable risks

    b.   Unacceptable risks

    c.   Static risks

    d.   Dynamic risks

    e.   None of the above.

21. The costs, which are incurred to take precautions and limits on the chances of recurrence of risks is called

    a.   Loss control costs

    b.   Loss financing costs

    c.   Risk identifying costs

    d.   Residual uncertainty costs

    e.   None of the above.

22. Insuring one's business covers the

    a.   Pure risks

    b.   Acceptable risks

    c.   Unacceptable risks

    d.   Dynamic risks

    e.   All of the above.

23. Business event risk may be

    a.   Disaster risk

    b.   Legal risk

    c.   Reputation risk

    d.   Taxation risk

    e.   All of the above.

24. Which of the following is a default risk?

    a.   Risk of non-recovery of sums due from outsiders.

    b.   Risk of a possible bankruptcy arising due to the inability of the firm to meet its financial obligations.

    c.   Risk of having excess funds.

    d.   Risk of an adverse effect of interest rate movements on a firm's profit or balance sheet.

    e.   None of the above.

25. While taking up an overseas project, a company faces

    a.   Political risk

    b.   Sovereign risk

    c.   Inflation risk

    d.   Currency risk

    e.   All of the above.

26. Which of the following risks fall under the category of Interest Rate Risk?

    a. Volatility risk.

    b. Rate level risk.

    c. Prepayment risk.

    d. Reinvestment risk.

    e. All of the above.

27. When the costs/yields of liabilities/assets are linked to a floating rate and there is no simultaneous movement in the interest rates, it leads to

    a. Basis risk

    b. Put risk

    c. Prepayment risk

    d. Real interest rate risk

    e. Volatility risk.

28. The Beta (β) co-efficient is measured by

    a. The non-diversifiable risk of an asset in relation to that of the market portfolio

    b. The systematic risk of an asset in relation to that of the market portfolio

    c. The market risk of a security in relation to that of the market portfolio

    d. The systematic risk of an asset in relation to that of the unsystematic risk of an asset

    e. (a), (b) and (c) above.

29. The firm producing and selling in domestic market may face _____ risk when the economy is opened.

    a. Operating risk

    b. Transaction risk

    c. Translation risk

    d. Both (a) and (b) above

    e. Both (b) and (c) above.

30. Which of the following risks is absent for a buyer of a futures contract?

    a. Market risk.

    b. Counterparty risk.

    c. Liquidity risk.

    d. Business risk.

    e. Financial risk.

31. Risk of the assets of a firm **not** being readily marketable is called

    a. Market risk

    b. Marketablity risk

    c. Business risk

    d. Financial risk

    e. Exchange risk.

32. Which of the following is an external business risk?

    a. Labor strike.

    b. Machinery breakdown.

    c. Changes in customer preferences.

    d. Government policy.

    e. Both (c) and (d) above.

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33. Which of the following statements are **false**?

    a.   Hedging transactions are zero-NPV transactions when trading is costless and markets are completely efficient.

    b.   When you buy or sell a futures contract the price is fixed today but payment is made at a later stage.

    c.   A holder of a financial futures contract is eligible for dividends and interest payments made on the underlying security.

    d.   A holder of a futures contract forgoes the convenience yield on the underlying commodity.

    e.   Purchasing a commodity in the futures market enables the holder to save on storage, insurance and wastage costs.

34. Which of the following statements is/are **false**?

    a.   A firm having fixed rate assets faces the risk of lower value of investments in decreasing interest rate scenario.

    b.   A firm having fixed rate assets faces the risk of lower value of investments in an increasing interest rate scenario.

    c.   Interest rate risk becomes prominent when the assets and liabilities of a firm do not match in their exposure to interest rate movements.

    d.   Exchange risk occurs due to interlinkages between the various markets.

    e.   Liquidity risk also refers to the possibility of having excess funds and no profitable avenues for deployment.

Corporate Risk Management

35. The aim of risk management is to

    a.   Maintain unsystematic risk at the desired level

    b.   Maintain systematic risk at the desired level

    c.   Cost to be kept minimum

    d.   Both (a) and (c) above

    e.   Both (b) and (c) above.

36. Risk includes

    a.   Upside potentials

    b.   Downside movement

    c.   Certain losses

    d.   Both (a) and (b) above

    e.   All of the above.

37. Which of the following investments **do not** have default risk?

    a.   Corporate deposit.

    b.   Corporate paper.

    c.   Company debenture.

    d.   Treasury bill.

    e.   Bonds issued by Financial Institutions.

38. Which of the following is a primary risk?

    a.   Regulatory risk.

    b.   Interest rate risk.

    c.   Counterparty risk.

    d.   Inflationary risk.

    e.   None of the above.

39. Which of the following statements is **false**?

    a.   Primary risks to be borne by a firm to generate profit.

    b.   Secondary risks are not integrally related to business.

    c.   Primary risks can be covered to a large extent.

    d.   Secondary risks can be covered to a large extent.

    e.   None of the above.

40. A firm having floating rate liabilities has decided to invest in floating rate assets, such a type of risk management is called

    a.   Loss control

    b.   Risk sharing

    c.   Combination

    d.   Separation

    e.   Risk transfer.

41. The concept of Value at Risk (VaR) is closely linked to concepts of

    a.   Normal distribution

    b.   Standard deviation

    c.   Mean

    d.   Both (a) and (b) above

    e.   All of the above.

42. Logistics Manager may expose a firm to

    a.   Price risk

    b.   Foreign exchange risk

    c.   Liquidity risk

    d.   Product risk

    e.   Operating risk.

43. Which of the following is **not** an external hedging technique?

    a.   Forwards.

    b.   Swaps.

    c.   Futures.

    d.   Options.

    e.   Netting.

44. Which of the following statements is **false**?

    a.   No risk management can be complete in itself.

    b.   Risk management has to be done in anticipation.

    c.   Risk management strategies should not be too rigid.

    d.   Risk management should aim at maintenance of risk at the minimal level.

    e.   None of the above.

45. Hybrid debt instruments can be tied-up with

    a.   Interest rate markets

    b.   Foreign exchange markets

    c.   Equity markets

    d.   Commodity markets

    e.   All of the above.

46. Which of the following statement(s) is/are **true**?

   a. Risk retention refers to the attempt to reduce the possibility of a loss.

   b. Risk is said to be retained when it is reduced or transferred.

   c. Combination refers to the technique of combining more than one business activity to reduce the overall risk of the firm.

   d. Risk sharing is a combination of risk retention and risk transfer.

   e. Both (c) and (d) above.

47. A particular portfolio having a VaR of X at 95% confidence level implies

   a. There is a 95% probability of the portfolio's value falling by more than X

   b. There is a 5% probability of the portfolio's value falling by more than X

   c. There is a 5% probability of the portfolio's value rising by more than X

   d. There is a 95% probability of the portfolio's value rising by more than X

   e. There is a 5% probability of the portfolio's value falling by less than X.

48. Which of the following statements is **true**?

   a. A firm trying to manage its risks can eliminate it completely.

   b. Risk management should be done after the happening of the event.

   c. A firm trying to manage its risks is exchanging certain unacceptable risks for risks, which are acceptable to it.

   d. Every risk management tool is foolproof in itself.

   e. None of the above.

49. Which of the following is/are feature(s) of corporate risk management?

   i. Corporates ignore the concept of risk management.

   ii. It should be looked as a wholistic approach rather than an individual activity.

   iii. All the risks of the corporates can be reduced.

   iv. It helps the managers realize the implications of their actions on the firm's risk level.

   a. (i), (ii) and (iii) above.

   b. (ii), (iii) and (iv) above.

   c. (i), (iii) and (iv) above.

   d. (i), (ii) and (iv) above.

   e. All of (i), (ii), (iii) and (iv) above.

50. Which of the following statements is **true**?

   a. Both systematic as well as unsystematic risks have bearing on the required rate of return.

   b. Only unsystematic risk has bearing on required rate of return.

   c. Only systematic risk is priced and has an influence on required rate of return.

   d. Although unsystematic risk may have no bearing on the required rate of return in the financial markets, unmanaged unsystematic risk can and often does hurt hareholders.

   e. Both (c) and (d) above.

51. Which of the following statements is/are **true** regarding Value at Risk (VaR)?

   a. VaR is a statistical measure calculated over a specific investment horizon.

   b. VaR measures the expected loss arising due to normal market movements in the variables responsible for the portfolio's risk.

   c. VaR does not make a distinction between the downside movements and upside movements of risk.

   d. Both (a) and (b) above.

   e. All of (a), (b) and (c) above.

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52. Value at Risk (VaR)

    a.   Cannot be used to quantify the risk arising out of individual assets/liabilities

    b.   Can be used to lay down the policy for the level of overall risk that is acceptable to the management

    c.   Does not measure 'event' risk

    d.   Both (b) and (c) above

    e.   Both (a) and (c) above.

53. Creation of exposures in the normal course of business which offset the existing exposures is called

    a.   Exposure netting

    b.   Leading

    c.   Lagging

    d.   Hedging

    e.   None of the above.

54. Asset-liability management can be used to manage

    a.   Exchange risk

    b.   Interest rate risk

    c.   Default risk

    d.   Liquidity risk

    e.   (a), (b) and (d) above.

55. Which of the following statements is/are **false**?

    a.   Price of systematic risk is identical for all the participants in the financial market.

    b.   In terms of the discounted cash flow model of firm valuation, unsystematic risk may lower the expected cash flows, even though it has no influence over the discount rate.

    c.   Managing unsystematic risks is not necessary for a firm to enhance investor's wealth.

    d.   Both (a) and (b) above.

    e.   None of the above.

56. Identify the **correct** statement.

    a.   The interest rate on convertible debentures or debentures with warrants is typically lower than that on straight debentures.

    b.   A call option cannot have a negative value.

    c.   Convertible debentures and debentures with warrants make sense when it is costly or difficult to assess the risk characteristics of the issuing firm.

    d.   Both (a) and (b) above.

    e.   All of (a), (b) and (c) above.

57. The inverse floating rate note issued by Sallie Mae in 1986 was a hybrid to manage

    a.   Commodity risk

    b.   Foreign exchange risk

    c.   Interest rate risk

    d.   Conflicts between bondholder and stockholders

    e.   Both (b) and (c) above.

58. Which of the following is the principal motivating factor for introduction of deep discount/zero-coupon bonds in India?

a. Tax benefit.

b. Volatility of interest rates.

c. RBI restrictions.

d. Both (b) and (c) above.

e. None of the above.

59. The distance between the actual price of the warrant and its lower limit is a function of which of the following factors?

a. Variance of the stock returns.

b. Time to expiration.

c. Risk-free interest rate.

d. Both (a) and (b) above.

e. All of (a), (b) and (c) above.

Financial Engineering

60. Who, among the following, coined the term Financial Engineering?

a. Enthusiastic investors.

b. London Central Bank.

c. World Bank.

d. London's Investment Banks.

e. Corporates.

61. The rationale behind the concept of "Financial Engineering" is _____.

a. To aid engineers to perform the finance functions of a firm

b. To look into the financial aspects of the financial projects effectively

c. To aid the market participants to react effectively to the rapidly changing Financial market scenario

d. To make the Financial markets stable

e. To enhance further development of the Finance subject.

62. Which of the following **does not** come under the scope of "Financial Engineering"?

a. Corporate Finance.

b. Trading.

c. Investment Function.

d. Accounting and Bookkeeping

e. Risk Management.

63. Which of the following is **not** a 'Conceptual Tool' of a financial engineer?

a. Hedging Theory.

b. Accounting relationships.

c. Portfolio Theory.

d. Equities.

e. Valuation Theory.

64. Which of the following can be identified as 'Physical Tools' of a 'Financial Engineer'?

    i. Bonds.

    ii. Weather Derivatives.

    iii. Hedging Theory.

    iv. Portfolio Theory.

    v. Securities.

    a. Only (i), (iii), (iv) above.

    b. Only (i), (iv), (v) above.

    c. Only (i), (ii), (v) above.

    d. Only (iv) above.

    e. Only (v) above.

65. Which of the following External/Environmental factors contribute to the growth of Financial Engineering?

    i. Regulatory Changes and increased competition.

    ii. Transaction costs.

    iii. Advances in Financial theory.

    iv. Liquidity needs of firms.

    a. Only (i), (ii) and (iii) above

    b. Only (i), (ii) and (iv) above

    c. Both (iii) and (iv) above

    d. Only (ii), (iii), (iv) above

    e. Only (iv) above.

66. The Internal/Intra-firm factors, which contribute to the growth of Financial Engineer are:

    i. Agency Costs.

    ii. Accounting Benefits.

    iii. Tax Asymmetries.

    iv. Quantitative sophistication and management training.

    a. Both (i) and (iv) above

    b. Both (i) and (iii) above

    c. Only (iii) above

    d. Only (i), (ii) and (iv) above

    e. Only (iii) and (iv) above.

67. Which of the following is **not** a reason for the existence of Tax Asymmetries among the firms?

    a. Different countries impose different tax burdens.

    b. Discrimination between Foreign and Domestic firms in a country's Taxation Policy.

    c. Tax sops provided to certain companies/sectors in order to encourage their development and growth.

    d. Tax exemptions or reductions given to a certain firm, based on its past performance by a country

    e. Firms' inability or ability to pay taxes on the basis of their earned profits.

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68. Which among the following innovation was **not** intended to suffice the "Liquidity Needs" of a firm?

    a. Sweep accounts.

    b. Stock index futures.

    c. Repos.

    d. Money market funds.

    e. Commercial Paper.

69. _____ is one of the important instruments for "Risk aversion"?

    a. Collateralized Mortgage Obligations (CMOs).

    b. Sweep accounts.

    c. Floating rate notes.

    d. Currency options.

    e. Real yield securities.

70. Which of the following statements is **false**?

    a. Collateralized Mortgage Obligations (CMOs) were created to protect the investors from prepayment risks.

    b. CMOs are considered to possess a high level of credit quality due to the underlying collateral's quality.

    c. CMOs take same cash flow that a conventional pass through certificates generates.

    d. CMO is an innovation, which is intended to suffice the Liquidity needs of a firm.

    e. CMO is an innovation, which will not suffice the Liquidity needs of a firm.

71. Which one of the following is **not** a characteristic of "Average Strike Rate Option?"

    a. It is a type of floating rate option.

    b. In this, the pay-off is determined by comparing the underlying price at the expiration with a strike computed as the average of the underlying over the pre-specified time.

    c. Its option strike is uncertain and not determinable until exercised.

    d. It is more expensive than normal option.

    e. Both (c) and (d) above.

72. Which of the following is **not true** regarding a "Financial Engineer"?

    a. He manages risk and return of a financial transaction.

    b. He looks after only the firm's financial analysis part of a transaction.

    c. He involves in the design, development and implementation of innovative financial instruments and processes and formulates creative solutions to finance problems.

    d. He works closely with Accountants, Tax Specialists and other functionaries.

    e. His work is much sophisticated than Financial Analysts.

Introduction to Derivatives

73. First currency futures was traded in

    a. New York Futures Exchange

    b. Chicago Mercantile Exchange

    c. London International Financial Futures Exchange

    d. Chicago Board of Financial Trade

    e. London Securities and Derivatives Exchange.

74. Which is the most recently introduced derivatives contract in Indian market?

    a.   Interest rate futures.

    b.   Interest rate swaps.

    c.   Currency options.

    d.   Stock index futures.

    e.   Option forward contract.

75. Which of the following is/are Over-The-Counter (OTC) derivative?

    a.   Forward.

    b.   Futures.

    c.   Options.

    d.   Swaps.

    e.   Both (a) and (d) above.

76. The major difference between exchange-traded and OTC derivatives is in respect to

    a.   Replacement risk

    b.   Price risk

    c.   Credit risk

    d.   Mark-to-market risk

    e.   None of the above.

77. Which of the following statements is **false**?

    a.   Hedgers in derivatives market are exposed to risk due to their normal business operations.

    b.   Speculators try to make profit by going against the market.

    c.   Arbitrageurs help in enhancing liquidity in the market.

    d.   Arbitrageurs make gain by trading in mispriced derivatives.

    e.   None of the above.

78. Which of the following is **'not'** the reason for popularity of derivatives?

    a.   Easy to take short position in the underlying asset.

    b.   Low transaction cost.

    c.   Leverage instrument.

    d.   High liquidity.

    e.   None of the above.

79. Derivatives are classified based on

    a.   Nature of contract.

    b.   Underlying assets.

    c.   Market mechanism.

    d.   Both (a) and (b) above.

81. Which of the following statement/s is/are **true**?

    a. A derivative is a security whose price does not depend on an underlying asset.

    b. A derivative means only a forward, or a future, or an option contract.

    c. A derivative instrument does not derive its value from any asset.

    d. A derivative is a contract for exchange of payments, whose value derives from the value of an underlying asset.

    e. None of the above.

82. Who among the following is **not** a participant in the derivatives market?

    a. Hedgers.

    b. Speculators.

    c. Central banks.

    d. Arbitrageurs.

    e. None of the above.

83. Which of the following activities are performed by hedgers?

    i. Protect a position or an anticipated position in the spot market by using an opposite position in derivatives market.

    ii. Eliminate or minimize or reduce the risk.

    iii. Sell futures.

    iv. Take a corresponding position in the derivatives market.

    a. (i) only

    b. (ii) only

    c. (i) and (ii) only

    d. (i), (ii), and (iii) only

    e. (i), (ii), and (iv) only.

84. Which one of the following statements is **not** a feature of derivatives?

    a. It is easier to take short position in derivatives than in other assets.

    b. Exchange traded derivatives are less liquid, and have high transaction costs.

    c. It is possible to construct portfolio which is exactly needed, without having the underlying assets.

    d. There is a relation between the values of derivatives and their underlying assets.

    e. None of the above.

85. The risks present in the OTC derivatives are

    a. Credit risk

    b. Counterparty risk

    c. Interest risk

    d. Both (a) and (b) above

    e. All of (a), (b) and (c) above.

86. _____ act as a critical link between the derivatives market and the cash market so that both the markets synchronize to the extent that there cannot be much disequilibrium in the markets.

    a. Hedgers

    b. Speculators

    c. Arbitrageurs

    d. Investors

    e. Central Banks.

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87. Arbitrage means

    a. Obtaining risk-free profits by simultaneously buying and selling identical or similar instruments in different markets

    b. Obtaining profits by selling instruments in a costlier market

    c. Obtaining losses by selling instruments in a cheaper market

    d. Obtaining losses by simultaneously buying and selling instruments in different markets

    e. None of the above.

88. Which of the following derivative contracts is most widely used in India for hedging?

    a. Oil futures.

    b. Pepper futures.

    c. Cotton futures.

    d. Currency forward contracts.

    e. Currency futures.

89. Which of the following derivatives are **not** available in India?

    a. Interest rate futures.

    b. Stock index futures.

    c. Currency forwards.

    d. Energy futures.

    e. Both (b) and (c) above.

Futures

90. Which of the following statement(s) is/are **true**?

    a. Like options, valuation of index futures is easy to understand.

    b. Unlike options, valuation of index futures is easy to understand.

    c. Like options, valuation of index futures is not easy to understand.

    d. Unlike options, valuation of index futures is not easy to understand.

    e. Index futures cannot be valued accurately.

91. Which of the following can be considered as the advantages of controlling beta by using stock index futures?

    a. The target beta can be achieved almost immediately.

    b. Low transaction cost.

    c. The optimal stock can be maintained.

    d. Both (a) and (b) above.

    e. All of the above.

92. The beta of a portfolio is 1.1. The investor who holds this portfolio foresees a bearish phase for the market in the short run and wants to reduce the beta of the portfolio to 0.6. Which of the following strategies can be adopted for achieving the desired level of beta?

    i. Sell a part of the equity portfolio and invest the proceeds in debentures.

    ii. Sell high beta stocks and buy low beta stocks.

    iii. Short sell high beta stocks.

    a. (i) only

    b. (ii) only

    c. (iii) only

    d. Both (i) and (ii) above

    e. All of (i), (ii) and (iii) above.

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93. An index fund means
    a. A type of fund designed to achieve a particular investment goal, by active portfolio management strategies
    b. A portfolio that attempts to match the performance of some stock market index by investing in the same stocks and in the same proportions as those that comprise the selected market index
    c. An investment portfolio that appreciates in value at least as rapidly as inflation index
    d. Both (a) and (b) above
    e. Both (a) and (c) above.

94. Which of the following statement(s) is/are **true** for index arbitrage?
    a. It is a technique to earn abnormal returns incurring more risk.
    b. It is a technique to earn abnormal returns incurring lower systematic risk.
    c. It is a technique to earn abnormal riskless return by trading simultaneously in the spot and future markets.
    d. It is a technique to hedge risk.
    e. None of the above.

95. The multiple attached with Nifty index futures
    a. 25
    b. 50
    c. 100
    d. 200
    e. 250.

96. Which of following statement(s) is/are **false** for the index futures?
    a. The initial and maintenance margins are applicable to both the buyers and sellers.
    b. The margins can be maintained in the form of cash or risk-free short date Government Securities.
    c. Cash customers position is marked to the market at the end of the cash settlement period.
    d. Both (a) and (b) above.
    e. None of the above.

97. The process of earning abnormal risk by trading simultaneously in the spot and futures market is called
    a. Stock index arbitrage
    b. Basis trading
    c. Program trading
    d. Both (a) and (b) above
    e. None of the above.

98. An investor goes long on Nifty future contract at Rs.1,225. Initial margin was 5000 with maintenance margin of 4500. If index closes at Rs.1,125 and multiple associated with the contract is 100, calculate the call money.
    a. Rs.9,500
    b. Rs.10,000
    c. Rs.14,500
    d. Rs.15,500
    e. None of the above.

99. When futures prices are above cash prices, the algebraic value of the basis
    a. Remains constant
    b. Increases as the basis widens
    c. Decreases as the basis widens
    d. Is equated to zero
    e. Is also above the cash price.

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100. If, at the time of making a contract, no transaction is recorded in the books because delivery and payment are yet to take place, the transaction is called as a/an

    a.   Executary contract

    b.   Preliminary contract

    c.   Futures contract

    d.   Forward premium contract

    e.   None of the above.

101. Estimating the relation between changes in futures price and changes in the spot price of the underlying asset relates to

    a.   The liquidity premium theory

    b.   The principle of delta hedging

    c.   One of the rules propounded by Malkiel

    d.   The pure expectations theory

    e.   None of the above.

102. To change the beta of a portfolio from to β to β using futures, where S is the spot price of the index and F is the futures price, and $\beta > \beta^*$,

    a.   A long position in $(\beta - \beta^*)\,\dfrac{S}{F}$ contracts is needed

    b.   A short position in $(\beta - \beta^*)\,\dfrac{S}{F}$ contracts is needed

    c.   A long position in $(\beta^* - \beta)\,\dfrac{S}{F}$ contracts is needed

    d.   A short position in $(\beta^* - \beta)\,\dfrac{S}{F}$ contracts is needed

    e.   A long position in $\left(\dfrac{\beta^* + \beta}{2}\right)\dfrac{S}{F}$ contracts is needed.

103. One of the following is a substitute for physical delivery while settling futures obligation.

    a.   Offsetting

    b.   Exchange of Futures for Physicals (EFP)

    c.   Alternative Delivery Procedure (ADP)

    d.   Cash settlement

    e.   There is no substitute for physical delivery while settling futures obligation.

104. A futures contract on bonds is now selling at 92.50 and any of the following bonds can be delivered under the contract. Which of the bonds is the cheapest to deliver?

Bond	Quoted Price	Conversion Factor
1	98.50	1.0292
2	101.50	1.0401
3	136.00	1.3453
4	120.75	1.2595

    a.   1

    b.   2

    c.   3

    d.   4

    e.   Information insufficient.

105. Value of a futures contract equals

    a. Ratio of price per unit times the initial margin required to deposit times the number of commodity units in a contract

    b. The market value of the futures contract

    c. Total expected value of the futures contract times the per unit value of the contract

    d. Price per unit times number of commodity units in a contract

    e. None of the above.

106. Which of the following formulae is required to describe a general cost of carry price relationship between the spot and futures price of any commodity?

    CP_t = Cash price at time t.

    $FP_{t,T}$ = Futures price at time t for a futures contract requiring delivery at time T.

    $R_{t,T}$ = Annualized riskless interest rate at which funds can be borrowed at time t for period (t – T).

    $G_{t,T}$ = The cost of storing the physical commodity per unit for the time period from purchase of the commodity (t) to delivery at (T).

    a. Cash price + Financing costs per unit + Storage cost per unit.

    b. Cash price + Spot price of a commodity – Futures price of the commodity.

    c. $FP_{t,T} = CP_t + CP_t \times \dfrac{R_{t,T}}{365} + G_{t,T}$

    d. $FP_{t,T} = CP_t \times \dfrac{CP_t}{G_{t,T}} \times 365$

    e. None of the above.

107. A cash market is

    a. The market in the actual financial instrument on which an options contract is based

    b. A multifaceted market involved in a variety of products and services

    c. The market for short-term funds

    d. The market in which financial securities are issued

    e. The market which deals with on the spot delivery of currency.

108. A short hedge occurs when

    a. Hedgers seek to eliminate or control the risk exposure that arises due to adverse changes in prices

    b. Hedgers seek to eliminate or control the risk exposure associated with the quantity that will be bought or sold at some future date

    c. A firm that owns or plans to purchase a cash commodity sells futures to hedge their cash position against declining prices

    d. A firm purchases futures to protect itself against a price increase in a commodity prior to purchasing it in either the spot or forward market

    e. Hedging is caused out for a period of 3 to 6 months.

109. The assets that can be delivered against a futures contract are called

    a. Speculated assets

    b. Hedged assets

    c. Cash and carry arbitraged assets

    d. Carriable assets

    e. Deliverable assets.

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110. High volume trading in a futures contract indicates

   a. That a number of contracts have already been executed in the past

   b. Presence of currently active buyers and sellers

   c. Presence of traders already holding positions

   d. That there will be buyers and sellers in future

   e. None of the above.

111. Basis risk can be reduced by

   a. Using the near month futures contract

   b. Matching cash and futures obligations

   c. Hedging with a futures contract that has a high price correlation

   d. Netting the receivables

   e. Only (a), (b) and (c) above.

112. When a position is over hedged, the profit or loss from the speculative futures position will depend upon

   a. The *ex ante* minimum-variance hedge ratio

   b. The *ex post* minimum-variance hedge ratio

   c. The hedger's cash position

   d. Open interest in that contract

   e. Actual price movement.

113. When futures are used to hedge an exposure, the final price obtained by the hedger can be expressed as

   a. The sum of spot price at the time of squaring off the hedge and the gain or loss on futures

   b. The sum of (i) the difference between the spot prices on the day of hedging and the day of closing out the hedge and (ii) futures price on the day of squaring off

   c. The sum of spot price at the time of hedging and the basis at the time of hedging

   d. The sum of the futures price at time of hedging and the basis at the time of squaring off the hedge

   e. Both (a) and (d) above.

114. If a related commodity on which a future is traded is used for hedging an asset on which no futures contract is traded it is called a

   a. Buying hedge

   b. Selling hedge

   c. Perfect hedge

   d. Rolling hedge

   e. Cross hedge.

115. Example(s) of deferred delivery contract is/are

   i. Futures contract

   ii. Option contract

   iii. Forward contract

   a. (i) only

   b. (ii) only

   c. Both (ii) and (iii) above

   d. Both (i) and (ii) above

   e. All of (i), (ii) and (iii) above.

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116. A good rule of thumb regarding futures is to choose a delivery month that is as close as possible to, but later than the expiration date of the hedge. The basis of this rule is based on the assumption that

   a. There is sufficient liquidity in contracts of all maturities

   b. There is sufficient liquidity in contracts of short maturity only

   c. The holder of the contracts does not want to get the asset delivered

   d. Both (a) and (c) above

   e. None of (a), (b) and (c) above.

117. The market in which the futures price is greater than the cash price is referred to as

   a. Basis

   b. Contango

   c. Backwardation

   d. Reverse cash and carry arbitrage market

   e. Actual market.

118. The optimal hedge ratio for hedging with futures will be equal to 1.0 when

   i. There is perfect positive correlation between the changes in the values of the futures and the assets hedged.

   ii. There is perfect negative correlation between the changes in the values of the futures and the assets hedged.

   iii. The standard deviation of the changes in values of the asset and the futures are equal.

   iv. The standard deviation of the changes in values of the asset and the futures are unequal.

   a. Both (i) and (iv) above

   b. Both (i) and (ii) above

   c. Both (i) and (iii) above

   d. Only (ii), (iii) and (iv) above

   e. All of the above.

119. Backwardation occurs when

   a. Current spot price = futures price

   b. Current spot price < futures

   c. Futures price < current spot price

   d. Futures price > current spot price

   e. Current spot price ≤ futures price.

120. The cash price of a ton rice on January 1, 2000 was Rs.1,500. The annualized borrowing rate on the same day was 12%. The cost of storing the rice is Rs.50 per month. Calculate the following with the help of the above information. What is the settlement price of November 1, 2000 rice futures contract?

   a. Rs.1,250

   b. Rs.1,780

   c. Rs.1,800

   d. Rs.1,695

   e. Rs.2,150.

121. Which of the following statements is **true**?

    a.   The clearing members hold most of the margin deposit funds.

    b.   The clearing association holds all the funds.

    c.   The funds are held in equal proportion by the clearing members and the clearing association.

    d.   Clearing associations hold the margin funds on a gross basis.

    e.   None of the above.

122. The minimum size of price movement which is specified by the London International Financial Futures Exchange (LIFFE) is also known as a/an

    a.   Index

    b.   Pip

    c.   Strip

    d.   Pick

    e.   Tick.

123. The mechanism for determining transaction prices in futures markets involves:

    a.   An auctioneer acting the for the exchange calling out bid and offered prices until a match is made in the market

    b.   A specialist offering to buy and sell at the highest and lowest prices in the market

    c.   Brokers seeking the highest sell and lowest buy prices available in the market

    d.   All of (a), (b) and (c) above

    e.   None of the above.

124. Which of the following statement/s is/are **true**?

    a.   Hedging with futures means substituting the price risk with the basis risk.

    b.   Hedgers pass on their risk to the speculators.

    c.   Hedging is achieved either by paying a price or by foregoing a prospective profit.

    d.   Both (b) and (c) above.

    e.   All of (a), (b) and (c) above.

125. An increase in volume associated with a decrease in open interest on futures exchange indicates that

    a.   Many operators are squaring up their positions

    b.   The price of underlying asset is likely to increase

    c.   The price of underlying assets are unlikely to change

    d.   Both (a) and (c) above

    e.   All of (a), (b) and (c) above.

126. Which of the following statement/s is/are **true**?

    a.   If the variance of basis is equal to the variance of the cash price, the hedge would be optional.

    b.   The higher the variance of the basis, the lower the effectiveness of the hedge.

    c.   By hedging through futures, one swaps price risk with basis risk.

    d.   Both (b) and (c) above.

    e.   Both (a) and (b) above.

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127. The price of a commodity future is quoted as

247 1/4   249 1/4   246 3/4   248   +2   275   220   121226

Which of the following statement/s is/are **true**?

    a.   247 1/4 is the opening price.

    b.   247 1/4 is the previous days closing price.

    c.   The settlement price is 248 on the day.

    d.   Both (a) and (c) above.

    e.   Both (b) and (c) above.

128. S_1 and F_1 represent spot and future prices at time t_1 and S_2 and F_2 represent spot and future prices at time t_2. If the basis has strengthened between time t_1 and t_2 ($t_1 < t_2$), then

    a. $F_2 - F_1 = S_2 - S_1$

    b. $F_1/S_1 = F_2/S_2$

    c. $F_2S_2 = F_1S_1$

    d.   Both (a) and (b) above

    e.   None of the above.

129. In which of the following futures contracts, the holding cost can be negative?

    a.   Index futures.

    b.   Oil futures.

    c.   Silver futures.

    d.   Gold futures.

    e.   None of the above.

130. Due to mark-to-market, profits and losses are settled at the end of

    a.   Every day

    b.   Every month

    c.   Every week

    d.   Every three months

    e.   Life of the contract.

131. If an investor wants to trade in forwards contract he can do so through/with

    a.   A broker

    b.   Another forward contracts trader

    c.   A middleman who need not be a broker

    d.   An exchange

    e.   Both (b) and (c) above.

132. In futures the guarantee to fulfill the contract is given by

    a.   The buyer of the futures contract

    b.   The seller of the futures contract

    c.   Both the parties to the contract

    d.   The clearing corporation

    e.   None of the above.

133. At any given time the clearing house net position will be equal to

    a.   The net outstanding short positions

    b.   The net outstanding long positions

    c.   Zero

    d.   Positions not yet cleared by it, that is out-trades

    e.   None of the above.

134. Which of the following is **false**?

    a.   In inverted markets, the price of distant futures contract is less than the near futures contract.

    b.   At the time of expiration, the value of basis should be equal to or nearly equal to zero.

    c.   In intra-commodity spread, the spread is between two economically related commodities.

    d.   Inter-market cross margining refers to collecting margins centrally irrespective of the positions of the traders spread over different markets or exchanges.

    e.   None of the above.

135. In futures trading, the margin is to be deposited by

    a.   Seller of the contract

    b.   Buyer of the contract

    c.   Both the parties to the contract

    d.   The broker

    e.   None of the above.

136. If the average daily price change is Rs.25 and the standard deviation of the price changes is Rs.3.00, the initial margin will be _____. Assume that there are 100 units per contract.

    a.   Rs.3,400

    b.   Rs.3,700

    c.   Rs.4,000

    d.   Rs.4,100

    e.   Rs.4,200.

137. The margin deposited with the broker as a replenishment is referred to as

    a.   Vertical margin

    b.   Variation margin

    c.   Maintenance margin

    d.   Spread margin

    e.   None of the above.

138. Initial margin is also referred to as

    a.   Vertical margin

    b.   Variation margin

    c.   Performance margin

    d.   Spread margin

    e.   None of the above.

139. A futures trader can square up his position only by dealing in contracts which are similar to the one he bought or sold in characteristics like

    a.   Number of contracts

    b.   Commodity traded

    c.   Month of expiry of the contract

    d.   Delivery terms

    e.   All of (a), (b) and (c) above.

140. In futures contract tick size refers to

    a. The daily price limit

    b. Minimum price fluctuation that is allowed per contract

    c. Change in the price from the previous closing price

    d. Maximum change allowed in the settlement price

    e. None of the above.

141. A trader is long in the spot market and short in the futures market. If the basis is positive and widens, the trader stands to

    a. Gain in futures market

    b. Lose in futures

    c. Insufficient data

    d. Cannot be determined

    e. None of the above.

142. A trader is short in the spot market and long in the futures market. If the basis is positive and narrows, the trader stands to

    a. Lose

    b. Gain

    c. His wealth remains the same

    d. Cannot be determined

    e. None of the above.

143. Standardization of futures contracts in case of commodities is/are in terms of

    a. Quality

    b. Daily price movements

    c. Expiration month

    d. Quantity

    e. All of the above.

144. Which of the following is/are **true**?

    a. Volume traded in a particular session is equal to the number of contracts bought and number of contracts sold.

    b. The settlement price is the price of the last trade on that day.

    c. Open interest denotes the cumulative number of contracts due for delivery.

    d. A broker who is not a member of the clearinghouse has to route his client's order through one who is a member of the clearinghouse.

    e. All of the above.

145. Which of the following statement/s is/are example(s) of underlying asset(s) for futures contracts?

    a. Bond index.

    b. Stock index.

    c. Currency.

    d. Oil .

    e. All of the above.

146. In which of the following forms can members of an exchange maintain the margin relating to transactions in futures?

    a. Cash.

    b. Treasury bills.

    c. Letter of credit.

    d. Both (a) and (b) above.

    e. All of (a), (b) and (c) above.

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147. Which of the following statements is **true**, in the context of intra-commodity spread?

    a. Selling a spread means "Sale of near maturity contract and purchase of far maturity contract".

    b. Selling a spread means "Purchase of near maturity contract and sale of far maturity contract".

    c. Buying a spread means "Purchase of far maturity contract and selling a near maturity ontract".

    d. Selling a spread means "Selling 2 contracts of different maturities".

    e. Both (b) and (c) above.

Options

148. Which of the following statement/s is/are **incorrect**?

    i. Call options with lower strike prices are more valuable.

    ii. If the current stock price is above the strike price of a call, the option has some intrinsic value.

    iii. Put options with lower strike prices are more valuable.

    iv. If the strike price is equal to the current stock price, an option is said to be at the money.

    a. (i) only

    b. (iii) only

    c. (iv) only

    d. Both (i) and (ii) above

    e. Both (ii) and (iv) above.

149. Buying and selling call or put option with the same strike price but different expiration dates is called

    a. Long hedge

    b. Short hedge

    c. Horizontal option spread

    d. Nearby contract

    e. None of the above.

150. Which one of the following is **not true**?

    a. Price of a call option rises with increase in the value of underlying asset.

    b. Price of put option rises with increase in the value of underlying asset.

    c. Price of call option rises with increase in time until expiration.

    d. None of the above.

    e. All of the above.

151. Which of the following is **not** an assumption of Black-Scholes model?

    a. The risk-free interest is constant over the life of the option.

    b. All asset markets are perfectly efficient.

    c. The option being valued can be exercised anytime before the expiration date.

    d. Both (a) and (b) above.

    e. All of the above.

152. Which of the following statement/s is/are **true**?

    a. Horizontal spreads involve buying an option and selling an option of the same type with same exercise price, but with a different time to expiration.

    b. Bull vertical put spread is created by purchasing a put option with a low strike price and selling a put option with a higher strike price, both with the same expiration date.

    c. A bear vertical call spread is created by buying a call with lower strike price and selling a call with higher strike price, both with same expiration.

    d. Both (a) and (b) above.

    e. Both (b) and (c) above.

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153. Which of the following statement/s is/are **false**?

    i. The price of a call option is always more than the underlying stock price.

    ii. The price of a call option cannot be less than the underlying stock price.

    iii. The price of a put option cannot be more than the strike price.

    a. (i) only

    b. (ii) only

    c. (iii) only

    d. Both (i) and (iii) above

    e. Both (ii) and (iii) above.

154. Which of the following statement(s) is/are **true**?

    a. A straddle is bought when the speculator expects the underlying asset to be volatile but is not sure about the direction of the movement.

    b. The writer of a naked put option must be bullish on the underlying asset.

    c. The buyer of the call option is bearish on the underlying asset market.

    d. All of the above.

    e. Both (a) and (c) above.

155. Which of the following statement/s is/are **true**?

    a. Spread positions are generally less volatile.

    b. Futures exchange normally allow lower margins for spread positions.

    c. Spread trading is conservative form of speculation.

    d. All of the above.

    e. Both (a) and (b) above.

156. Among the instruments listed below, which is/are option like instruments?

    i. Rights

    ii. Warrrants

    iii. Puttable and Callable bonds.

    a. (iii) only

    b. Both (ii) and (iii) above

    c. (ii) only

    d. Both (i) and (iii) above

    e. (i), (ii) and (iii) of the above.

157. Anticipating a in significant change from the spot price, a dealer buys two calls on dollars at X_2 and sells one call at X_1 and one at X_3. It implies

    a. $X_1 < X_2 < X_3$

    b. $X_1 > X_2 > X_3$

    c. $X_2 > X_1 > X_3$

    d. $X_2 < X_1 < X_3$

    e. Both (a) and (b) above.

158. Which of the following statement(s) is/are **true**?

    i. Black-Scholes valuation model gives identical relationship for valuing options on dividend paying stocks or currencies.

    ii. Black-Scholes model can be used to work out exact values of American put options.

    iii. The values of put and call options will be equal at a strike price which is equal to the forward rate for the same maturity.

    a. (i) only

    b. (ii) only

    c. Both (i) and (ii) above

    d. Both (i) and (iii) above

    e. All of (i), (ii) and (iii) above.

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159. Which of the following statement/s is/are **true**?

    a.   The price of the European option is normally higher than that of an American option on the same asset with same strike price.

    b.   The options are referred to as wasting assets.

    c.   The pay-off profile of options is symmetrical.

    d.   Both (a) and (c) above.

    e.   Both (b) and (c) above.

160. A covered call is

    a.   Simultaneous buying and writing call option at different strike price

    b.   Simultaneous buying a call and a put option at the same strike price

    c.   Buying a call option with a short position in the underlying asset

    d.   All of the above

    e.   None of (a), (b) and (c) above.

161. The binomial option-pricing model uses _____ time whereas the Black-Scholes model uses _____ time and further assumes that the underlying asset's volatility is_____ and that _____ computational methods are used to derive the option prices.

    a.   Discrete   Continuous   Constant   Closed-form

    b.   Continuous   Constant   Closed-form   Variable

    c.   Continuous   Discrete   Variable   Numerical

    d.   Discrete   Continuous   Variable   Closed-form

    e.   Continuous   Discrete   Variable   Closed-form

162. Higher the volatility of the price of underlying asset, higher would be the price of

    a.   A futures contract on the asset

    b.   A put option on the asset

    c.   A call option on the asset

    d.   Both (b) and (c) above

    e.   All of (a), (b) and (c) above.

163. If the value of the option is zero on the expiry date, then

    a.   The spot rate is less than or equal to strike price for a call option

    b.   The spot rate is more than or equal to strike price for a put option

    c.   The strike price is equal to spot price irrespective of whether it is a put option or call option

    d.   Both (a) and (b) above

    e.   All of the above.

164. A strangle involves

    a.   Buying a call and a put with same strike price and different maturities

    b.   Buying a call and a put with same expiration date and same exercise price

    c.   Buying a call and a put with same expiration date and different exercise prices

    d.   Buying two calls at same expiration date and different exercise prices

    e.   Buying two puts at different expiration date and same exercise prices.

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165. The pay-off profile of a butterfly spread is

    a.   V shaped

    b.   U shaped

    c.   Z shaped

    d.   Inverted U shaped

    e.   Inverted L shaped.

166. Suppose a put option has an underlying asset of Rs.102 and the exercise price is Rs.100. What will be the value of the put in the following cases?

    i.   If the put is exercised

    ii.   If the stock trades at Rs.100

    iii.   If the stock trades at Rs.94.

    a.   –2, 0, 6

    b.   0, –2, 6

    c.   0, 0, 6

    d.   –2, –2, 6

    e.   0, 0, 8.

167. Which of the following relationships correctly indicates put-call parity?

    a. $c - p = s + PV(X)$

    b. $p - c = s - PV(X)$

    c. $c - p = s - PV(X)$

    d. $c + p = s - PV(X)$

    e. $c = p - s + PV(X)$.

168. An option dealer took a short position in a call and put options on dollar at strike price of Rs.43.00. He received a premium of Rs.2.50 for each option. For dealer to make a gain in this option strategy price should remain in the range of

    a.   Rs.40.50 to Rs.43.00

    b.   Rs.43.00 to Rs.45.50

    c.   Rs.40.50 to Rs.45.50

    d.   Rs.38.00 to Rs.48.00

    e.   Rs.40.50 to Rs.45.00.

169. The minimum margin, which a customer must maintain with the member at all times, is known as

    a.   Initial margin

    b.   Maintenance margin

    c.   Variation margin

    d.   Margin call amount

    e.   None of the above.

170. What is the time value of a put option at the time of maturity if premium = 1, strike price = 35 and spot price = 35.5?

    a.   0

    b.   0.5

    c.   1.0

    d.   1.5

    e.   2.0.

171. With regard to vertical spread which of the following statement(s) is (are) **correct**?

    i.   Is a non-directional strategy which requires the underlying to rise or fall

    ii.   Is a directional strategy which requires the underlying to rise or fall

    iii.   Can be constructed with only puts

    iv.   Can be constructed with only calls

    v.   Can be constructed with either puts or calls.

    a.   Both (i) and (v) above

    b.   Both (ii) and (v) above

    c.   (i), (iii) and (iv) above

    d.   (ii), (iii) and (v) above

    e.   None of the above.

172. A call option with strike price of 35 has a premium of 2. A call option with strike price of 36 may have a premium of

    a.   1

    b.   < 2

    c.   3

    d.   4

    e.   5.

173. Going long on a currency and short on a call option results in the pay-off profile of a

    a.   Put option buyer

    b.   Put option writer

    c.   Call option buyer

    d.   Call option writer

    e.   None of the above.

174. Going short on a currency and long on a call option results in the pay-off profile of a

    a.   Put option buyer

    b.   Put option writer

    c.   Call option buyer

    d.   Call option writer

    e.   None of the above.

175. Going long on currency and long on put option results in the pay-off profile of

    a.   Put option buyer

    b.   Put option writer

    c.   Call option buyer

    d.   Call option writer

    e.   None of the above.

176. If you are an exporter expecting to receive $1,00,000 after three months, you can hedge by

    a.   Buying call option

    b.   Selling put option

    c.   Buying put option

    d.   Both (a) and (b) above

    e.   None of the above.

177. If you are an Indian importer, needing to remit $1,000,000 after three months, you can hedge exposure by

a. Buying call option

b. Buying put option

c. Selling call option

d. Selling put option

e. Either (a) or (d) above.

178. In which option does the buyer get the right to buy the underlying asset?

a. Call option.

b. Put option.

c. American option.

d. European option.

e. Asian option.

179. In which option does the buyer get the right to buy the underlying asset any time during the contract period?

a. Digital option.

b. Asian option.

c. American option.

d. European option.

e. None of the above.

180. Ms. Priya has bought a call option on MTNL at strike price of Rs.175 by paying premium of Rs.10. She is short on a call option on MTNL at a strike price of Rs.185 for Rs.6. Calculate at what price of MTNL, Ms. Priya's position will break even.

a. Rs.169

b. Rs.175

c. Rs.179

d. Rs.185

e. Rs.201.

181. The spot price of ITC is Rs.910. An exchange is trading the following option contracts.

Strike price	Premium	
	Call	Put
905	15.00	5.50
910	11.50	7.50
915	9.00	9.00
920	7.50	11.50
925	5.50	15.00

An investor bought a call option at a strike price of 920 and a put option at strike price of Rs.910. The position created by the investor is called

a. Long straddles

b. Long vertical spread

c. Long strangles

d. Long horizontal spread

e. None of the above.

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182. A _____ is created by going short on both put and call options, and the strike price and time to expiration of both the options are the same.
    a. Synthetic put
    b. Long straddle
    c. Short straddle
    d. Long strangle
    e. Short strangle.

183. Suppose a June call option on a stock X is currently trading at Rs.31 with a strike price Rs.35. On the expiration date the price of the stock is Rs.32. Then, which of the following is **correct**?
    a. Option is in-the-money.
    b. Option is out-of-the-money.
    c. Option is at-the-money.
    d. Pay-off is Rs.3.
    e. Pay-off is Rs.6.

184. There is a put option on a stock trading at Rs.2 its strike price is Rs.35. What would be the price of the put option with a strike price of Rs.34?
    a. 1
    b. 2
    c. 3
    d. < 2
    e. Cannot be determined.

185. When you buy a call option on any underlying asset by paying Rs.3 as a premium with strike Rs.48, the price of the underlying asset should be _____ for you to obtain profits?
    a. 49
    b. 50
    c. 51
    d. > 51
    e. > 45.

186. For which of the following options, the time value will be maximum?
    a. In-the-money options.
    b. At-the-money options.
    c. Out-of-the money options.
    d. Deep-in-the-money options.
    e. Deep-out-of-the-money options.

187. When the strike price of an option is equal to the spot price of the underlying asset at the expiration date/exercise date, then the option is said to be
    a. Deep-in-the-money
    b. In-the-money
    c. Out-of-the-money
    d. At-the-money
    e. Either (a) or (b) above.

188. Synthetic long put can be created by which of the following combinations?
    a. Long put + long on the underlying asset.
    b. Long call + long on the underlying asset.
    c. Long call + short on the underlying asset.
    d. Long put + short on the underlying asset.
    e. Long call + long put underlying asset.

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189. A modest risk-taking speculator who expects wide variation in the exchange rates can

 a. Buy a butterfly spread

 b. Buy a call option

 c. Buy a put option

 d. Sell a call option

 e. Buy a straddle.

190. A synthetic long call is a combination of

 a. Long put + long stock

 b. Long call + long stock

 c. Long call + short stock

 d. Long put + short stock

 e. Long call + short put.

191. The pay-off profile of a 'fence' strategy is equivalent to that of a

 a. Butterfly spread

 b. Straddle

 c. Strangle

 d. Bull spread

 e. Ratio spread.

192. A straddle consists of

 a. Buying a call and selling a put with identical strike rate

 b. Writing a call and buying a put with identical expiration date

 c. Buying a call and a put with identical strike rate and expiration date

 d. Writing a call and put with identical strike rate but different expiration date

 e. Buying a call with a farther maturity and writing a put with nearer maturity.

193. Stochastic process

 a. Describes the change in the value of a variable over a period of time in a predefined way

 b. Involves changes over a discrete intervals or continuous intervals of time

 c. Describes the change in the value of a variable other than a period of time in an uncertain way

 d. Both (b) and (c) above

 e. None of the above.

194. Which of the following is/are assumptions of Black-Scholes approach?

 a. Short sale of securities with full use of procards.

 b. No dividend payment during the life of the derivative.

 c. Risk-free rate is the same for all maturities.

 d. Both (a) and (c) above.

 e. All of (a), (b) and (c) above.

195. If c and C represent prices of European and American call options and S represents the current stock price, then

 a. C < S

 b. C > S

 c. C < c

 d. Both (a) and (b) above

 e. All of (a), (b) and (c) above.

196. Which of the following factors is/are **not** considered while valuing options on stocks?

    a.   Current stock price.

    b.   Time to expiration.

    c.   Volatility of stock price.

    d.   Risk-free interest rate.

    e.   None of the above.

197. Which of the following is/are **true**?

    a.   The price difference between two American puts cannot exceed the difference in exercise prices.

    b.   The price difference between two European puts cannot exceed the difference in exercise prices.

    c.   The price difference between two American puts cannot exceed the difference in the present value of exercise prices.

    d.   Both (a) and (b) above.

    e.   Both (b) and (c) above.

198. The writer of the option is also known as a

    a.   Buyer of the option

    b.   Holder of the option

    c.   Seller of the option

    d.   Mediator of the option

    e.   None of the above.

199. The potential for loss for a put option writer is

    a.   Limited to the premium

    b.   Limited to the exercise price

    c.   Limited to the difference between the exercise price and the stock price at the time of exercise

    d.   Unlimited

    e.   None of the above.

200. Which of the following statement/s is/are **true**?

    a.   An option holder will have a right to exercise but not the obligation of exercising.

    b.   An option writer will have a right to exercise the option but not obliged to do so.

    c.   If the writer of the option choses to exercise, the liability of the buyer becomes unlimited.

    d.   The liability of option buyer is unlimited.

    e.   None of the above.

201. 'American options' are those

    a.   Options which are traded on New York Stock Exchange

    b.   That can be exercised at any time during a specified period

    c.   That can be exercised only at the specified period

    d.   That can be exercised even after the specified period

    e.   None of the above.

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202. 'European options' are

    a.   Those options in which writer's liability is limited

    b.   Those options which can be exercised at a specified time only

    c.   Those options which can be exercised during a specified period only

    d.   Those options which can be exercised only if the asset price crosses an agreed limit

    e.   None of the above.

203. When the price of the stock is same as the price of the option

    a.   The put option is said to be out of the money

    b.   A call option is said to be at the money

    c.   A put option is said to be at the money

    d.   A call option is said to be out of the money

    e.   Both (b) and (c) above.

204. When the price of the stock is less than the exercise price of the option

    a.   Put option is said to be out of money

    b.   Call option is said to be at the money

    c.   Put option is said to be in the money

    d.   Call option is said to be in the money

    e.   Put option is said to be at the money.

205. 'Covered Call Writing' means

    a.   Buying a stock and a put option and writing a call option on the asset already owned

    b.   Buying a call option and stock and writing a put option

    c.   Buying a call option and writing a put option

    d.   Buying a call option and purchasing a stock

    e.   Selling a call option and purchasing a stock.

206.

The above graph represents pay-off profile for a

    a.   Long call option

    b.   Short call option

    c.   Long put position

    d.   Short put position

    e.   Long call and short put.

207.
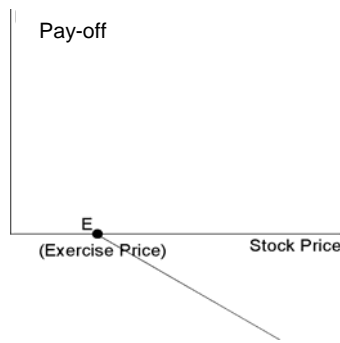
The above graph represents pay-off profile for a

a.   Long call option
b.   Short call position
c.   Long put position
d.   Short put position
e.   Long call and short put.

208.

The above graph represents a pay-off profile for a

a.   Long put
b.   Short put
c.   Long call
d.   Short call
e.   Long call and short put.

209.
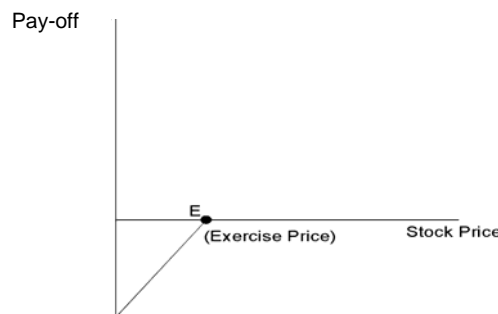
The above graph represents a pay-off profile for a

a.   Long put
b.   Short put
c.   Long call
d.   Short call
e.   Long call and short put.

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210. The value of a put option at the time of expiration is

    a.   Max $(0, E - S)$

    b.   Max $(S - E, 0)$

    c.   Max (E, S)

    d.   Max $(S, 0)$

    e.   Max $(E, 0)$.

211. Put-call parity theorem states that

    a.   The pay-off from a call option is exactly equal to pay-off from a put option

    b.   The price of one of the options (put or call) is related to the price of the other

    c.   The pay-off from a call option is exactly equal to the pay-off from a put option and buying a stock

    d.   The pay-off from a call option and buying a stock is exactly equal to the put option

    e.   Both (b) and (c) above.

212. The value of an option

    a.   Increases as the time to expiration decreases

    b.   Increases as the time to expiration increases

    c.   Decreases as the volatility of stock price increases

    d.   Increases as volatility of stock price decreases

    e.   Both (b) and (d) above.

213. The value of a call option

    a.   Increases as the interest rate increases

    b.   Increases as the time to expiration increases

    c.   Increases as the stock price increases

    d.   Increases as the exercise price decreases

    e.   All of the above.

214. Which of the following is a shortcoming of the binomial model?

    a.   It cannot be used for call options.

    b.   It is not useful when possible inflows undergo continuous changes due to various factors

    c.   That it cannot be used as highest and lowest values of the stock cannot be determined easily.

    d.   It cannot be used as there is a difference in lending and borrowing rates in real world.

    e.   None of the above.

215. A long straddle involves

    a.   Buying a call with a higher exercise price and writing a call with a lower exercise price

    b.   Buying a call with a lower exercise price and writing a call with a higher exercise price

    c.   Buying a call and a put each of which has the same exercise price and same time to expiration

    d.   Buying two calls at the same exercise price and writing a put at a lower exercise price

    e.   Buying a put and writing a call each of which has the same exercise price and same time to expiration.

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216. A buyer of a straddle will **not** profit if

    a. The price of the underlying asset only increases substantially

    b. The price of the underlying asset only decreases substantially

    c. The price of the underlying asset remains more or less stable up to the expiration date

    d. The price of the underlying asset remains in a narrow range

    e. The price of the underlying asset is a circuit breaker.

217. Long strangle strategy involves

    a. Buying a put and a call on the same underlying asset for the same exercise price but at different time to expiration

    b. Buying a put and a call on the same underlying asset with the same exercise price but at different time to expiration

    c. Buying a put and a call on the same underlying asset at different exercise price and different time to expiration

    d. Buying a put and a call on the same underlying asset with the same expiration period but different exercise prices

    e. Selling a put and buying a call of the same exercise price and time to expiration.

218. Which of the following statement/s is/are **false**?

    a. The higher the ratio of the current price of the stock to the exercise price of the call, the higher the value of the call.

    b. The longer the time to expiration on the call, the higher the value.

    c. The higher the riskless rate of interest, the greater the value of the call.

    d. The lower the ratio of the current price of the stock to the exercise price of the call, the lower the value of the call.

    e. The longer the time to expiration on the call, the lower the value of call.

219. Given $N(d_1) = 0.5080$ and $N(d_2) = 0.3707$, the hedge ratio is

    a. 0.5080

    b. 0.3707

    c. 0.8787

    d. 0.1373

    e. 0.5007

220. The strategy of buying an option and selling another option of the same type and time to expiration but with different exercise price is known as

    a. Vertical spread strategy

    b. Horizontal spread strategy

    c. Diagonal spread strategy

    d. Straddle

    e. Strangle.

221. Which of the following are risks of writing call options?

    a. Risk of being assigned an exercise.

    b. The covered call writer foregoes the opportunity to benefit from an increase in the value of the underlying asset.

    c. The risk of writing multiple options exposes the writer to larger risks.

    d. The credit risk.

    e. All of (a), (b) and (c) above.

222. Which of the following statements describes a short sellers' profit?

    a. The per share profit from short selling is limited to an amount equal to the price at which the shares were sold short.

    b. The short seller earns Re.1 profit for every Re.1 fall in the price of the security.

    c. Short seller must own the stock which he sold off.

    d. Both (a) and (b) above.

    e. All of the above.

223. An investor buys 100 6-month call of Reliance Industries at a strike price of Rs.200, when the current market price is Rs.180 per share.

    The call price is Rs.5 per share, at the end of six months the maximum loss to the investor will be

    a. Rs.500

    b. Rs.1,800

    c. Rs.2,000

    d. Rs.2,500

    e. Rs.3,000.

224. Which of the following strategies **does not** involve buying the underlying security?

    a. Covered call writing.

    b. Protective put.

    c. Spreads.

    d. Both (b) and (c) above.

    e. Both (a) and (c) above.

225. If an investor is long on a call option at a strike price of Rs.400, he will make profit only when the stock price is

    a. Below Rs.400

    b. Above Rs.400

    c. Rs.400

    d. Rs.500

    e. Rs.600.

226. An investor is short on put at strike price of Rs.200. Determine his profit/loss, if closing price is 200 and premium charged was Rs.5 and trading lot for put is 100.

    a. Rs.500 profit

    b. Rs.1,500 profit

    c. Rs.2,500 profit

    d. Rs.2,500 loss

    e. Rs.3,500 profit.

227. An investor buys a call option contract for a premium of Rs.200. The exercise price is Rs.20 and the current market price of the share is Rs.17. If the share price after three months reaches Rs.25, what is the profit made by the option holder on exercising the option. Contract is for 100 shares. Ignore the transaction charges.

    a. Rs.200

    b. Rs.250

    c. Rs.300

    d. Rs.350

    e. Rs.400.

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228. An investor buys a call option contract for a premium of Rs.300. The exercise price is Rs.30 and the current market price of the share is Rs.26. If the share price after three months reaches Rs.30, the amount of loss to the investor will be _____.

    a. Rs.300

    b. Rs.350

    c. Rs.400

    d. Rs.450

    e. Rs.500.

229. You wrote a put option contract for a premium of Rs.250. The exercise price of option is Rs.50 and the current market price is Rs.45. After a period of four months the price of the stock is Rs.53. If the option holder exercises the option, total loss will be Rs._____. Ignore the transaction costs and the contract is for 100 shares.

    a. 50

    b. 100

    c. 250

    d. 450

    e. 550.

230. A put option was written at a premium of Rs.400. The current market price of the stock is Rs.38 and the exercise price of the contract is Rs.35. After a period of two months the price of the stock is Rs.30. The amount of the profit made by the option holder is Rs._____. (Assume that the contract is for 100 shares)

    a. 325

    b. 250

    c. 150

    d. 100

    e. 75.

231. The determinants of the option values is/are

    a. Volatility in the price of the underlying share

    b. Remaining time for exercising the option

    c. Current market price of the stock

    d. Interest rates in the market

    e. All of the above.

232. In options 'out-trades' are referred to as

    a. Uncanceled short positions

    b. Uncanceled long positions

    c. Unmatched trades submitted by both the parties

    d. Trades conducted outside the exchange premises

    e. None of the above.

233. Margins are imposed on the writers of the option to provide immunity to

    a. Buyer

    b. Broker

    c. Exchange

    d. Options clearing corporation

    e. All of the above.

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234. The number of option contracts traded on a company's stock in an exchange has the following effect:

　　a.　　The option holders become the rightful owners of the company

　　b.　　The option holders can cast their vote only in annual general meetings

　　c.　　The option holders will be treated as creditors to the company

　　d.　　Do not affect the company in any manner

　　e.　　None of the above.

235. The margin paid on long positions is _____.

　　a.　　The amount by which the option is 'Out of money'

　　b.　　10% of the market value per share on a contract

　　c.　　20% of the market value per share on a contract

　　d.　　Sum of (a) and (c) above

　　e.　　Equal to the premium on the option contract.

236. Which of the following is **false** regarding 'Options'?

　　a.　　The value of an option does not depend on price of the underlying asset.

　　b.　　Options give you the right, but not the obligation, to buy or sell an asset.

　　c.　　Options cannot be used to hedge commodities.

　　d.　　Both (a) and (c) above.

　　e.　　All of (a), (b) and (c) above.

237. Which of the following statements is **false**?

　　a.　　An option holder is the seller of the option.

　　b.　　Options represent a special kind of financial contract under which the option holder enjoys the right, but has no obligation to do something.

　　c.　　A European option can be exercised only on the expiration date.

　　d.　　An American option can be exercised on or before the expiration date.

　　e.　　Both (c) and (d) above.

238. Buying a range forward implies

　　a.　　Simultaneous buying of a call and selling of a put option with identical maturity

　　b.　　Simultaneous buying of a put and selling of a call option with identical maturity

　　c.　　Simultaneous buying of a call and a put option with identical maturity

　　d.　　Simultaneous selling of a call and a put option with identical maturity

　　e.　　None of the above.

Financial Swaps

239. A medium-term swap has a tenure of

　　a.　　Less than one year

　　b.　　One to two years

　　c.　　Less than three years

　　d.　　Three to five years

　　e.　　Beyond five years.

240. A bank who is a party to a swap transaction can be termed as

　　a.　　Swap facilitator

　　b.　　Swap broker

　　c.　　Swap dealer

　　d.　　All of the above

　　e.　　Both (a) and (c) above.

241. Swap coupon is the

    a.   Principal amount on which the interest calculation is made

    b.   The floating rate of interest on the swap

    c.   The fixed rate of interest on the swap

    d.   1/100th of 1%

    e.   None of the above.

242. What are the motives behind a swap transaction?

    a.   Quality spread.

    b.   Currency risk management.

    c.   Interest risk management.

    d.   All of the above.

    e.   Both (a) and (c) above.

243. Which of the following is **not correct** regarding swap market?

    a.   It is difficult to identify counterparty to take opposite position.

    b.   Swap market is an exchange controlled market.

    c.   Default risk is a major concern in swap market.

    d.   The swap deal cannot be terminated without the agreement of the parties involved.

    e.   Secondary market for swap is underdeveloped.

244. An asset swap is

    a.   Exchange of principal amount

    b.   Exchange of interest obligation

    c.   Exchange of interest income

    d.   Both (a) and (b) above

    e.   Both (a) and (c) above.

245. If a bank enters into a swap with an offering company, without finding a counterparty to the swap and hedge the interest risk is known as

    a.   Swap intermediation

    b.   Swap facilitation

    c.   Warehousing

    d.   Assignment broking

    e.   None of the above.

246. Effective Date is the date

    a.   On which swap is entered into

    b.   On which interest accrual stops

    c.   On which interest payments begin

    d.   On which applicable LIBOR for each period is fixed

    e.   None of the above.

247. The date on which the parties agree to swap is called

    a.   Trade date

    b.   Effective date

    c.   Reset date

    d.   Maturity date

    e.   None of the above.

248. Basis swap involves

   a.   Fixed and fixed interest in different currency

   b.   Fixed and floating interest in same currency

   c.   Fixed and floating interest in different currency

   d.   Floating and floating interest in same currency

   e.   None of the above.

249. When a swap gives the holder the right to terminate the swap any time before its maturity is called

   a.   Forward swap

   b.   Callable swap

   c.   Deferred swap

   d.   Basis swap

   e.   None of the above.

250. A swap which gives the seller the option to terminate swap at any time before its maturity is called

   a.   Basis swap

   b.   Vanilla swap

   c.   Callable swap

   d.   Putable swap

   e.   Accreting swap.

251. The writer of a call swaption is the

   a.   Fixed rate payer

   b.   Floating rate payer

   c.   Seller of the right to enter into a swap

   d.   Both (a) and (c) above

   e.   Both (b) and (c) above.

252. In a put swaption

   a.   Buyer has the right to enter into a swap as a floating rate payer

   b.   Seller has the right to enter into a swap as a floating rate payer

   c.   Buyer has the right to enter into a swap as a fixed rate payer

   d.   Seller has to pay floating rate if the option is exercised

   e.   None of the above.

253. An equity swap involves

   a.   Exchange of dividends on a portfolio with periodic interest payment

   b.   Exchange of capital gains on a portfolio with periodic interest payment

   c.   Exchange of dividends on a portfolio with stocks of a particular company

   d.   Both (a) and (b) above

   e.   All of the above.

254. Quality spread exists because of

   a.   Difference in credit rating

   b.   Market saturation

   c.   Different financial norms

   d.   All of the above

   e.   Both (a) and (c) above.

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255. Combination of two fixed-floating currency swaps to form a fixed to fixed currency swap is called

   a. Circus swap

   b. Extendible swap

   c. Forward swap

   d. Vanilla swap

   e. None of the above.

256. Value of an off-market swap can be

   a. Positive

   b. Negative

   c. Zero

   d. Both (a) and (b) above

   e. All of the above.

257. Which of the following risks is **not** related to interest rate swap?

   a. Spread risk.

   b. Credit risk.

   c. Settlement risk.

   d. Basis risk.

   e. None of the above.

258. Basis risk arises in

   a. Fixed to floating rate swap

   b. Fixed to fixed rate swap

   c. Floating to floating rate swap

   d. Currency swap

   e. All of the above.

259. One basis point is equal to

   a. $\dfrac{1}{10}$ th of 1%

   b. $\dfrac{1}{100}$ th of 0.1%

   c. $\dfrac{1}{1000}$ th of 10%

   d. $\dfrac{1}{1000}$

   e. Both (c) and (d) above.

260. Which of the following statements is **false**?

   a. Collectively, swap facilitators are known as 'Swap Banks'.

   b. Swap brokers share the gain from a swap arrangement.

   c. Swap dealers bears the financial risk associated with a swap deal.

   d. Both (b) and (c) above.

   e. None of the above.

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261. Consider the following information.

Company	Objective	Fixed	Floating
X	Floating	8%	Libor
Y	Fixed	10%	Libor + 1%

Which of the following statements is/are **false**?

a. X has absolute advantage in both fixed and floating rate market.

b. X has comparative advantage in fixed rate market.

c. Y has comparative advantage in fixed rate market.

d. Y has comparative advantage in floating rate market.

e. Both (b) and (c) above.

262. Consider the information given in the previous question. The quality spread that exists is equal to

a. 0.50%

b. 1.00%

c. 1.50%

d. 2.00%

e. Nil.

263. Consider the following information.

Company	Objective	T-bill rate	Libor rate
Alpha	T-bill based funds	T-bill + 2.5%	Libor + 1.0%
Beta	Libor based funds	T-bill + 0.5%	Libor + 1.5%

Maximum possible gain from arranging swap between two parties is

a. 0.50%

b. 1.00%

c. 1.50%

d. 2.00%

e. 2.50%.

264. Consider the information given in the previous question.

If a bank acts as an intermediary for arranging swap between Alpha and Beta, and if bank's share is 40% of the gain from swap, then gain to each party if rest of the gain is shared equally between them is

a. 0.30%

b. 0.45%

c. 0.50%

d. 0.60%

e. None of the above.

265. Plain vanilla interest rate swaps involved

a. Fixed to fixed rate swap

b. Fixed to floating rate swap

c. Floating to floating rate swap

d. Currency swap

e. None of the above.

266. The date on which the interest accrual stops is called
    a. Trade date
    b. Effective date
    c. Reset date
    d. Maturity date
    e. Value date.

267. In which of the following convention the actual number of days are counted between previous fixed day payment date and forthcoming fixed day payment date, including previous fixed date and excluding forthcoming fixed day?
    a. Actual/Actual.
    b. Actual/360.
    c. Actual/365.
    d. 30/365.
    e. Both (b) and (c) above.

268. If the previous fixed day payment date and forthcoming fixed day payment date are 01.02.2001 and 01.08.2001, then fixed day count fraction will be
    a. 178/360
    b. 179/360
    c. 180/360
    d. 181/360
    e. 182/360.

269. Which of the following statements is '**false**' regarding rate capped swaps?
    a. Rate capped swap gives protection to floating rate payer against interest rate rise.
    b. Rate capped swap gives protection to fixed rate payer against interest rate fall.
    c. Upfront fee is paid by floating rate payer to fixed rate payer.
    d. An interest rate swap which incorporates cap feature is called rate capped swap.
    e. None of the above.

270. In an extendible swap
    a. The fixed rate payer gets the right to extend the swap maturity date
    b. The floating rate payer gets the right to extend the swap maturity date
    c. If interest rate rise, such swap creates gain for the buyer
    d. All of the above
    e. Both (a) and (c) above.

271. Which of the following statements is **false** with respect to Deffered Rate Swaps (DRS)?
    a. DRS allows fixed rate payer to enter a swap at any time up to a specified future date.
    b. Buyer of DRS feel that the rates may fall in future.
    c. Date of commencement of payments in DRS is set at a future date.
    d. If interest rate falls fixed rate payer gets benefitted.
    e. None of the above.

272. If in an interest rate swap, interest rate risks can be shifted by converting a floating rate liability to a fixed rate liability, then it is called
    a. Amortizing swaps
    b. Accreting swaps
    c. Roller-Coaster swap
    d. Extendable swap
    e. None of the above.

273. Which of the following statements is **false**?

    a. If present values of fixed leg and floating leg are not equal it is called an off-market swap.

    b. For a floating rate payer value of swap is equal to the value of fixed coupon bond minus floating rate note.

    c. The value of fixed leg in a swap does not change.

    d. The rate at which both the present values of fixed leg and floating leg are equal is called swap rate.

    e. None of the above.

Answer questions 274 – 277 based on the following information.

Company 'A' borrows $1 million for 5 years at fixed rate of 12% and company 'B' borrows $1 million for 5 years at floating rate of LIBOR + 3.5% from the market. 'A' can also borrow at a floating rate of LIBOR + 2.5% from the market and 'B' can also borrow at a fixed rate of 14% from the market.

The two companies agree to a swap in which 'B' would pay 'A' a fixed rate of 13.5% and 'A' would pay 'B' a floating rate of LIBOR + 3.5%.

274. If 'A' and 'B' enter the swap contract, the effective interest 'A' would be paying each year.

    a. LIBOR + 3.5%

    b. LIBOR + 3.0%

    c. LIBOR + 2.0%

    d. LIBOR

    e. None of the above.

275. The effective interest rate 'B' would be paying each year

    a. LIBOR + 3.5%

    b. 13.5%

    c. 13%

    d. 14%

    e. None of the above.

276. What does 'B' save by doing the swap and **not** borrowing from the market at 14% fixed rate?

    a. 0.5% per year.

    b. LIBOR + 0.5% per year.

    c. 5% per year.

    d. 12% per year.

    e. None of the above.

277. What does 'A' save by doing the Swap and **not** borrowing from the market at LIBOR + 2.5% floating rate?

    a. 1% per year.

    b. LIBOR + 0.5% per year.

    c. 0.5% per year.

    d. 5% per year.

    e. None of the above.

278. A financial swap helps in overcoming

    a. Interest rate risk

    b. Credit risk

    c. Exchange risk

    d. Both (a) and (b) above

    e. Both (a) and (c) above.

279. If the previous fixed day payment date and forthcoming fixed day payment date are 04/09/1999 and 04/03/2000 then fixed day count fraction is calculated as

    a. 0.33

    b. 0.17

    c. 0.50

    d. 0.16

    e. 0.18.

280. If the previous fixed day payment date and forthcoming fixed day payment date are 04/11/1999 and 04/05/2000 then fixed day count fraction will be

    a. 0.50

    b. 0.51

    c. 0.49

    d. 0.53

    e. 0.52.

281. A swap quote of LIBOR/fixed 5 year swap at 85/95 over 5 year treasury by a bank means that

    a. Bank is willing to pay LIBOR and receive fixed rate to be determined in the given range

    b. Bank is willing to receive LIBOR and pay fixed rate to be determined in the given range

    c. Bank is willing to pay 5 year treasury +85bp and receives LIBOR

    d. Bank is willing to receive 5 year tracking +85bp and pay LIBOR

    e. None of the above.

282. If the volatility per trading day of a stock is given by 1.5 and if the number of trading days is 225 then the volatility per annum is

    a. 15.00

    b. 17.25

    c. 22.5

    d. 0.1

    e. 2.25

283. A currency swap involves

    a. An exchange of principal amounts today

    b. An exchange of interest payments during the currency of the loans

    c. A re-exchange of principal amounts at the time of maturity

    d. An exchange of principal and interest in one currency with principal and interest in another currency

    e. All of the above.

284. Which of the following is **not true** in case of Swaptions?

    a. It is combination of a swap and an option.

    b. The buyer has the right, but not the obligation, to conclude swap on the pre-agreed terms.

    c. It is not an option contract.

    d. Both (b) and (c) above.

    e. All of the above.

Accounting for Derivatives

285. The Derivative Financial Instruments (DFI) include

   a. Fixed rate loan commitments

   b. Forward contracts

   c. Mortgage-backed securities

   d. Indexed debt

   e. Both (a) and (b) above.

286. Where is the cash flow hedge included in the FAS-133?

   a. Current income.

   b. Current net income.

   c. Other comprehensive income.

   d. Comprehensive net income.

   e. None of the above.

287. Which of the following statements is **true**?

   i. Derivative instruments are assets and liabilities.

   ii. Only the fair value of the derivative instruments should be considered for reporting purposes.

   iii. The gains and losses arising from the derivative instruments is also reported.

   a. (i) only

   b. (ii) only

   c. Both (i) and (ii) above

   d. Both (i) and (iii) above

   e. Both (ii) and (iii) above.

288. Fair value is

   a. The amount at which the asset can be bought or sold

   b. An agreement legally enforceable, specifying all significant terms

   c. A transaction that gives no present rights or obligations since there is no firm commitment

   d. The specified price or rate such as a stock price, interest rate, currency rate, commodity price or a related index

   e. None of the above.

289. Which of the following are features of embedded derivative instruments?

   i. An embedded derivative instrument should be separated from the best contract and accounted separately.

   ii. Risk and economic characteristics are not related to those of the contract.

   iii. A separate instrument with the same terms as the embedded derivative instrument would be accounted for as a derivative instrument.

   iv. The hybrid instrument is to be measured at fair value under GAAP.

   a. Both (i) and (iii) above

   b. Both (i) and (ii) above

   c. (i), (iii) and (iv) above

   d (ii), (iii) and (iv) above

   e. (i), (ii) and (iii) above.

290. According to FAS-133, what is/are the cause(s) of changes in the fair values of the derivatives?

    a. Effective hedging.

    b. Ineffective hedging.

    c. Unrelated to hedging.

    d. All of (a), (b) and (c) above.

    e. Unrelated to the fair value of an existing asset or liability.

291. Which of the following statement(s) is/are **false**?

    a. Both the call and the put are treated as embedded derivative instruments for an issuer.

    b. Only a call is treated as an embedded derivative instrument for an issuer.

    c. Only a put is treated as an embedded derivative instrument for an issuer.

    d. Neither call nor put is treated as an embedded derivative instrument for an issuer.

    e. None of the above statements is true.

292. Which of the following **cannot** be designated as a hedging instrument for a cash flow hedge?

    a. Non-option derivative.

    b. Non-derivative instrument.

    c. Derivative instrument.

    d. Written option.

    e. None of the above.

293. Any component excluded from the computation of the effectiveness of the derivative instrument is reported in

    a. Comprehensive income

    b. Accumulated other comprehensive income

    c. Earnings

    d. Cash flows

    e. None of the above.

294. Which of the following is **false**, if it has to be assumed that there is ineffectiveness in the cash flow hedge between an interest bearing financial instrument and an interest rate swap?

    a. The financial instrument is not pre-payable.

    b. The principal amount and the notional amount of the swap do not match.

    c. The fair value of the swap is zero at origin.

    d. The index base for the variable rates match.

    e. Re-pricing dates match.

295. A credit balance in comprehensive income represents

    a. Reduction in cost of sales

    b. Unrealized gain

    c. Deferred gain

    d. Realized gain

    e. None of the above.

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296.   _____ is the currency of the environment in which an entity generates and expends cash.

    a.   Reporting currency

    b.   Functional currency

    c.   Local currency

    d.   Foreign currency

    e.   None of the above.

297.   Which of the following statements is/are **false**?

    a.   All assets and liabilities are translated using the current exchange rate.

    b.   Stockholder's equity accounts are translated using historical rates.

    c.   Translation adjustments result from translating all assets and liabilities at the historical and weighted average rates.

    d.   Stockholders' equity is translated by using historical and weighted-average rates.

    e.   As the adjustments have no direct effect on the cash flows, and also the translation adjustment is due to the net investment rather than subsidiary's operations, the cumulative balance is reported as a component of accumulated other comprehensive income.

Sensitivity of Option Premiums

298.   Given that riskless portfolio can be constructed by combining 202 long calls with a short position of 100 units of underlying asset. Which of the following statements is **true**?

    a.   The option's delta is 0.4950.

    b.   The hedge ratio is 2.02.

    c.   The option's lambda is 0.4962.

    d.   The option's theta is 2.02.

    e.   None of the above.

299.   The call option delta is

    a. > 0

    b. ≥ 0

    c. < 0

    d. ≤ 0

    e.   Can assume any value.

300.   The change of an option's price with respect to change in the price of the underlying asset is

    a.   Delta

    b.   Gamma

    c.   Vega

    d.   Rho

    e.   Theta.

301.   Which of the following statements is **true**?

    a.   The value of the call option decreases with increase in the stock price.

    b.   The value of the put option decreases with increase in the stock price.

    c.   The value of call option increases with decline in strike price.

    d.   The smaller the "time to expiration", the higher the option price.

    e.   Both (b) and (c) above.

302. The theta of an option is defined at the rate of change of

    a.   Its delta with respect to time

    b.   Its gamma with respect to interest rate

    c.   Its price with respect to time

    d.   Its price with respect to interest rate

    e.   Its price with respect to volatility.

Weather Derivatives

303. Which of the following derivative exchanges first introduced weather derivatives?

    a.   New York Mercantile Exchange.

    b.   Chicago Board of Trade.

    c.   Chicago Mercantile Exchange.

    d.   London International Financial Futures Exchange.

    e.   None of the above.

304. The major takers of weather derivatives in USA is/are

    a.   FMCG companies

    b.   Agro-based companies

    c.   Consumer-durable companies

    d.   Utility companies

    e.   Both (b) and (d) above.

305. Temperatuere derivatives are traded in Chicago Mercantile Exchange in multiples of

    a. $10

    b. $50

    c. $100

    d. $200

    e. $250.

306. If a days average temperature is 40^0F, then the Cooling Degree Days (CDD) index is

    a.   –25

    b.   0

    c.   25

    d.   90

    e.   None of the above.

307. The first contract on weather derivatives in the Chicago Mercantile exchange was executed by

    a.   Enron

    b.   Cogentrix

    c.   Davis Energy Group

    d.   Alstom Energy

    e.   Aquila Energy.

308. Heating Degree Days (HDD) index is used to measure cold waves in

    a.   Winter months

    b.   Summer months

    c.   Spring month

    d.   Autumn months

    e.   Both (a) and (d) above.

309. Cooling Degree Days (CDD) index is used to measure warmth in

    a.   Summer months

    b.   Autumn months

    c.   Winter months

    d.   Spring months

    e.   Throughout the year.

310. Weather derivatives are traded in CME for

    a.   One year

    b.   Six months

    c.   Three months

    d.   One month

    e.   All of the above.

311. If a company expects the coming month to be hot, it can

    a.   Sell CDD indices in summer

    b.   Buy CDD indices in winter

    c.   Sell HDD indices in summer

    d.   Buy HDD indices in winter

    e.   Both (a) and (d) above.

312. A company has sold HDD index, and if the days, remain hot then it would

    a.   Gain

    b.   Loss

    c.   No gain-no loss

    d.   Gain or loss will depend on the expectations

    e.   Insufficient information.

313. A company which is expecting hot days in summer should

    a.   Sell put options on CDD in summer

    b.   Buy call options on CDD in summer

    c.   Buy call options on HDD in summer

    d.   Sell put options on HDD in winter

    e.   None of the above.

314. Minimum tick size of a weather derivative in CME is

    a.   1.00 Degree Day Index Point

    b.   1.25 Degree Day Index Point

    c.   2.00 Degree Day Index Point

    d.   3.00 Degree Day Index Point

    e.   5.00 Degree Day Index Point.

Value at Risk

315. Which of the following is **not** an advantage of VaR against other risk management techniques?

    a.   Sum up the different types of risk.

    b.   Allow to take preventive control measures.

    c.   Measure capital at risk.

    d.   Measure earnings at risk.

    e.   None of the above.

316. The steps to be undertaken for measuring VaR is/are

    a.   Decide the confidence level for calculating loss

    b.   Develop a probability statement for potential value changes

    c.   Consider the market driven factors

    d.   Decide on the time horizon

    e.   All of the above.

317. 36-day value at risk is about _____ times the 9-day value at risk.

    a.   1

    b.   2

    c.   3

    d.   4

    e.   6.

318. Which of the following techniques is **not** used in measurement of VaR?

    a.   Hybrid method.

    b.   Variance/Covariance models.

    c.   Sensitivity analysis.

    d.   Monte Carlo Simulations.

    e.   Historical pattern of observations.

319. Which of the methods for measuring VaR is/are suitable for shorter period of study?

    a.   Monte Carlo Simulation.

    b.   Hybrid Method.

    c.   Variance/Covariance Models.

    d.   Both (b) and (c) above.

    e.   All of the above.

320. Which of the following techniques expresses returns as a histogram of hypothetical values?

    a.   Historical pattern of observations.

    b.   Monte Carlo Simulations.

    c.   Variance/Covariance models.

    d.   Hybrid method.

    e.   Both (a) and (b) above.

321. In Monte Carlo Simulation techniques VaR is calculated as

    a.   Difference between cut-off point and current value of portfolio

    c.   Average of cut-off point and current value of portfolio

    b.   Current value of portfolio less cut-off point

    d.   Square root of difference between cut-off point and current value of portfolio

    e.   None of the above.

322. In a standard normal distribution _____ of the values are contained within plus or minus 2 standard deviations of mean.

    a.   68.3%

    b.   90.0%

    c.   95.5%

    d.   99.7%

    e.   None of the above.

323. If the mean value of an asset is Rs.100 and its standard deviation is 3, then

    a.   68.3% of values contained within 106 and 94

    b.   95.5% values contained within 106 and 94

    c.   90.0% values contained within 106 and 94

    d.   99.7% values contained within 106 and 94

    e.   None of the above.

324. Which of the following statements is **not correct** regarding VaR?

    a.   VaR cannot measure risk accurately in extreme market conditions.

    b.   VaR focuses on single arbitrary point.

    c.   VaR is based on the current data which may be different in future.

    d.   VaR is basically a statistical measure and not a managerial one.

    E   None of the above.

325. Riskmetrics consists of

    a.   A methodology to estimate the market risk based on VaR approach

    b.   A set of volatilities and correlation forecasts for use as inputs to estimate market risks

    c.   A data engine for risk management

    d.   All of the above

    e.   Both (b) and (c) above.

326. Riskgrades is a

    a.   Set of volatilities and correlation forecasts

    b.   Data engine for risk management

    c.   Software to measure VaR

    d.   Software to measure portfolio risk

    e.   None of the above.

327. A software which measures the level of risk of a bond portfolio is known as

    a.   Bond Manager

    b.   Risk Manager

    c.   Credit Manager

    d.   Pension Manager

    e.   None of the above.

328. Which of the following software uses quantum mechanics and fluid dynamics related scientific techniques for derivative analysis?

    a.   NUMERIX.

    b.   RAROC 2020.

    c.   Risk Grades.

    d.   Risk Manager.

    e.   None of the above.

329. If annualized volatility of an asset is 15%, then daily volatility is (Assume 250 working days in a year)

    a.   0.0411%

    b.   0.0600%

    c.   0.7851%

    d.   0.9487%

    e.   None of the above.

Introduction to Insurance: Life and Non-Life

330. In which of the following contracts will there be no need to prove the insurable interest?

    a.   Between parent and child.

    b.   Employer and employee.

    c.   Creditor and debtor.

    d.   Partners.

    e.   Both (a) and (b) above.

331. Which of the following explains the principle of *Uberrimae fides?*

    a.   It is the element of utmost good faith.

    b.   It requires the insured to disclose all relevant material details to the insurer.

    c.   It requires the insurer to disclose all relevant material details to the insured.

    d.   Both (b) and (c) above.

    e.   All of (a), (b) and (c) above.

332. Which of the following statements relating to the doctrine of subrogation is **true**?

    a.   It ensures all rights of the insured subject matter are transferred to the insurer on indemnification.

    b.   It is applicable to the life insurance only.

    c.   In life insurance, the legal heirs of the insured have no right to recover the perceived loss from a third party.

    d.   Both (a) and (b) above.

    e.   All of (a), (b) and (c) above.

333. Which of the following statements relate to annuities?

    a.   It is for people who want to hedge the risk of living longer.

    b.   It is a continuous stream of income in return for the half-yearly premiums.

    c.   In an annuity contract, the insurer stops paying upon the death of the insured.

    d.   Both (a) and (b) above.

    e.   Both (a) and (c) above.

334. Which of the following insurance policies is evolved on the principle that variation in the value of insured stock or merchandise results in under-insurance/over-insurance?

    a.   Declaration policy.

    b.   Floating policy.

    c.   Reinstatement value policy.

    d.   Transit insurance policy.

    e.   Liability insurance policy.

335. Which of the following perils are excluded from the cover of the fire insurance policy?

    a.   Earthquake.

    b.   Cyclone.

    c.   Lightning.

    d.   Both (a) and (b) above.

    e.   All of (a), (b) and (c) above.

336. Which of the following cover represents the Act Liability Only Cover?

    a.   It covers both the loss or damage risks and third party liability.

    b.   It affords the widest protection and attracts the highest rate of premium.

    c.   It has a more wider cover than third party liability only cover.

    d.   It covers only the liability of the vehicle owner/driver required to be covered compulsorily under the provisions of the Motor Vehicles Act.

    e.   Both (a) and (b) above.

337. Which of the following insurances come under the classification of insurance of interest?

    a.   Fidelity guarantee insurance.

    b.   Guarantee insurance.

    c.   Products liability insurance.

    d.   Both (a) and (b) above.

    e.   All of (a), (b) and (c) above.

338. Which of the following items form the income for LIC?

    a.   First year premium.

    b.   Income from investments.

    c.   Income from business carried on by its subsidiaries

    d.   Both (a) and (b) above.

    e.   All of (a), (b) and (c) above.

339. Which of the following investment categories should **not** be less than 40 percent of the total investments of LIC?

    a.   Central government.

    b.   State government securities, state and central government guaranteed securities.

    c.   In socially-oriented sector.

    d.   Both (a) and (b) above.

    e.   Both (b) and (c) above.

340. Which of the following items of uses of funds form the outgoes for LIC?

    a.   Payment of claims.

    b.   Loss adjustment expenses.

    c.   Commission.

    d.   Both (b) and (c) above.

    e.   All of (a), (b) and (c) above.

Part I: Answers to Questions on Basic Concepts

Introduction to Risk Management

1. *(b)* Risk is the possibility that the actual outcome may be different from the expected outcome. So variance in the value of assets, liabilities and operating income due to unanticipated changes in some factors is risk.

2. *(e)* A corporate's aim is to create wealth for its shareholders. This is done by maximizing profits, reducing known and expected losses and reducing the uncertainty of cash flows. A risk manager is appointed in order to calculate the expected risk and minimize it.

3. *(e)* All the 4 options are used for measuring risk. Variance and SD are computed using the entire data set and gives a full estimate of the risk. Semi-variance is calculated for only the upside and downside movement of the underlying variable from the mean. Range gives the full estimate of the extreme values of the variable compared to a % in SD. Therefore the answer is (e).

4. *(d)* Risk is the possibility of the outcome being different from the expected, it can be adverse or favorable though controlling the adverse outcome is more pronounced. Therefore statements (b) and (c) are true, and (a) is not entirely true. So option (d) is the answer.

5. *(e)* A risk manager is an expert appointed in order to identify the nature of the expected risks, the remedial measures available to manage the expected risks thus identified and to compute the costs of managing the identified risks, in order to ensure that the cost of managing the risk is not higher than the possible costs to be incurred in case of loss.

6. *(e)* All the above mentioned tools are used to manage risk, either individually or in combinations.

7. *(e)* Insurance is a method of risk transfer, under which a third party (an insurance company) is arranged to pay for the losses if they occur. This is also referred to as risk financing. Therefore answer is (e).

8. *(c)* An insurance policy for vehicles covering third party loses. Under this, payment is made to the third party without actually transferring the risk is a transfer technique for managing the risk without actual transfer of the asset or liability to the third party.

9. *(d)* Methods for risk management depend on various factors. The amount the firm can afford to spend for risk management, the degree or extent of risk that is acceptable to the firm, the future outlook of the business, the level of operations of the firm, etc.

10. *(b)* Through options/futures, one can finance one's risk by hedging the position before the risk takes place.

11. *(e)* A banking always tries to minimize its exposures by matching the price of the borrowings and lendings, matching the maturities of various deals to avoid maturity mismatch and forecast interest rate movements to reduce the foreign exchange risks. It is to be noted that risk cannot be eliminated but can be minimized.

12. *(e)* Risk can be defined as a specific unexpected outcome that may happen in the course of a business. Based on this definition, options (a) and (b) are correct.

13. *(b)* The degree of risk present in a particular situation depends on the nature of the situation and the need not be an absolute or independent amount but will depend on the type of risk and the gravity of the situation.

Total Risk: Main Issues

14. *(d)* Investment risk need not affect the exchange risk, because investments can be domestic also, or in the same currency for both the parties.

15. *(a)* The statement is false because profitability has no relation to liquidity. If the sales are done through credit, the liquidity risk may arise, while the deals may be very profitable.

16. *(c)* Processing risk is an internal business risk as it has to do with the internal manufacturing process of the firm.

17. *(d)* Because in an increasing interest rate scenario the value of fixed rate assets (as it would be discounted by a higher interest rate) would go down as the fixed rate is expected to be lesser than the increased rate. Therefore statements (a) and (c) are true.

18. *(c)* When one of the counterparties defaults in repayment, it gives rise to low quality assets, as the NPAs start building up. This results in the other counterparty getting a lower credit rating which in turn can give rise to credit risk.

19. *(c)* Non-acceptable risks are those major risks that may affect the profitability or even standing of the company. These risks have potential for major losses.

20. *(c)* Static risks are those risks that do not depend on various scenarios. Pure risks are types of static risks.

21. *(a)* Loss control costs are the increased precautions and limits on the risk activities in order to reduce the chances of recurrence of the risks.

22. *(a)* Pure risks are those risks whose outcome can only be a loss. Insurance policy covers only losses, and thus, pure risks.

23. *(e)* All of the above mentioned are types of risks related to business.

24. *(a)* Whenever there is a risk that the money lent to outsiders may not be recovered, it is known as a default risk.

25. *(e)* While taking up an overseas project, a company faces risks which are not there in a domestic project. Such risks could be political risks, sovereign risks, inflation risks, currency risks or a combination of any of the above, and they solely depend on the country in which the project is undertaken.

26. *(e)* All the above mentioned options are types of interest rate risks.

27. *(a)* Basis risk is fundamental to hedging. Basis means the difference between the cash price and the futures price. When the cash price of commodities changes and the interest rate risk does not change simultaneously in the same direction, the basis equilibrium changes and this results in basis risk.

28. *(e)* Beta (β) measures the non-diversifiable risk in relation to the market portfolio. Non-diversifiable risk is also known as market risk or systematic risk, so options (a), (b) and (c) are correct. Hence (e) is the answer.

29. *(a)* Operating risk may be increased for a domestically operating country when the economy is opened up to foreign multinational companies.

30. *(b)* Counterparty risk is absent from a futures contract, as the contract is done with the futures exchange and one party does not have to find another counterparty.

31. *(b)* Marketable or marketability risk is the risk of the assets of the firm not being readily marketable, whenever there is an urgent need for funds. The non-marketability may lead to liquidity risk. Marketing risks can also take place because of selling at lower than expected prices due to existence of competition, change in fashion or taste of the consumers, etc.

32. *(e)* Machinery breakdown and labor strike are both internal causes while government policy and change in customer preferences are external causes which result in external business risks.

33. *(c)* In a financial futures contract, the holder need not take physical possession of the underlying security and as such, he will not be entitled to dividends or interest payments on the underlying security. This is because in the futures market, the settlement can be either by physical delivery, cash payment of difference, offsetting or exchange of futures for physicals. The holder will only be entitled for dividends or interest if he takes the physical delivery of the asset.

34. *(a)* In a decreasing interest rate scenario the value of fixed rate assets at higher rates would appreciate, because they are valued at a lower (discount) rate of interest. Thus answer is (a).

Corporate Risk Management

35. *(d)* Unsystematic risk is the risk pertaining to the individual company. Corporate risk management is the science of identifying such risks, managing to keep them to the minimum with minimum costs of management.

36. *(d)* Certain losses are not included in risk because risk includes uncertainty whereas in certain losses there is no uncertainty. Therefore both statements (a) and (b) are true. Thus the answer is (d).

37. *(d)* Treasury bills are gilt-edged securities issued by the central bank of the country or by the government, and as such they do not have default risk, as they are guaranteed by the central government, unless the government itself goes bankrupt, which is highly illogical.

38. *(c)* Primary risks are those risks are those are an essential part of the business. Counterparty risk affects the firm directly, unlike the other types of risks mentioned, which affect the entire economy.

39. *(c)* Primary risks are those, that are an essential part of the business. They can be minimized but cannot be covered fully or even to a very large extent, but only covered partly.

40. *(a)* Loss control management involves various measures to limit or reduce the risks. A firm having floating rate liabilities can keep a better balance between the payables and receivables by investing in floating rate assets, rather than fixed rate assets, as the variations in the interest rates will affect both the assets and liabilities simultaneously keeping a proper balance of the same.

41. *(e)* VaR is a probabilistic statistical measure to know the level of risk in numerical terms. It involves the normal distribution curve, which is based on the mean and the standard deviations from the mean.

42. *(a)* Logistics means the careful organization of complex business activities so that they happen in a successful and effective way. Logistics managers may expose the firm to price risks when they fix the input prices or agree to a specific input-price adjustment clause.

43. *(e)* Netting is the standard practice followed by a multinational company in order to reduce the transaction costs during the flow of funds from one subsidiary to the other or from the parent company to the subsidiaries or vice-versa. Through netting the difference between the receivables and payables in foreign exchange is estimated and hedging is done for the net amount. This is an internal technique.

44. *(d)* The main aim of risk management is to maintain the risk level at an acceptable level that need not always be the minimum.

45. *(e)* Hybrid debt instruments are debt securities combined with any other type of derivatives. They can be tied to any of the markets mentioned above.

46. *(e)* By diversifying one's activities, overall risk exposure can be reduced and a good way of risk sharing is by retaining part of it and transferring the rest to some outside party.

47. *(b)* VaR is the measurement of loss which has a chance over a certain pre-decided confidence level of being exceeded. If the confidence level is 95%, the chance that the loss may be exceeded is 5%.

48. *(c)* By hedging, insuring, diversifying, etc., the firm is trying to minimize its risks, by transferring the unacceptable risks and accepting other risks that are acceptable to it.

49. *(d)* It is to be noted that all the risks of a corporate cannot be reduced. A typical example is pure risks which cannot be reduced in certain circumstances. Therefore (d) is the right choice.

50. *(e)* Systematic or market risk can be priced and measured through the beta (β) and it influences the rate of return as the investor can decide whether to invest or not based on it. Unsystematic risk or company specific risk cannot be priced or measured accurately, but as it is existent it must be properly managed, or else it may result in losses that can affect the interests of the shareholders.

51. *(d)* VaR is a statistical measure of the maximum potential loss from uncertain events in the normal business over a particular time horizon. It is measured in units if currency through a probability level. It is basically a loss measurement consistent with a confidence limit.

52. *(d)* As VaR is a numerical measure of the risk level, it can be used to lay down the policy for the level of overall risk that is acceptable to the management. VaR cannot be used to measure event risk or even the risk to the business under extreme market conditions, because it is difficult to model risk under such conditions.

53. *(a)* Exposure netting refers to creation of exposures in the normal course of business which offset the existing exposures.

Loading refers to advancing a payment and hagging refers to postponing a payment. Hedging refers to simultaneously buying and setting exactly correlated assets. Therefore (a) is the answer.

54. *(e)* ALM is used to manage both the interest rate risk exchange risk and liquidity risk. It aims at minimizing the exposure to price risk by holding the appropriate combination of assets and liabilities so as to meet the firm's objectives and simultaneously minimizing the firm's risk. Therefore (e) is the right choice.

55. *(c)* Statements (a) and (b) are true. Systematic or market risk is the same to all the participants in the market. Unsystematic or firm's individual risk has no influence on the discount rate applicable to the industry but will reduce the expected cash flows, as the public will stay away from such an investment. Statements (c) is false because managing unsystematic risk is essential for a firm to statilice its earnings and add value to it's investor's wealth.

56. *(e)* The interest rate on convertible debentures or debentures with warrants tends to be lower than in the case of simple debentures, because simple debentures do not carry the option of earning more in future when the conversion takes place into shares. A call option is an option given by the writer to the buyer of the option to purchase from him the underlying asset. As such, it cannot be a negative amount. Equity shareholders carry the risks of the firm as they are the true owners. If the risk of the firm cannot be assessed accurately, investment in debentures is a wiser step, as they carry a fixed rate of interest that must be paid irrespective of the financial position of the company.

57. *(c)* As the interest rates were falling in the US, Sallie Mae, in 1986 introduced an inverse floating rate note to hedge the risks.

58. *(a)* Deep discount or zero-coupon bonds do not carry interest rates and are issued at a discount to the face value and redeemed at par. The difference between the issue price and the face value is the implied interest yield. These bonds carry lower interest yield than the market and the main attraction is the tax rebate available on them.

59. *(e)* The price difference between the actual price of the warrant and the price of issue depends on the following factors: The variance in the returns that are earned in the stock price, the time to expiration of the warrant and the risk-free rate of interest or the rate at which the government securities are being offered to the public(c) Depending on these factors the warrant will command a price in the market.

Financial Engineering

60. *(d)* The word 'Financial Engineering' was first coined in the mid 80s, among London Investment Banks to build risk management departments consisting of teams of experts who would advocate structured solutions to corporate risk exposures.

61. *(c)* Many a time, when an innovation is effected, the market participants face a lot of difficulty in adapting themselves to these changing situations. This necessitated a process to aid the market participants to react effectively to the changing scenarios. Thus, evolved the concept of financial engineering.

62. *(d)* The Scope of financial engineering is much wider and includes Corporate Finance, Trading, Risk Management, Investment and Money Management, etc. But it does not include the function of "Accounting and Bookkeeping."

63. *(d)* Conceptual tools are used to gain familiarity with the basics of finance. They mainly guide the financial engineer to conceptualize the ideas. Some of the conceptual tools include valuation theory, portfolio theory, hedging theory, accounting relationships, and tax treatment for various businesses. As the equities are physical tools it is the answer.

64. *(b)* Physical tools are used to precisely implement the financial engineering processes. Broadly, the instruments consist of equities, fixed income securities, derivatives, and a number of variants of these basic forms.

65. *(a)* The environmental factors include price volatility, globalization of markets, tax asymmetries, technological advances, advances in financial theory, regulatory change and increased competition, and transaction costs. And the liquidity needs of a firm is an intra-firm factor.

66. *(d)* Intra-firm factors include liquidity needs, risk aversion among managers and owners, agency costs, greater levels of quantitative sophistication among investment managers, and more formal training of senior level personnel. Tax asymmetries is an environmental factor.

67. *(e)* Tax asymmetries is an environmental factor and an individual firm's ability or inability to pay taxes on the basis of their earned profits cannot affect it.

68. *(b)* The innovations like money market funds, money market accounts, sweep accounts, electronic funds transfer and electronic payment systems, commercial paper, and repos are intended to suffice the liquidity needs of a firm while stock index futures is intended to satisfy risk aversion aspect.

69. *(d)* The "Currency Options" are intended to suffice the risk aversion aspect of a firm and not for liquidity needs.

70. *(e)* The CMO is an innovation, which will suffice the liquidity needs of a firm.

71. *(d)* The "Average Strike Rate Option" is an innovative instrument which is a type of floating strike option, where the pay-off is determined by comparing the underlying price at expiration with a strike computed as the average of the underlying asset over the pre-specified time. Since the option strike is uncertain and not determinable until exercised, this type of option is less expensive than a normal option.

72. *(b)* Even though a financial engineer does financial analysis in some firms, the major part of his work starts after the completion of financial analysis. His work involves the design, development and implementation of innovative financial instruments and processes, and the formulation of creative solutions to problems in finance.

Introduction to Derivatives

73. *(b)* Chicago Mercantile Exchange (CME) is the first to introduce futures in 1972 in the form of financial futures.

74. *(c)* Currency options were introduced in the Indian markets in July/August 2003. Therefore answer is (c).

75. *(e)* There is no organized exchange for forwards and swaps, so both of them can be termed as OTC derivatives.

76. *(c)* The credit risk on OTC derivatives is more than on the exchange traded ones, as the transactions are ad hoc and not legalized. There is no intermediary or clearing agent between the two parties and this may lead to increased credit risks. The products of the beta and the value of futures on the stock gives the position taken. This when compared with the exposure will give profit or loss to the investor.

77. *(e)* Arbitrageurs try to identify differences in the rates of securities or derivative instruments between two different markets and make profit out of the same by buying in one exchange and selling in the other. They perform a very valuable economic function by keeping the derivatives prices and current underlying assets price closely consistent. Speculators help in enhancing liquidity and arbitragers help in price discovery leading to market efficiency.

78. *(e)* All the above mentioned options are the advantages of derivatives.

79. *(e)* All the above mentioned options are the ways of classifying derivatives.

80. *(c)* Speculation on derivatives is a way of earning profits and of maintaining the prices of the derivative instruments under control, so it can be termed as a treasury function.

81. *(d)* Derivatives are financial instruments that derive their value from the value of other, more basic underlying variables or assets. As derivatives are bought or sold, they can also be termed as contracts to exchange payments between both the parties involved in the trade.

82. *(c)* Central banks do not usually participate directly in the derivative markets nor do they interfere in the derivative markets in order to control the prices. But India is an exception the derivative markets are regulated by the derivatives exchanges.

83. *(e)* The options given in (i), (ii) and (iv) are the main features of hedging activity.

84. *(b)* Exchange traded transactions tend to be very liquid as the number of players involved in the market is very large. The transaction costs are also low given the fact that the volumes are very high.

85. *(d)* OTC derivatives are not traded in any market and as such do not come under any regulatory norms of the stock exchanges. The risks involved depend on both the parties to the contract and the chances of high credit risk and counterparty risk of default are present.

86. *(c)* Arbitrageurs try to profit from market price differences in two different markets or exchanges. For instance, in the futures market, arbitrageurs by their activities tend to reduce or eliminate the price differences that exist between the cash market and the futures market, by buying and selling till the price difference does not yield any profits.

87. *(a)* The description given in (a) is the definition of arbitraging.

88. *(d)* Given the fact that futures market is not very well developed in India, hedging of currency positions is done through currency forwards contracts, in order to ensure that there are no losses due to price volatility in the future.

89. *(d)* At present stock index futures, currency forwards, and interest rate futures are all available in India. Energy futures are yet to be introduced in India. Therefore answer is (d).

Futures

90. *(b)* Index futures are obligations to deliver at settlement, an amount equal to 'x' times the stock index value on the expiration day of the contract at the price at which the contract was struck. Given the fact that the index value is widely understood, it is easier to understand the index futures as compared to options.

91. *(e)* All the options given above are the advantages of controlling beta by using stock index futures.

92. *(e)* The investor can follow all the ways given for controlling beta by using stock index futures. The product of the beta and the value of futures on the stock give the position taken. This when compared with the exposure will give profit or loss to the investor.

93. *(b)* The description given in (b) is the definition of an index fund.

94. *(c)* If the price of the index futures contract is out of line with the theoretical price, then an arbitrageur can earn abnormal returns by trading simultaneously in the cash and futures markets. Hence alternative (c) is correct.

95. *(d)* S&P CNX Nifty futures have a multiple of 200. Therefore, the answer is "d".

96. *(c)* The cash customers position is not marked-to-market at the end of the cash settlement period, but settled by cash, as there is usually no delivery of the underlying stocks and stock certificates.

97. *(a)* The statement is the definition of arbitrage in the futures market.

The process of earning abnormal returns by trading simultaneously in the cash and futures markets is referred to as Stock Index Arbitrage. Hence alternative (a) is correct.

98. *(b)* Rs.(1,225 – 1,125) x 100 = Rs.10,000.

99. *(c)* Basis is the difference between the cash price and the futures price. The futures price is usually above the cash price when the contract is distant from expiration and the more distant the price, the wider the basis and the lower the algebraic value. Hence, when the futures price is more than the cash price, the basis is negative.

100. *(d)* A forward contract is an agreement to buy or sell an asset at a certain future time and future price, which can be at premium, discount or par. It is not normally traded in the exchange. Under this both delivery and payment take place at future date.

101. *(b)* According to the principle of delta hedging, the changes in futures price and changes in the spot price of the underlying asset can be estimated. Here, Delta can be defined as the ratio of the change in the price of the stock option or futures contract to the change in the price of the underlying asset.

102. *(b)* Option (b) is the formula to be used for the change of the beta of a portfolio from β to β* using futures, where S is the spot price and F is the futures price.

103. *(d)* Normally, in the futures exchange, physical delivery is not done and instead cash payments at the time of expiration of the contract are done to settle any gain or loss, without taking delivery. Therefore alternative (d) is the answer.

104. *(a)* Cheapest-to-deliver bond is the bond with the lowest cost of delivering.

Cost of delivering = Quoted price – (Current Futures price x Conversion factor)

Cost of Bond 1 = 98.50 – (92.50 x 1.0292) = 3.299

Cost of Bond 2 = 101.50 – (92.50 x 1.0401) = 5.29

Cost of Bond 3 = 136.00 – (92.50 x 1.3453) = 11.5598

Cost of Bond 4 = 120.75 – (92.50 x 1.2595) = 4.24

Since Bond 1 has lowest cost of delivering, it is the cheapest to deliver bond.

105. *(d)* The value of a futures contract is Price/Unit x No. of Commodity units.

106. *(a)* The formula given under (a) is the formula that defines the cost-of-carry relationship between the spot and futures price of a commodity.

Cost of carry = Cash price + financing costs + storage costs.

i.e., $F_{t,T} = C_t + C_t \times S_{t,T} \times R_{t,T} + C_{t,T}$

107. *(a)* A cash market is the market for a commodity at present, based on which the options or futures contract is based.

108. *(c)* Short hedge, also known as selling hedge occurs when the hedger sells the futures contracts in order to hedge the cash commodity against declining prices.

109. *(d)* Most of the contracts in the futures market end up in settlement by either cash delivery or any other method, without resorting to physical delivery. Very few assets that are carried forward for delivery are known as deliverable assets.

110. *(b)* High volume in any exchange implies the existence of a large number of buyers and sellers in the market.

111. *(e)* Options (a), (b) and (c) are the ways of reducing the basis risk.

112. *(e)* Hedging implies taking the opposite position in order to cover one's exposure in the cash market. If over hedging is done, the profit or loss will depend on how much movement is there in the actual cash price in future.

113. *(d)* The hedger shall receive the futures price at which the contract was tied-up plus the basis (difference between the futures price and the cash price), which can be negative or positive, at the time of settling the contract. i.e Price = $Ft_1 + b_2$ where Ft_1 is the sport price at the time of hedging and basis price at the time of squaring off the hedge.

114. *(e)* This is mostly used by those companies that want to hedge their future positions on commodities on which there is no futures contract being traded. E.g.: Air-line fuel futures contracts are not traded. In order to hedge the position, an airline company may have to use future contracts of gasoline, crude oil or heating oil for the hedging.

115. *(c)* An option and forward contract can be termed as deferred delivery contracts, because they usually end up in the delivery of the underlying asset, unlike the future and forward contracts which end up in settlement of differences.

116. *(d)* This rule is good because the farther away the delivery month is, the lower will be the price and if the delivery month is later than the expiration date, the basis will be negative. This is a good option subject that there is a good liquidity in the contracts of the said commodity in all the maturities and the holder does not want to take the delivery of the asset, but go for a settlement.

117. *(b)* When the futures prices obtained by full-carry relationship are accurately projected, the basis becomes negative, and the futures price becomes higher than the cash price. This is known as contango.

118. *(c)* In a perfectly positive correlation with an equal standard deviation in the changes of values of the asset in the cash and future market, the hedge ratio will be 1.00.

119. *(c)* If the futures price is less than the cash price, the basis is positive. This condition prevails only if the futures price is determined by some other factors than the cost-of-carrying. This is known as backwardation.

120. *(e)* Settlement price = 1500 + 1500 x 0.12x (10/12) + 50 x 10 = 2150. Therefore, answer is (e).

121. *(b)* A gross margining system requires that margins be posted on all the long and short positions, and the total amount is kept with the clearing association. The amount demanded by the clearing associations will depend on the financial characteristics of the customer and is a matter of negotiation between the clearing association and the customer.

122. *(e)* Tick is the minimum price fluctuation of the exchange.

123. *(c)* Transaction prices are set in the futures market by the 'open outcry'. In open outcry the futures brokers seek the highest selling prices or the lowest buying prices available from all other brokers in the market at the time. With this process only the lowest buy prices and highest sell prices are matched. Hence, the answer choice (c) is correct.

124. *(e)* All the statements given above are true characteristics of hedging with futures.

125. *(a)* This is true of any exchange. If the operators start squaring off their positions and booking profits, the volume will increase and there will be decreased interest in new deals.

126. *(d)* Both statements (b) and (e) are true characteristics of hedging with futures.

127. *(d)* This is the correct way of reading the futures quotations as given in the newspapers. $247\frac{1}{4}$ is the opening price on a particular day and it is not the closing price of the previous day. 248 is the settlement price on a particular day. Hence (d) is the answer.

128. *(a)* If the basis has strengthened between time t_1 and t_2, the spot price S_2 and the futures price F_2 are bound to be greater than the spot price S_1 and the futures price F_1. The difference between F_2 and F_1 is equal to the difference between S_2 and S_1, in order to attain an equilibrium position between the futures and the spot prices.

129. *(e)* Holding costs can be either 0 or a positive number which is the cost of holding the stock. Negative costs are usually not there.

130. *(a)* In the mark-to-market system, the profits or losses are normally settled everyday in the exchanges.

131. *(e)* As forward contracts are not dealt in the exchanges, it is not possible to deal in them through a broker. Deals can be done directly with the counterparty or with a middleman who will arrange for a counterparty.

132. *(d)* The clearing corporation which could be a separate institution or part of the stock exchange clears all the transactions undertaken in the respective exchange and settles the amount due to or from the members. As such, it takes the guarantee to ensure that the contracts are fulfilled.

133. *(c)* The clearing corporation settles the positions of all the members and matches the same on a daily basis. So its net position is always zero, as for every purchase there must be an equal and opposite sale.

134. *(c)* The intra-day spread is the difference in the price between two different commodities that are traded in the same futures market, whether they are related to each other or not.

135. *(c)* Every member has to deposit margins with the exchange, whether he is buying or selling.

136. *(a)* Rs.25 x 100 + 3 x Rs.3 x 100 = Rs.3,400.00.

137. *(b)* As the price of the futures contract changes, gains or losses accrue to the holder of the contract. The gains or losses are credited or debited to the margin account. If the price movements are adverse, the balance in the account falls. In these circumstances, the trader is required to replenish the margin, bringing it on par with the initial value whenever the level or value of funds on deposit with the broker, reach a certain level. This level is referred to as the maintenance margin. The additional amount, which the trader deposits with the brokerage firm, is called the "Variation Margin".

138. *(c)* The initial margin is also known as the performance margin as it is kept with the exchange till the completion of all the obligations of the contract are fulfilled or as long as the investor wants to trade in the market.

139. *(e)* All the above mentioned are the characteristics of the contracts, except for the delivery terms which may be different.

140. *(b)* The minimum price change in the exchange is called 'tick'. It varies from currency to currency.

141. *(a)* A trader is long in the spot market means that he has bought the security. He is short on the futures market, it means that he has sold futures contract. The basis is positive means. Current spot price > futures price. The positive basis widens and so the trader incurs a loss in the spot market while he gains in the futures market. Therefore answer is (a).

142. *(b)* A trader is long in the futures market means that he has bought the futures. He is short on the spot market; it means that he has sold the security. The basis is positive means Current spot price > futures price. The positive basis narrows and so the trader incurs a relative gain which is more than the relative loss. The end result is a gain and the answer is (b).

143. *(e)* All the options mentioned above are the standard features of a futures contract.

144. *(e)* All the statements mentioned above are true and self-explanatory statements.

145. *(e)* All the options mentioned above are examples of underlying assets for futures contracts.

146. *(d)* All the options given above represent the methods in which the members can keep their margin relating to transactions in the futures market.

147. *(a)* The statement given under (a) is the definition of intra-day commodity spread and is self-explanatory.

Options

148. *(b)* A put option is an option given to sell the underlying asset. So, the higher the premium, the more valuable is the option.

149. *(c)* This is also known as a time spread. It consists of buying and selling of call or put options with the same strike price and different expiration dates.

150. *(b)* The price of the put option decreases with the increase in the price of the underlying asset, which is just the opposite of the call option.

151. *(c)* Black-Scholes model states that the option follows European exercise terms, which means that it can only be exercised on the expiration day.

152. *(d)* Both the statements given under (a) and (b) are true and self-explanatory. (c) is false because in a bear vertical spread, a call with a lower strike price is sold and a call with a higher strike price is bought.

153. *(d)* The price of a call option need not always be more than the underlying stock price. It could also be the same as the price of the underlying stock. Similarly, the price of a put option can be the same or more than the strike price.

154. *(a)* A straddle involves a call and put option with the same expiration date. This strategy appeals to investors who want to take a position in an underlying asset that is volatile but does not have a clue whether it will rise or fall in the short run. The investor however, only anticipates a sharp movement in the price of the asset.

155. *(d)* Spread positons are generally less volatile because it protects the spread holder to get a limited profit or limited loss. If the market moves either way in an extreme manner,then in one end it will gain and in the other end it will lose and the difference would remain more or less constant in magnitude.

156. *(c)* A warrant is an instrument that gives the owner an option to purchase a fixed number of shares of stock at a designated price over a specific time period.

157. *(e)* It is a butterfly spread and X_1 , X_2, X_3 are related as $X_1>X_2>X_3$ or $X_1<X_2<X_3$. Therefore both statements (a) and (b) are true. Thus answer is (e).

158. *(d)* The explanation for statement (iii) is as —

Put-call parity is $p = c + Xe^{-rt} - S$

X is the strike price equal to the forward rate for the same maturity.

The term e^{-rt} discounts the strike price(i.e. forward rate for the same maturity) and brings X to the spot price i.e. S

Therefore $Xe^{-rt} = S$

And so $p = c$.

159. *(b)* Options are referred to as wasting assets as they will expire if not exercised. The principal risk associated with the buying of options is that the investor loses his entire investment if the option is not exercised.

160. *(e)* A covered call involves buying the underlying asset and writing a call, i.e., long on asset and short on call. So none of the options is true. Thus the answer is (e).

161. *(a)* The binomial option-pricing model uses discrete time whereas the Black-Scholes model uses continuous time and further assumes that the underlying asset's volatility is constant and that closed-form computational methods are used to derive the option price. Hence, the answer choice (a) is correct.

162. *(d)* Both the options given under (b) and (c) are true. A higher volatility of the price of underlying asset results in higher values of both call and put options.

163. *(e)* All the statements given above are true and self-explanatory. The action is opposite for call and put options.

164. *(c)* The statement given under (c) is true. If the strike prices of the call and put options are X_1 and X_2, then a strangle is chosen in such a way that $X_1 > X_2$.

165. *(a)* A short butterfly is V shaped and a long butterfly is inverse V shaped.

166. *(c)* If the put is exercised, the value of the put will be 0, as nothing will be received by way of premium. If the stock is trading at Rs.100, the put value will be 0 as it will not be exercised. If the stock trades at Rs.94, the value of the put will be Rs.(100 – 94) = Rs.6.

167. *(c)* The option given under (c) represents the true put-call parity ratio. It can also be represented as $c + Xe^{-r(T - t)} = p + S$. If this relationship does not hold, arbitrage opportunities exist.

168. *(d)* The total option premium received by the dealer is Rs.5.00.

If the price is Rs. 38 the call is not exercised but the put sold is exercised leading to a loss of Rs.5.00 which is offset by the option premium. Therefore net profit/loss is 0.

If the price is Rs.48 the call is exercised leading to a loss of Rs.5.00 but the put is not exercised. The option premium of Rs.5.00 makes good the loss.

169. *(b)* This margin is always to be maintained to ensure that the balance in the margin account never reaches 0.

170. *(a)* It is 0 because, as the spot price is more than the strike price, the investor will opt to sell the share rather than exercise the put option.

171. *(b)* A vertical spread is a directional strategy which is based on the underlying asset either to rise or fall over the duration of the option. A bull vertical spread can be constructed by using the two calls and a bear vertical spread can be constructed by using two puts with the same expiry date but different strike prices. Hence the answer choice (b) is correct.

172. *(b)* For a call option, the premium is inversely proportional to the strike price. Therefore, if the strike price increases, the premium decreases. In this case the premium will be less than Rs.2. Therefore answer is (b).

173. *(b)* The type of option mentioned here is synthetic put option. A short call option when combined with a long position in the asset (here currency), it results in a synthetic short put option. i.e., it results in the pay-off of a put option writer. Therefore (b) is the correct answer.

174. *(a)* The type of option mentioned here is synthetic put option. A long call option when combined with a short position in the asset (here currency), it results in a synthetic long put option. i.e., it results in the pay-off of a put option buyer. Therefore (a) is the correct answer.

175. *(c)* The type of option mentioned here is Synthetic call option. A long put option when combined with a short position in the asset (here currency), it results in a synthetic long call option. i.e., it results in the pay-off of a call option buyer. Therefore (c) is the correct answer.

176. *(c)* Whenever there is a foreign currency receivable, a put option should be bought, because it gives the option buyer a right to sell the underlying asset at a predetermined price, so that he is not affected even if the exchange rates move adversely. Thus (c) is the right answer.

177. *(a)* Whenever there is a foreign currency payable, a call option should be bought, because it gives the option buyer a right to buy the underlying asset at a predetermined price, so that he is not affected even if the exchange rates move adversely. Thus (a) is the right answer.

178. *(a)* A call option is an option given to the buyer to purchase the underlying asset.

179. *(c)* The option given under (c) is the definition of an American option.

180. *(c)* Rs.185 – Rs.6 = Rs.179 or Rs.175 + Rs.10 – Rs.6 = Rs.179.

181. *(c)* In a long strangle, the investor buys a call at X_1 and a put at X_2, in such a way that $X_1 > X_2$.

182. *(c)* The definition given under option (c) is the definition of a short straddle. A straddle involves a call and a put option with the same exercise price and the same expiration date. In a short straddle, the seller sells a call and a put option at the same exercise price and the same expiration date. In a long straddle, the buyer buys a call and a put option at the same exercise price and the same expiration date.

183. *(b)* A call option is said to be out-of-the-money when the strike price is above the spot price of the underlying asset.

184. *(d)* For a put option, the premium is directly proportional to the strike price. If the strike price decreases, the premium also decreases. In this case it will be less than Rs.2.

185. *(d)* You will break even at Rs.48 + Rs.3 = Rs.51.

For a call option, the trader makes profit when the stock price exceeds the sum of the exercise price and the premium. Since the exercise price + premium = 51, the stock price should be greater than 51 so that the trader will make a profit.

186. *(b)* An option whose exercise price is equal to the current spot price is said to be at-the-money and it has the highest time value.

187. *(d)* An option whose exercise price is equal to the current spot price is said to be at-the-money.

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188. *(c)* A synthetic long put can be created by purchasing a long call option and going short on the underlying asset.

189. *(e)* Whenever a speculator is expecting a wide variation in the stock prices, he can either sell a butterfly or buy a straddle. Here the answer is (e).

190. *(a)* A synthetic long call option can be created by purchasing a long call option and going short on the underlying asset.

191. *(d)* A fence involves buying a call option at a higher strike price and selling a put option at a lower strike price simultaneously. The hedger will be protected from any rise in the underlying asset since he will exercise his call. The pay-off of a fence is similar to a bull spread.

192. *(c)* The statement given under (c) is the definition of a straddle and is self-explanatory.

193. *(d)* A reasonably strict definition of this (also called a random process) is a family of random variables indexed by t, where t belongs to some index set T (which may denote time, space, or whatever else one wishes). A more intuitive definition might call this the set of all possible outcomes of an experiment (this set also being called the ensemble) inherently involving some degree of randomness along with the mechanism by which individual outcomes, or realizations, selected. Thus, it includes both (b) and (c). Therefore answer is (d).

194. *(e)* All the options given above are the assumptions of Black and Scholes model. The option under (a) should be read as "Short Sale of Securities" is allowed with full use of proceeds.

195. *(a)* The call option of an American option is usually equal or lower than the underlying stock price.

196. *(e)* The following are considered while valuing options. The value of an option depends upon:

- The spot price or current price of the underlying asset.

- The exercise price or strike price of the option.

- The time-to-maturity or time-to-expiration.

- Volatility of the underlying asset or volatility in the price of underlying asset.

- The risk-free rate of interest.

- Dividends expected during the life of the option, in case of dividend-paying options.

197. *(a)* Alternative (a) is true because the price difference between two American puts is always less than the difference in their exercise prices.

198. *(c)* The seller of an option is also know as writer.

199. *(c)* The maximum loss to the put writer (seller) is limited to the put option seller loses if market price is less than exercise price difference between the price at which the put writer is forced to buy the stock and the market price at which he could have bought it otherwise stock price at the time of exercise.

200. *(a)* Alternative (a) is correct because an option is a contract in which the seller of the contract grants the buyer, the right to purchase from the seller a designated instrument or an asset at a specific price which is agreed upon at the time of entering into the contract. Therefore, the option buyer has the right but not an obligation to buy or sell. But the seller of the option has an obligation to deliver or take delivery of the underlying asset at the agreed price.

201. *(b)* Alternative (b) is correct because, an American Option can be exercised on any business day within the life of an option including the expiration date.

202. *(b)* The statement given under (b) is true and is self-explanatory (they can be exercised on expiry date only).

203. *(e)* The statements given under (b) and (c) are true. An option (call or put) whose exercise price is equal to the current spot price is said to be at-the-money options.

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204. *(c)* The statement given under (c) is true. An option is said to be in-the-money when a trader makes profit if he exercises it. A call option is said to be in-the-money if the stock price exceeds the exercise price, and a put option is said to be in-the-money if the exercise price exceeds the stock price. An option is said to be out-of-money when a trader makes a loss if he exercises it. A call option is said to be out-of-money if the exercise price exceeds the current stock price, and a put option is said to be out-of-money if the current stock price exceeds the exercise price. Hence (c) is the correct answer.

205. *(e)* The statement given under (e) is true. The strategy of covered call writing involves buying the underlying asset and writing a call on that asset.

206. *(a)* Alternative (a) is correct, since in the case of a call option, the trader makes a profit whenever the current stock price is greater than the exercise price. The graph shows that the upside potential associated with the strategy is unlimited. Therefore, it represents the pay-off of long call option. Also, if X is the strike price and S_T is the final price of the underlying asset, the pay-off from a long position in a European call option is max $(S_T – X, 0)$. i.e., the option will be exercised if $S_T > X$ and it will not be exercised if $S_T < X$.

207. *(b)* Alternative (b) is correct, in the case of a call option, the trader makes a profit whenever the current stock price is greater than the exercise price and since the graph shows that the downside risk is unlimited, it represents a short-call position. Also, if X is the strike price and S_T is the final price of the underlying asset, the pay-off from a long position in a European call option is $–\max (S_T – X, 0)$ or $–\min (X – S_T, 0)$ i.e., the option will be exercised if $S_T < X$ and it will not be exercised if $S_T > X$.

208. *(a)* Alternative (a) is correct, because the pay-off to the holder of a long position in a European put option is $\max(X – S_T, 0)$.

209. *(b)* Alternative (b) is correct, because the pay-off to the holder of a short position in a European put option is $–\max(X – S_T, 0)$ or $\min(S_T – X, 0)$.

210. *(a)* The value of a put option at expiration should be max $(0, E – S)$ where E is the exercise price and S is the underlying price of the stock at expiration.

211. *(b)* According to put-call parity, $P = C + Xe^{-rt} – S$.

212. *(b)* The longer the time to maturity, the greater the opportunity, so the higher the price of the option.

213. *(e)* All the statements given above are true and refer to chapter "Sensitivity of Option Premium".

214. *(b)* The binomial model is useful when the possible inflows follow a probabilistic distribution either increasing or decreasing and cannot be used for inflows with continuous changes due to various factors.

215. *(c)* The statement given under (c) is true and is self-explanatory.

216. *(d)* The buyer of a straddle will profit only if the price of the underlying asset changes substantially-either up or down, i.e., there should be a wide variation in prices.

217. *(d)* A strangle is a combination of a call and put with the same expiration date and different strike prices. Under a long strangle, a call and put options are bought on a particular underlying asset with different strike prices and same expiration period. The exercise price of the call is higher than that of put. Thus (d) is the correct alternative.

218. *(e)* The longer the time to maturity, the greater the opportunity, so the higher the price of the call option.

219. *(a)* The hedge ratio is $N(d_1)$.

220. *(a)* Under a vertical spread strategy, an option is bought and simultaneously another option is sold. Both the options have the same time to expiration but different exercise prices. There are two types of vertical spread: Bull spread and Bear spread. Under Bull spread, an option with a lower strike price is bought and an option with a higher strike price is sold. Under a bear spread, an option with a lower strike price is sold and an option with a higher strike price is bought.

221. *(e)* All the options given under (a), (b) and (c) are the risks faced by option writers.

222. *(d)* Both the options given under (a) and (b) are true.

223. *(a)* The investor will not exercise the option. Since the stock price is less than the exercise price. The maximum loss will be 100 x Rs.5 = Rs.500.

224. *(c)* Spread strategies involve only the use of options, they do not involve buying the underlying securities.

225. *(b)* The investor will make profits when the price is above Rs.400, since it is a call option. In case of a call option, a trader makes profit if the current stock price is more than the exercise price.

226. *(a)* 100 x Rs.5 = Rs.500.

(Please note that since the investor is short on the put option, he has sold the put option) In this case, the holder of the option will not exercise the option, as the stock price is equal to the exercise price. Therefore, the seller of the option will make a profit equal to the premium. Since the trading lot is 100, the total profit made by the option writer is Rs.500.

227. *(c)* Assuming a call option. Premium Rs.200 + Exercise Price Rs.2,000 = Total outgo of Rs.2,200. After 3 months if the share price is Rs.2,500, the net profit is Rs.300 (Rs.2,500 – Rs.2,200).

228. *(a)* Premium Rs.300 + Exercise Price Rs.3,000 = Total outgo of Rs.3,300. After 3 months if the share price is Rs.3,300, the net loss is Rs.300 (Rs.3,000 – Rs.3,300).

229. *(e)* Assuming a put option. Exercise Price Rs.5,000 – Premium Rs.250 = Total outgo of Rs.4,750. After 4 months if the share price is Rs.5,300, the net loss is Rs.550 (Rs.4,750 – Rs.5,300).

230. *(d)* Assuming a put option. Exercise Price Rs.3,500 – Premium Rs.400 = Total outgo of Rs.3,100. After 2 months if the share price is Rs.3,000, the net profit is Rs.100 (Rs.3,100 – Rs.3,000).

231. *(e)* All the options given above are determinants of option values as evident in Black Scholes model.

232. *(c)* In order to have a trade the bid and ask prices must match. In case there are unmatched trades due to difference in price or volume or demand, unmatched trades take place.

233. *(e)* Immunity can be provided to all the parties mentioned above by putting margins in options trades.

234. *(d)* The number of shares of a company traded on the stock exchange do not affect the company's performance in any way.

235. *(e)* The statement given under (e) is true and is self-explanatory.

236. *(d)* The value of an option depends on the value of the underlying asset and options can be used for hedging in the commodity markets.

237. *(a)* A seller of an option is also known as the option writer.

238. *(a)* The statement in (a) above is the definition of range forward.

Financial Swaps

239. *(d)* Swaps can be divided into short-term, medium-term, and long-term swaps. Short-term swaps have maturity periods of less than three years, medium-term swaps mature between three and five years and long-term swaps have a life extending beyond five years. Therefore (d) is the answer.

240. *(e)* Swap facilitators and swap dealers are parties to any swap transactions. Swap brokers are intermediaries who help in identifying the potential counterparties to a swap transaction.

241. *(c)* Swap coupon is the fixed rate of interest on the swap.

242. *(d)* The following are some of the significant motives for entering into a swap transaction:
– quality spreads (lower financing costs)
– currency risk management
– interest risk management
Swaps can also be used to
– enter new markets
– larger scale of operations.

243. *(b)* The swap market is not exchange controlled and it is an over-the-counter market.

244. *(c)* An asset swap is a variant of interest rate swap, where there is exchange of interest income. An interest rate swap is defined as an agreement between two or more parties who agree to exchange interest payments over a specific period on agreed terms. It should be remembered that the exchange of principle is notional.

245. *(c)* Warehousing means to enter into a swap with one counterparty by the bank, then hedging the interest rate risk until a counterparty wanting to take an opposite position is found.

246. *(c)* Effective date is the date when the initial fixed and floating payments begin. It is also called value date.

247. *(a)* It can also be defined as the date in which the parties enter into the swap.

248. *(d)* A swap in which a stream of floating interest rates is swapped against another stream of floating interest rates is known as a basis swap.

249. *(b)* A callable swap gives the holder the right to terminate the swap at any time before its maturity. A swap, in which a stream of floating interest rates are exchanged for another stream of floating interest rates, is known as basis swap. A forward swap is one in which the commencement date is set at a future date, and it helps in locking the swap rates and use them later as and when needed. Forwards swaps are also known as deferred swaps. Hence (b) is the correct answer.

250. *(d)* A putable swap gives the seller of the swap to terminate the swap at any time before its maturity. A callable swap gives the holder the right to terminate the swap at any time before its maturity. A swap, in which a stream of floating interest rates are exchanged for another stream of floating interest rates, is known as basis swap. Vanilla swap is an interest rate swap, which can be defined as an agreement between two or more parties who agree to exchange interest payments over a specific period on agreed terms. Accreting swaps can be used to convert floating rate payments into fixed rate payments if the principal amount increases every time additional loan is availed.

251. *(e)* A call swaption gives the buyer the right to enter into a swap as a fixed rate payer. The writer of the call swaptions are floating rate payer if the option is exercised. Hence (e) is the answer.

252. *(a)* In a put swaption the buyer is a floating rate payer.

253. *(e)* An equity swap means an exchange of dividends earned and capital gains on a portfolio, which is based on a stock index against periodic interest payments. Hence all the statements are true. Therefore (e) is the answer.

254. *(e)* Quality spread is the difference between the borrowing power of two parties in the market. This difference in the interest rates arises because of the difference in credit ratings of the two firms, market saturation and financial leverage of a firm. Thus (e) is the answer.

255. *(a)* Two fixed-floating currency swaps are combined to form a fixed to fixed currency swap, which is known as circus swap. It can be created by combining a currency swap and an interest rate swap with floating rate or both having LIBOR pricing. Hence (a) is the answer.

256. *(d)* When the market rates change after the initial pricing of the swap, the values of both the fixed leg and the floating leg will be different. The cash flows on the fixed leg do not change but the discounting factor changes and so the value also changes. On the floating side, both the values change and hence the value changes. Therefore, the swap in which the present values of the fixed leg and the floating leg are not equal is called an off-market swap. i.e., the value of an off-market swap can be positive or negative and not zero. Thus (d) is the answer.

257. *(c)* There is no question of settlement in an interest rate swap. At the end of the swap, both the counterparties take their principal back and repay the same to the bank.

258. *(c)* Basis risks take place mostly in floating-to-floating rate swaps, when both the sides are pegged to two different indices and both the indices are fluctuating and there is no proper correlation between both. Hence (c) is the answer.

259. *(c)* 1 basis point is one hundredth of 1% or one thousandth of 10%.

260. *(b)* Both the counterparties and not the share brokers share the net gain from the swap.

261. *(e)* The cost of borrowing for X is lower than that of Y in both fixed and floating markets. Therefore, X enjoys absolute advantage in both the markets. The cost of funds for Y is higher in fixed rate by 2% whereas the same is higher by 1% in floating market. This advantage is known as comparative advantage. Hence, Y has comparative advantage in floating rate market. Therefore statements (a) and (d) are true and statements (b) and (c) are false. Hence (e) is the answer.

262. *(b)* 10% – 8% + LIBOR – (LIBOR + 1%) = 1%.

263. *(e)* Max gain = (T-bill+2.5%) + (Libor + 1.5%) – (T-bill + 0.5%) – (Libor + 1.0%)=2.5%

So the correct option is "e".

264. *(e)* Total gain from swap = 2.5% bank's share = 0.4 x 2.5%=1.00%. Gain to each party = 0.75%. Hence, option "e" is correct.

265. *(b)* Plain vanilla swaps are those which swaps where fixed rate obligations are exchanged for floating rate obligations over a specific period of time on a notional principal. Hence (b) is the answer.

266. *(d)* On maturity date the interest accrual stops.

267. *(e)* Under the Actual/360 convention, the actual number of days is counted between previous fixed day payment date and forthcoming fixed day payment date, including previous fixed date and excluding forthcoming fixed date. Actual/365 is also similar to Actual/360, but the denominator is taken as 365. Hence (e) is the answer.

268. *(d)* Fixed day count can be calculated under the Actual/360 convention. Here, the previous fixed day payment date is included and the forthcoming fixed payment date is excluded. Hence total number = 28 + 31 + 30 + 31 + 30 + 31 = 181/360.

269. *(b)* Rate capped swap gives protection to floating rate payer against interest rate rise (and not fall).

270. *(e)* In an extendible swap, the floating rate payer gets the right to extend the swap maturity date. If the interest rates rise and are expected to rise further then such an extendible swap works to the advantage of the fixed rate payer since he is required to pay less than the current rates. Hence (e) is the answer.

271. *(e)* All the statements given above are true and none of them is false.

272. *(c)* Amortizing swaps are useful for managing the associated interest rate risk arising from mortgage loans. Accreting swaps can be used to convert floating rate payments into fixed rate payments if the principal amount increases every time additional loan is availed. Roller coaster swap can be used to shift the interest rate risk by converting a floating rate liability to a fixed rate liability, or vice versa. In an extendible swap, the fixed rate payer gets the right to extend the swap maturity date. Hence (c) is the answer.

273. *(c)* The value of the fixed leg of a swap can change if the fixed rate drastically falls or rises.

274. *(c)* The differential savings is 14% – 12% – LIBOR + 2.5% – (LIBOR + 3.5%) = 1% which can be divided equally by both the parties i.e. 0.5% each savings. So, A will be paying LIBOR + 2.5% – 0.5% = LIBOR + 2%.

275. *(b)* B would be paying 14% – 0.5% = 13.5%.

276. *(a)* Each party stands to gain 0.5%.

277. *(c)* Each party stands to gain 0.5%.

278. *(e)* Statements under options (a) and (c) are the main reasons for counterparties to enter into swaps.

279. *(c)* Here 30/360 convention is used. (27 + 30 x 5 +3) /360 = 0.5.

280. *(a)* Here 30/360 convention is used. $(27 + 30 \times 5 + 3)/360 = 0.5$.

281. *(c)* A swap quote of LIBOR/fixed 5 year swap at 85/95 over 5 year treasury by a bank means that the bank is willing to pay 5 year treasury+ 85 basis points and receive Libor. The bank is willing to receive 5 year treasury +95 basis points and pay LIBOR. So, the correct answer is option "c".

282. *(c)* $\sqrt{225 \times 1.5} = 15 \times 1.5 = 22.5$.

283. *(e)* All the statements given are the characteristics of currency swaps.

284. *(c)* The swaption is also an option contract and so the correct answer is "c".

Accounting for Derivatives

285. *(e)* Derivative Financial Instruments (DFIs) include Option contracts, Interest rate caps, Interest rate floors, Fixed-rate loan commitments, Note issuance facilities, Letters of credit, Forward contracts, Forward rate agreements, Interest rate collars, Futures and Swaps. DFIs exclude Mortgage-backed securities, Interest only obligations, Principal only obligations and Indexed obligations. Hence (e) is the answer.

286. *(c)* FAS 133 requires standardized accounting and reporting for all derivative instruments and for hedging activities. The following table shows where to include the derivative transactions:

Type of derivative transaction	Accounting treatment
No hedge	Included in current income
Fair value hedge	Included in current net income
Cash flow hedge	Included in other comprehensive income
Foreign currency hedge	Included in comprehensive net income

Hence (c) is the answer.

287. *(c)* Statement (iii) is false because only true assets and liabilities are reported and not the gains or losses arising from derivative instruments. Hence (c) is the answer.

288. *(a)* Fair value is defined as the amount at which the asset can be bought or sold. Firm commitment is an agreement legally enforceable, specifying all significant terms. Forecasted transaction gives no present rights or obligations. An underlying is a specified price or rate such as a stock price, interest rate, currency rate, commodity price or related index. Hence (a) is the answer.

289. *(a)* Statement (ii) is not true because risks and economic characteristics are not clearly related to those of the contract. Hence (a) is the answer.

290. *(d)* The statements under (a), (b) and (c) identity changes in the fair values of the derivatives.

291. *(a)* Only calls and puts that do not accelerate repayment of principal but require a cash settlement equal to the option price at the date of exercise are treated as embedded derivative instruments.

292. *(b)* Only derivative instruments can be designated as hedging instruments for a cash flow hedge.

293. *(c)* Any component excluded from the computation of the effectiveness of the derivative instrument is reported in earnings. Hence (c) is the answer.

294. *(b)* If it is assumed that there is ineffectiveness in the cash flow hedge between an interest bearing financial instrument and an interest rate swap, the principal and the notional amount of the swap must match.

295. *(c)* A credit balance in comprehensive income represents a deferred gain.

296. *(b)* Functional currency is an entity's currency of the primary economic environment in which it operates. i.e., the currency of the environment in which an entity primarily generates and expends cash. Reporting currency is the currency in which an entity prepares its financial statements. Local currency is the currency of a particular country being referred to. Foreign currency is the currency of a foreign entity. Hence (b) is the answer. Hence (c) is false.

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297. *(c)* All assets and liabilities are to be translated at the current rate and not at the historical rate.

Sensitivity of Option Premiums

298. *(a)* The gives portfolio is a riskless portfolio.

The value of the long calls = Value of the underlying assets.

No. of long calls x Unit price = No. of underlying assets x Unit price.

202 x Unit price = 100 x Unit price

$$\frac{\text{Unit Price of long call}}{\text{Unit Price of underlying}} = \frac{100}{202}$$

Hedge ratio or Delta = 0.4950.

299. *(b)* The Delta of a call option has an upper bound of 1 and a lower bound of '0'.

300. *(a)* The statement given under (a) is the definition of delta.

301. *(e)* Option is "e". (b) is true because delta of a put option is negative. (c) is true because for a call option the premium is inversely proportional to the strike price. Hence (e) is the answer.

302. *(c)* The statement given under (c) is the definition of Theta.

Weather Derivatives

303. *(c)* The Chicago Mercantile Exchange (CME) was the first exchange to transact in weather derivatives in order to ensure that the profitability or revenue expectation of a company are not adversely affected by the playfulness of the weather.

304. *(d)* Till date, the major takers of weather derivatives in US are the utility companies, as compared to the agro-based companies.

305. *(c)* In CME, the temperature derivatives are traded in multiples of $100.

306. *(b)* The temperature is taken as 0 if it is below 65° under the CDD.

307. *(e)* The first transaction on weather derivatives took place in 1997 in the CME and was executed by Aquila Energy of the USA as a weather option embedded in a power contract.

308. *(a)* The HDD index is used to measure cold waves during winter months. Higher the index, colder the day and vice-versa.

309. *(a)* The CDD index is used to measure warmth in summer months. Higher the index, warmer the day and vice-versa.

310. *(d)* CME trades the index for a month or part of a month only and never more than that.

311. *(e)* If a company expects the coming month to be hot, it should either sell CDD indices in summer or buy the HDD indices in winter. Hence (e) is the answer.

312. *(a)* If a company expects the coming month to be hot and sells HDD indices in winter, and if the days turn out to be hot as expected then the company will earn good revenues. Thus, the company would make an overall gain.

313. *(d)* A company expecting hot days in summer should buy a call option of the HDD in winter. Thus (d) is the answer.

314. *(a)* Minimum tick size of a weather derivative (futures or options) in CME is 1 degree-day index point ($100).

Value at Risk

315. *(a)* The VaR does not sum up the risks but measures the risk of each event in numerical units of currency terms.

316. *(e)* All the statements given above are the steps to be taken to measure VaR and are self-explanatory.

317. *(b)* $3^2 = 9$ and $6^2 = 36$. So, $6/3 = 2$ times.

318. *(c)* Sensitivity analysis is done to measure the changes in the option prices due to change in the prices of the underlying asset and not for VaR.

319. *(d)* The Monte Carlo and Historical Pattern of Observations methods are used for longer period of study; and the Variance/Co-variance methods are better suited for shorter period of study. Hybrid models are also applicable to shorter periods of measurement. Hence (d) is the answer.

320. *(e)* Historical pattern of observations and Monte Carlo Simulations express returns as a histogram of hypothetical values. Hence (e) is the answer.

321. *(a)* The result of Monte Carlo Simulations is a random distribution of market prices or rates, on which a cut-off point has to be assumed as the confidence level. The difference between the cut-off point and the current value of the portfolio is the VAR. hence (a) is the answer.

322. *(c)* The Normal Distribution is a bell-shaped perfectly symmetrical distribution and has the following characteristics:

Standard Deviation from Mean	Confidence Level
1	68.3%
1.65	90.0%
2	95.5%
3	99.7%

Hence (c) is the answer.

323. *(b)* If the distance from the mean is 2 Standard Deviations, then the 95.5% of values are contained within (100 + 2 x 3) and (100 – 2 x 3), i.e. 106 and 94.

324. *(c)* VaR is based on the past observed data which may not be the same in future.

325. *(d)* Riskmetrics employs a comprehensive set of daily re-estimated volatilities and correlations across a broad range of instruments as input to estimate market risks. It consists of all the given parts. Hence (d) is the answer.

326. *(b)* RiskGrades is a data engine for risk management developed by J P Morgan.

327. *(b)* Risk Manager is software, which measures the level of risk of a bond portfolio.

328. *(a)* Numerix is software that uses quantum mechanics and fluid dynamics related scientific techniques for derivatives analysis and risk measurement. RAROC 2020 is software for measuring accuracy of risk and is developed by Bankers Trust, a leading banker in US. Risk Manager is software, which measures the level of risk of a bond portfolio. RiskGrades is a data engine for risk management developed by J P Morgan. Hence (a) is the answer.

329. *(d)* $15\%/\sqrt{250} = 0.9487\%$.

Introduction to Insurance: Life and Non-Life

330. *(a)* It is not required as there is always an interest of the parents to protect their children from any kind of accidents.

331. *(e)* All the insurance contracts of insurance are Uberrimae Fides contracts. i.e., these contracts require utmost good faith on both the parties which ask for voluntary disclosure of all the material facts relevant to the subject matter of the contract. Any material facts that are not disclosed to the other party having a direct or indirect relationship to the contract will make it null and void. Therefore, all the given statements explain the concept of Uberrimae Fides.

332. *(a)* Doctrine of Subrogation refers to "the right of the insurer to stand in the place of the insured, after settlement of a claim, in so far as the insured's right of recovery from an alternative source is involved. It ensures that all rights of the 'insured subject matter' are transferred to the insured on indemnification. It is not applicable to life insurance contracts. In life insurance, legal heirs have a right to recover the perceived loss from a third party, but it cannot be subrogated irrespective of the status of the policy amount that has to be paid by the insurer. Thus (a) is the answer.

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333. *(e)* An annuity is an investment that can be made either in a single lump sum or through installments paid over a certain number of years, in return for which a specific sum is received every year, half-year, or every month, either for life or for a fixed number of years. LIC offers annuities for those who want to hedge the risk of living longer. In an annuity contract, the insurer stops paying upon the death of the insured. Hence (e) is the answer.

334. *(a)* Declaration policy is evolved on the principle that variation in the value of insured stock of merchandize results in under-insurance and over-insurance. Floating policy covers insurance of all the stocks and goods at more than one location such that fluctuation of value of stocks at all locations will be covered. Reinstatement value policy is issued when the insurer is satisfied about the bonafides of the insured and the subject matter is a building and/or machinery. Transit insurance policies are available under various inland transits like rail, road, registered post, and air. Liability insurance policy is a miscellaneous insurance policy. Hence (a) is the answer.

335. *(d)* Earthquake and cyclone do not cause fire directly and as such are excluded from the cover of a fire insurance policy.

336. *(d)* The 'Act' Liability only covers the liability of the vehicle owner/driver required to be covered compulsorily under the provisions of the Motor Vehicles Act. It affords the narrowest protection and attracts the lowest rate of premium. Hence (d) is the answer.

337. *(d)* Fidelity guarantee insurance and guarantee insurance come under the classification of insurance of interest. Hence (d) is the answer.

338. *(d)* First year premium and income from investments form the main sources of income for LIC. Hence (d) is the answer.

339. *(b)* State government securities, state and central government guaranteed securities should not be less be than 40 percent of the total investments of LIC. Hence (b) is the answer.

340. *(a)* Payment of claims form the major outgoes for the LIC. Hence (a) is the answer.

Frequently Used Formulae

Corporate Risk Management

1.   Variance $(\sigma^2) = P_1 (r_1 - E)^2 + P_2 (r_2 - E)^2 + ... + P_n (r_n - E)^2$

2.   Standard Deviation $(\sigma) = \sqrt{\text{Variance}}$

3.   Return, Variance and Standard Deviation of individual security returns for both *ex post* and *ex ante* data:

Historical (ex post)	Expected (ex ante)
Arithmetic mean return	Expected return
$\bar{r_i} = \dfrac{1}{n} \sum\limits_{t=1}^{n} r_{it}$	$E(r_i) = \sum\limits_{s=1}^{n} r_{is} \, P_s$
Variance (Risk)	Variance (Risk)
$\sigma_i^2 = \dfrac{1}{n-1} \sum\limits_{t-1}^{n} (r_{it} - \bar{r_i})^2$	$\sigma_i^2 = \sum\limits_{s=1}^{n} \left[r_{is} - E(r_i) \right]^2 . P_s$
Standard deviation	Standard deviation
$\sigma_i = \sqrt{\dfrac{1}{n-1} \sum\limits_{t=1}^{n} (r_{it} - \bar{r_i})^2}$	$\sigma_i = \sqrt{\sum\limits_{s=1}^{n} \left[r_{is} - E(r_i) \right]^2 . P_s}$

$\bar{r_{it}}$ =   Historical (ex post) return generated by the ith stock in time period t.

r_{is} =   Expected (ex ante) return for the ith stock assuming that S state of the world occurs.

P_s =   Probability that the S state of the world will occur.

4.   The return on stock $R_s = \alpha + \beta r_m$

   R_s –   Estimated return on the stock

   r_m –   Return on the market

   β –   Measure of stock's sensitivity to the market index

   α –   Estimated return when the market return is zero.

5.   Required return on a security $R_s = R_f + \beta(R_m - R_f)$

   R_f –   Return that can be earned in a risk-free investment

   R_m –   Return on the market.

Futures

1.   Relationship between the cash price and the futures price of any commodity:

$$F_{t,T} = C_t + C_t \times S_{t,T} \times \frac{T-t}{365} \times G_{t,T}$$

Where,

   C_t –   Cash price at time t

   $S_{t,T}$ –   Annualized interest rate on borrowings

   $G_{t,T}$ –   Storage costs

   $T - t$ –   Time period

   $F_{t,T}$ –   The futures price at time t, which is to be delivered at time period T.

2. Hedge Ratio (HR): $\dfrac{Q_f\ (\text{Quantity of futures units})}{Q_c\ (\text{Quantity of current units being hedged})}$

Value of HR = Q_c x ΔCP (Change in price of current units) – Q_f x ΔFP (Change in price of future contracts)

Q_c x ΔCP = Q_f x ΔFP

$\Delta CP/\Delta FP$ = $\dfrac{Q_f}{Q_c}$

3. Optimal hedging ratio $\Rightarrow$ $Q_f = Q_c$ x $\Delta CP/\Delta FP$

$\qquad\qquad\qquad\qquad\ Q_f = Q_c$ x HR

Let NFC $\Rightarrow$ Number of Future Contracts

Q_{fc} $\Rightarrow$ Quantity of the commodity represented by futures contract

$\therefore Q_f$ = NFC x Q_{fc}

$\therefore Q_c$ x HR = NFC x Q_{fc}

NFC = $\dfrac{Q_c}{Q_{fc}}$ x HR

4. Hedge Ratio $= \dfrac{\text{Futures position}}{\text{Underlying asset position}}$

5. Minimum variance hedge ratio $\Rightarrow$ h $= F_p\ \dfrac{\sigma_{sp}}{\sigma_{Ft}}$

Where,

h – Hedge ratio

p – Co-efficient of correlation between S_p and F_t

σ_{Ft} – Standard deviation of ΔF_t

σ_{Sp} – Standard deviation of ΔS_p

ΔF_t – Change of futures price during hedging

ΔS_p – Change in spot price during hedging.

6. T-bill purchase price = Face value x $\left[\dfrac{1-\%\,\text{discount}}{100}\ x\ \dfrac{\text{Days to maturity}}{360}\right]$

7. IRR (Implied Repo Rate)

IRR = $((FP_{t.T} - CP_{t,T})/(CP_{t,T})) \times 360/(T-t)$

Where,

$FP_{t,T}$ = Price of futures T-bill

$CP_{t,T}$ = Cash price of T-bill.

8. The accrued interest for bond transaction = $(B - tc/B)$ x semi-annual coupon interest and transaction price of the bond.

P = Quoted price + Accrued interest

Where,

B – Total number of days in the coupon period

tc – Number of days remaining till next coupon payment

P – Transaction price of the bond.

9. T-Bond futures:

Theoretical Futures price

= Adjusted cash price of cheapest to deliver bond + Net cost-of-carry.

Case I

If the cash price is equal to the invoice price, theoretical futures price

$$= \frac{\text{The quoted cash price (in \% form)}}{\text{Conversion factor}}$$

Case II

Theoretical futures price at any time before expiration

= Cash price/Conversion factor + Net cost-of-carry.

10. Implied repo rate and identification of cheapest-to-deliver bond:

$C_{t,\,T} = FP_{t,T} - (CP_t/CF)$

Where,

$C_{t,T}$	is	Implied net cost-of-carry
$FP_{t,T}$	is	Actual futures price
CP_t	is	Actual price of cash bond
CF	is	Conversion factor.

11. Hedge ratio with T-Bond Futures:

$HR = \Delta CP_t/\Delta FP_{t,T}$

Where,

Δ stands for the change in the price of CP_t and $FP_{t,\,T}$.

12. Index futures contract price: $FP_{t,T} = CP_t + CP_t \times (R_{t,\,T} - D_{t,\,T}) \times (T - t)/365$

Where,

$FP_{t,T}$	–	Price of the stock index futures contract
CP_t	–	Price of cash index at a time t
$R_{t,T}$	–	Annualized financing rate for period $(T - t)$
$D_{t,T}$	–	Expected average annual dividend
$T - t$	–	Carrying period or number of days due to next dividend or maturity.

13. Pricing of index futures

i. Rupee return earned by the investor if he invests in a portfolio that is identical to stock index = $(I_t - I_0) + D_t$

Where,

I_0	–	Current index value
I_t	–	Expiration day index value
D_t	–	Dividends received.

ii. Rupee return earned by the investor if he invests in an index futures contract

= $(F_t - F_0) + R_f$

Where,

F_0	–	Current price of index futures contract
F_t	–	Expiration day price
R_f	–	Interest earned.

iii. If the investor is indifferent between the above two alternatives,

$F_0 = I_0 + (R_f - D_t)$

14. Calculation of Beta (β) = Cov (R_i, R_m)/Var (R_m)

Where,

R_i = Return on stock i

R_m = Return on market portfolio.

15. Crack Spread

C = (Nhu x Phu x 42) + (Nho x Pho x 42) – (Ncl x Pcl)/Ncl

Where,

Nhu – Quantity of gasoline

Phu – Price of gasoline per gallon

Nho – Quantity of heating oil

Pho – Price of heating oil per gallon

Ncl – Quantity of crude oil

Pcl – Price of crude oil per barrel

42 – Factor used to convert the quantity as the products are priced per gallon and crude oil per barrel.

Options

1. Initial Margin for naked options that are out-of-money would be higher of the following:

i. 100 x Option premium per share + 0.2 (stock's market price) 100 – Amount by which the option is out-of-money.

ii. 100 x Option premium per share + 0.10 (stock's market price) (100).

2. Initial Margin for naked options that are in-the-money:

100 x Option premium per share + 0.10 (stock's market price) (100).

3. Option price is a function of

C_o or P_o = f $(S_o, E, \sigma^2, t, r_f, d)$

C_o – Value of call option

P_o – Value of put option

E – Exercise price

S_o – Price of underlying stock

σ^2 – Price volatility of underlying stock

t – Time to expiration

r_f – Risk-free interest rate

d – Cash dividend.

4. Put-call parity:

Valuation at Expiration Date T

i. $S_T > x$

– Call + Cash : $(S_T – x) + x = S_T$

– Put + Stock : $0 + S_T = S_T$

ii. $S_T < x$

$0 + x = x$

$(x – S_T) + S_T = x$

Put-call parity equation is

$C + X_e^{-r(T-t)} = P + S$.

5. Hedge ratio

	Cash flow at	Cash flows at t = 1 year	
	t = 0	$S_1 = u\,S_0$	$S_1 = d\,S_0$
Sell call	C	$-C_u$	$-C_d$
Buy n stocks	$-nS_0$	nuS_0	ndS_0

If the value of this portfolio is independent of the value of stock,

$-C_u + nuS_0 = -C_d + ndS_0$

$n\,(uS_0 - dS_0) = C_u - C_d$

$$n = \frac{C_u - C_d}{S_0\,(u - d)}$$

6. Cash flows associated with Hedge Ratio

	Cash flow at t = 0	Cash flows at t = 1	
		$S_1 = uS_0$	$S_1 = dS_0$
Write call	C	$-C_u$	C_d
Buy n stocks	$-n\,S_0$	nuS_0	ndS_0
Borrow	$\dfrac{-C_d + ndS_0}{1 + r}$	$C_u - nuS_0$	$C_d - ndS_0$
Total	$C - n\,S_0 - \dfrac{C_d + ndS_0}{1 + r}$	0	0

7. Call price $= C = \dfrac{C_u P + C_d\,(1 - P)}{R}$

$$P = \frac{R - d}{u - d}$$

8. Black-Scholes option pricing model:

$C = SN(d_1) - X_e^{-r(T-t)}\,N\,(d_2)$

$P = X_e^{-r(T-t)}N(-d_2) - SN\,(-d_1)$

Where,

$$d_1 = \frac{\ln(S/X) + (r + \frac{\sigma^2}{2})\,(T - t)}{\sigma\sqrt{(T - t)}}$$

$$d_2 = \frac{\ln(S/X) + (r - \frac{\sigma^2}{2})\,(T - t)}{\sigma\sqrt{(T - t)}}$$

$$d_2 = d_1 - \sigma\sqrt{(T - t)}$$

Where,

    C = is the call option price

    P = is the put option price

    S = is the spot price of the underlying asset

    X = is the strike price of the option

    r = is the risk-free rate

    T – t = is the time to expiration expressed in years

σ =   is the analyzed standard deviation of returns on the underlying asset, i.e. the volatility measure

$N(d)$ =   is cumulative standard normal distribution

e   =   is exponential function (2.7183)

l_n =   is natural logarithm.

Financial Swaps

1.   Valuation of interest rate swaps:

$$V = F_B - F_F$$

Where,

   V   –   Value of the swap

   F_B –   Value of fixed coupon bond

   F_F –   Value of floating rate note.

2.   Valuation of currency swaps

$$V = P_F - P_L$$

Where,

   V   –   Value of the swap

   P_F –   Value of foreign currency bond

   P_L –   Value of local currency bond.

Sensitivity of Option Premiums

1.   Delta call = $\Delta C/\Delta S = N(d_1)$

Where,

   ΔC – Change in the call price

   ΔS – Change in the stock price.

2.   Delta put = $\Delta C/\Delta S = N(d_1) - 1$

3.   Value of the portfolio $\Rightarrow P = -C + N(d_1)S$

4.   Delta for portfolio of derivatives consisting of a single underlying asset:

$$\Delta P \;=\; \sum_{j=1}^{n} W_j \Delta_j$$

Where,

   P   = Δ of portfolio

   Δ_j = Δ of j derivative

   W_j = Weight of j derivative in the portfolio.

5.   Theta of call = $\dfrac{-SN'(d_1)\sigma}{2\sqrt{T-t}} - rXe^{-r(T-t)} N(d_2)$

6.   Theta of put = $\dfrac{-SN'(d_1)\sigma}{2\sqrt{T-t}} + r Xe^{-r(T-t)} N(-d_2)$

Where d_1 and d_2 are defined as per Black-Scholes model.

$$N'(d) \;=\; \frac{1}{\sqrt{2\Pi}}\, e^{-d^2/2}$$

7.   Vega of call or put = $S \sqrt{T-t}\; N'(d_1)$

Where,

$$N'(d_1) = \frac{1}{\sqrt{2\Pi}} \, e^{-d_1^{2}/2}$$

8. Rho for an European put option $= -X \, (T - t)e^{-r(T-t)} \, N(-d_2)$

9. Rho for an European call option $= X \, (T - t)e^{-r(T-t)} \, N(d_2)$

10. Gamma of call or put $= N \, (d_1)/S \, \sigma\sqrt{T - t}$

11. Portfolio Insurance:

Delta of a put on an index $\Rightarrow \Delta = e^{-f(T-t)} \, [N \, (d_1) - 1]$ and

$$d_1 = \frac{\ln(S/X) + (r - f + \sigma^2/2) \, (T - t)}{\sigma\sqrt{(T - t)}}$$

Value at Risk

1. Daily volatility $= \dfrac{\text{Annual volatility}}{\sqrt{\text{Number of working days}}}$

2. Value-at-Risk (VaR) = Position Value x Daily Volatility.

Part II: Problems

Corporate Risk Management

1. Calculate the PV convenience yield for cheap wine from the following information.

    Spot price   : $12,600 per 10,000 gallon tank

    Futures price   : $13,800 per 10,000 gallon tank

    Interest rate   :   8%

    PV (storage costs) : $250 per year.

2. Price changes of 2 stocks alpha and gamma are positively correlated. The historical relationship is as follows:

    Average percentage change in alpha = 0.015 + 0.85 (percentage change in gamma).a5-56P AMCID 18 BDC BT/TT27

Futures

7. October Soyabean Oil futures are selling at 19.44 cents per lb. The standard size of the contract is 60,000 lbs. Initial margin requirement is $3000 while the maintenance margin is $1500. If a trader goes long in two October futures contracts and the prices on the subsequent 4 days are 19, 19.4, 19.6 and 19.8 cents/lb, explain how the margin account changes. Assume that money in excess of the initial margin is withdrawn immediately.

8. On February 14, 2000, the following spot and future prices were being quoted.

   Rs./$ Spot   =   46.73

          March futures   =   46.85

          June futures   =   46.92

          September futures =   47.06

   Mr. Amit Singhal, a forex dealer, holds the view that the market is wrong and the $ will actually depreciate. Another speculator, Mr. Navneet Bansal, agrees with the market that the dollar will appreciate but thinks that the market is overestimating the extent of appreciation.

   What strategy should they adopt in order to make profits? Also, calculate their profit if on July 12, 2000 the following rates materialize.

   Spot Rs./$:   46.98

   September futures   :   47.10

   (We can assume that the standard size of a future contract is $1,000,000).

9. A speculator has obtained the following quotes in $/Yen 100 in December, 2000.

   Spot rate   :   0.892

   Feb' 01 futures   :   0.887

   May' 01 futures   :   0.875

   Aug.' 01 futures   :   0.890

   Nov.' 01 futures   :   0.879

   The speculator feels that the yen will appreciate far more against the dollar than implied by the above rates. He decides to use spread trading to take advantage of the situation. Suppose, two months later when he closes out, the following rates are quoted ($/Yen 100), calculate the speculator's gains/losses.

   Feb.' 01 futures   :   0.892

   May' 01 futures   :   0.900

   Aug.' 01 futures   :   0.915

   Nov.' 01 futures   :   0.926

10. On Aug 1, 2000 the Rs./$ spot rate in New York is Rs.46.00 and Dec. £ futures are trading at $1.4750. The Rs./£ spot rate on that day is Rs.68.93. Microsoft Corporation has a 3-month sterling receivable of £1,00,000. You are given that the standard size of sterling futures contracts is £62,500 and Microsoft decides to hedge its risk by trading in two sterling futures contracts.

    By December 1, 2000 the spot dollar has appreciated to Rs.46.73 while the spot pound sterling has depreciated to Rs.68.45. If Dec. futures are trading at 1.4544, what is the profit or loss incurred by Microsoft?

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11. Willmar Schaube, a German company, is planning to set-up a plant in India. The whole plant will be imported from USA at a cost of $2 million. Willmar Schaube will be settling the dollar liability on December, 10. The current market quotes are:

$/∈ spot	:	0.8949
December LIFFE ∈ futures	:	0.8876
3-month $/∈ forward rate	:	0.8850

Explain how the company can hedge currency risk. Also, calculate the effective cost in ∈ if the following rates materialize on December, 8.

$/∈ spot	:	0.8760
December ∈ futures	:	0.8695

Assume that the standard size of a futures contract is ∈ 125,000.

12. A corporate is expecting to receive Yen 50 million after 3 months. It decides to hedge the foreign exchange risk using the futures markets. The standard size of yen futures contracts is Yen 12.5 million. Currently, both spot and futures yen are quoting $0.00892. If after three months, when the corporate closes out, the futures are quoting $0.00885 and the spot price of the yen is also $0.00885, calculate the effective realization for the corporate while selling the receivables. Also, explain how the corporate has benefitted by using the futures markets.

13. An oil company is planning to hedge its risk by buying December oil futures in June. Calculate the optimal hedge ratio given the following.

    i.   Standard deviation of the change in unit price of oil for the next 6 months is 0.03.

    ii.   Standard deviation of the change in oil futures prices for the next 6 months is 0.036.

    iii. The coefficient of correlation between change in futures prices for the next six months and change in spot prices for the next six months is 0.72.

14. A Dutch exporter is expecting to receive a payment of $1,000,000 after 3 months. The exporter does not have the required credit rating to finalize a forward contract. He decides to cover the exposure using futures contracts in London.

    The following rates are being quoted:

    Spot: ∈/$: 1.117   £/$: 0.678

              Dollar futures: £ : 0.672/$

    Three months later, when the exporter cancels his futures contract by reversing his position, the following rates are being quoted.

    Spot: ∈/$: 1.112   £/$: 0.665

              Dollar futures: £ : 0.662/$

    Making necessary assumptions, explain the strategy which the exporter would have adopted and the outcome of the strategy.

15. On March 1, a trader buys a June Eurodollar future contract at 95.32. The initial margin requirement is $2000 while the maintenance margin is $1500. The settlement prices for the next 10 days are given below:

March 2	–	95.25
3	–	95.22
4	–	95.24
5	–	95.20
6	–	95.17
7	–	95.15
8	–	95.10
9	–	95.15
10	–	95.17

You are required to prepare a statement that indicates how the amount in the margin account varies each day.

16. On October 31st, 2000 the 3-m interest rates in the US and Germany are 6.56% and 4.8% p.a. respectively. The $/∈ spot price is 0.8453. What is the theoretical futures price of January 2001 euro futures contract with delivery on Jan. 31? If the actual futures price is 0.8635, what is the arbitrage?

17. On October 31st, the spot $/£ is 1.4544 and the Jan, 2001 pound futures are trading at 1.4625. The delivery date is Jan. 29th and the pound interest rate is 5.84% p.a. What is the IRR for the Jan. pound futures contract? If the US interest rate is 6.6% p.a, what is the arbitrage?

18. A US firm enters into 6 long Japanese yen futures contract on September 22nd, at a price of $0.00892/¥. Subsequently, the settlement prices of the contract are:

Date	Futures Price ($/¥)
Sep. 22nd	0.008854
Sep. 25th	0.008665
Sep. 26th	0.008456
Sep. 27th	0.008704
Sep. 28th	0.008548

The standard size of the contract is 1,25,00,000 yen.

    a. Compute the cash flows incurred by the firm at the end of each day because of the marking-to-market.

    b. If the initial margin is $3000/contract, and the maintenance margin is $1750/contract, show the firm margin account and amount of additional deposits to be made (assuming no withdrawls).

19. A US exporting firm has a receivable on December 20th for £1,000,000. Today is November 7th and the firm wants to hedge itself against depreciation of pound. The following are the rates prevailing today.

    Spot $/£   – 1.475

    June Pound future – 1.4825

    a. What is the hedging strategy the firm has to adopt?

    b. If the following are the rates that prevailing on Dec. 20th
        i.   Spot $/£   – 1.4676
             June Pound future – 1.4544
        ii. Spot $/£   – 1.4826
             June Pound future – 1.4865

    The standard size of the contract is £62,500.

    What are the gains/losses of the firm due to the hedge?

    What is the effective amount it receives?

20. A US importing firm has a payable of euro one million on December 11th. Today is September 8th and the firm wants to hedge against appreciation of the euro. The following are the rates prevailing today:

    Spot $/∈   – 0.8950

    December euro future – 0.8967

    a. What is the hedge?

    b. If the following are the rates that prevail on December 11th,
        i.   Spot $/£   – 0.8972
             December euro future – 0.8985
        ii. Spot $/∈   – 0.8942
             December euro future – 0.8939

    The standard size of the contract is 1,25,000 euro.

    What are the gains/losses of the hedge? What is the effective purchase cost of euro?

21. Assume that the 3-m US interest rate and German interest rates are 3.5% and 3% respectively. The futures contract has 80 days to delivery and the spot is $0.8452/∈. What is the theoretical euro futures price?

22. Assume that NSE-50 Index futures are traded with rupee value being Rs.100 per Index point on 15th September, the Index closed at 1195 and December futures (last trading day December 15) were trading at 1225. The historical dividend yield on the Index has been 3% and 3 M T-bill yield was 9.5%.

    a. Determine whether on September 15 the futures were underpriced or overpriced.

    b. What arbitrage transaction was possible to gain out this mispricing?

    c. Calculate the gains and losses if the Index on 15th December closes at (i) 1260 (ii) 1175.

23. The following is an extract from futures price quotations in a financial newspaper. Explain the various terms and numbers in the table.

    British Pounds (IMM): 62,500 pounds; $ per pound

March	1.5060	1.5068	1.5053	1.5055	–0.0007	3454
June	1.4990	1.5020	1.4990	1.5010	–0.0006	5430
September	1.4920	1.4945	1.4910	1.4935	+0.0005	7864

24. A corn farmer sells 10 futures contracts of 5000 bushels each at Rs.4.00 per bushel. The spot price is Rs.3.30 per bushel. At the time of harvesting, which is four months from now, if the price per bushel reaches Rs.4.15, what is the basis at the time of expiration of the contract? Does the farmer gain or lose and by how much amount with respect to futures price and spot price four months ago?

25. A speculator bought two future contracts of Corn on day 1 and sold them on day 7. He again sold two contracts on day 8 and bought them on day 10. Each contract consists of 5000 bushels. The settlement price of wheat bushels during 10 trading days is shown below. The initial and maintenance margins to be deposited with the clearing house are $400 and $400 respectively. The speculator has already deposited $100 with the broker. Given this data, prepare the daily gains and loss tables along with equity and margin account table in the next page.

Days	Settlement Price (in cents)
1 (Bought two contracts)	225
2	228
3	230
4	227
5	223
6	225
7 (Sold two contracts)	229
8 (Sold two contracts)	233
9	236
10 (Bought two contracts)	239

    What is the amount of profit/loss made by the speculator?

26. A jeweler requires 500 troy ounces of gold after three months. The spot price of gold for a troy ounce is Rs.20,000. He buys three futures contracts at Rs.23,000 each. Did he take the appropriate action? If the spot price of the gold per troy ounce after three months is Rs.18,000, what is the profit/loss for the jeweler (each gold contract is for 100 troy ounces)?

27. A speculator goes long in 6 Eurodollar futures of standard size $1,000,000. Currently, the futures are quoting at £0.7025. The initial and maintenance margins are both £3000. If the price of futures changes to 0.7030, 0.7020 and 0.7040 on the next three days, determine the daily variation in the margin account.

28. A 90-day Treasury Bill Futures contract quotes 95.02. Find the value of the underlying contract if the face value is $1,000,000.

29. The current price of an index is Rs.1,380 and the annualized dividend yield on the index is 4.8%. A six-month futures contract on the index can be purchased for a price of Rs.1,434. The risk-free rate of interest is 12%. Show how the arbitrageur can earn an abnormal rate of return irrespective of the outcome on the expiration date. Assume that 50% of the stocks included in the index will pay dividends during the next six months. Ignore margin requirements, transaction costs and taxes. What is the implied risk-free rate given the market price of Rs.1,434.

30. A highly diversified portfolio is currently worth Rs.10 lakh and has a beta of 1.0. The BSE sensex is currently at 4000. Show how a (hypothetical) put option on the BSE Sensex with a strike price of Rs.3,800 can be used to provide portfolio insurance. Assume that each option is for 10 times the value of the index.

31. A wheat farmer in order to protect himself from price fluctuations sells 15 futures contracts of 5000 bushels each at the rate of Rs.9.00 per bushel. At the time of harvest which is five months from now, the basis is –0.15 and the price of wheat per bushel is Rs.9.50. Did the farmer gain or lose and by how much amount?

32. The current stock index is 3500 and the annualized dividend yield on the stocks is 6%. A six-month futures is now currently trading at 4000. The risk-free rate is 12%. Find if there is any scope for arbitrage opportunity if 25% stocks pay dividends. (Assume the multiple associated with futures to be 100).

33. "Arbitrage profits" an investor told are riskless profits. You take simultaneous but opposite positions in two markets to reap gains from pricing disparities. Acting on this belief, his friend tried to find the arbitrage profit by trading simultaneously in futures and stock index. He has collected the following information:

    - Present level of stock index   – 3000
    - Index futures priced at   – 2000
    - Risk-free rate of return   – 10% p.a.
    - 50% stocks are to pay dividends at 6%
    - The index futures has a multiple of 100
    - The futures has six months to expiration.

    Required:

    a. Find the arbitrage profits, if any.

    b. Discuss the risks associated with arbitrage transactions in futures.

34. The settlement price of an index future contract on a particular day was 1,760. The multiple associated with the contract is 100.

    The maximum amount by which the contract can realistically change is 50 points per day. The initial margin is, therefore, set at 50 x 100 = Rs.5,000. The maintenance margin is set at Rs.4,000. The settlement prices on the following four days are as follows:

Day	Settlement price
1	1,800
2	1,752
3	1,780
4	1,824

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Required:

Calculate the mark-to-market cash flows, the daily closing balances and net profit (loss) in the accounts of

a.   An investor who has gone long at 1,760; and

b.   An investor who has gone short at 1,760.

35.   The current stock index is 3450 and the annualized dividend yield is 4%. A six-month future is now currently trading at Rs.3,585. The risk-free rate is 10%. Verify whether there is any scope for a risk-free arbitrage if 50% of stocks pay dividend.

36.   Recently, the L C Gupta Committee recommendations on stock index futures have been accepted in principle. An investor is interested in creating a hypothetical index portfolio to understand the concept of stock index arbitrage. He has collected the following information:

*   The current price of the index is 2300.

*   The dividend yield on the index is 3%.

*   A six-month futures index is currently priced at 2500.

*   The rate on 364-day T-bills is 10%.

*   60% of the companies are likely to pay dividend.

Required:

a.   Calculate the fair price of the index futures contract.

b.   Calculate the investor's gains/losses if the index stands at 2400, 2600 at the end of six months. (Assume the multiple to be 100).

c.   As a stock index arbitrageur what are the risks you should be cautious about?

37.   A fund manager tries to create a hypothetical index future contract based on the following information pertaining to the index. The current level of the index is 3375. A six-month futures contract on the index can be purchased for 3525. The goverment's T-bill yield is 8%. Further it is also assumed that 60% of the stocks in the index which paid dividends last year will pay for this year too and that the dividend yield of 3.5% on the index will not change in future. The index has a multiple of 100 and the tenure of the futures contract is 6 months.

Required:

a.   Calculate the fair value of the index contract.

b.   Verify whether there exists the scope for riskless arbitrage using stock index futures. (You can assume the absence of taxes, transaction costs).

c.   Assume that the stock portfolio of an aggressive manager has a beta of 1.25. If markets are likely to go through a bearish phase in the next two years and the manager would like to reduce the beta of his portfolio to 0.75, how can he use index futures to manage his portfolio beta? How is it superior to stock trading?

38.   A trader has gone long on 5 Brent crude futures for December settlement at $26.32 per barrel. The minimum contract size for Brent futures contract is 100,000 barrel. The initial margin is $50,000 and the maintenance margin is $30,000. The futures closes at the following prices on the next ten trading days:

Day 1	$ 26.19
Day 2	$ 26.30
Day 3	$ 26.45
Day 4	$ 26.48
Day 5	$ 26.34
Day 6	$ 26.21
Day 7	$ 25.98
Day 8	$ 25.87
Day 9	$ 25.90
Day 10	$ 25.95

The trader will take out the profit out of the margin account whenever he gets the opportunity to do so.

You are required to

a.   Prepare the margin account showing all the cash flows.

b.   Find the profit/loss for the trader after 10 trading days.

39.   The price of Silver was $ 7.511 per ounce in the New York market on April 27, 2001. At the close of trading on the same day, the settlement price of December 2001 silver futures contracts was $ 8.456. The annualized borrowing rate on April 27, 2001 was about 11% on the Eurodollar rates. The cost of storing gold is negligible, as the quantity stored is very small.

You are required to calculate the following:

a.   The cost-of-carry price relationship between the cash price of silver and the futures price of silver.

b.   Show how an arbitrage gain can be made with the conclusion derived by you in (a) above.

40.   A firm in Denmark exports diamonds after cutting and polishing. On September 15, an order worth $20million to a US customer is shipped. The payment is due 3 months from that date. The spot DKK/$ is 6.5898 and the 3-month forward rate is DKK 6.4927/$.

The firm is considering to hedge its exposure by taking position in futures of either Euro or Pounds as both the currencies are related to DKK in a similar manner.

The spot rates as on September 15th are—

$/£ = 1.5435 $/€ =1.1112

And the December £ futures are trading at $/£ 1.5559

The December € futures are trading at $/€ 1.1008

On December 15th, the spot rates are as----

DKK/$ =6.4921

$/£ =1.5817

$/€ =1.1192

In the futures market

December £ futures are trading at $/£ 1.5814

December € futures are trading at $/€ 1.1189

You are required to compute the firm's gain and losses in both the hedging strategies.(standard size of Euro futures are 125,000 and the size of British Pounds is 62,500.)

41.   On June 05, 2002 you bought 5 gold futures at a price of $ 297.50 per ounce. The size of gold futures is 100 ounce per contract, initial margin is $2000 per contract and maintenance margin is $1500 per contract.

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Closing prices of gold futures for 10 trading days are:

Date	Closing price
June 05	$ 298.20
June 06	$ 297.10
June 07	$ 294.40
June 10	$ 293.90
June 11	$ 292.70
June 12	$ 287.00
June 13	$ 287.00
June 14	$ 287.80
June 17	$ 288.50
June 18	$ 289.10

On June 19, 2002 you square-off the position at a price of $289.70.

You are required to prepare the margin account showing all the cash flows and calculate profit/loss after squaring-off the contract. (You can assume any amount above the initial margin to be withdrawn).

42. An Indian exporter exported goods worth ¥ 500 million to a Japanese company. Payment for the same is expected to be realized on November 21st, 2002. The firm also imported equipment worth $4 million from a US company, payment for which is due on December 22nd, 2002. The company would like to hedge both the exposures through December ¥ futures traded in IMM. The firm is also considering to hedge the payable and receivable individually through forward contracts.

The following rates are observed by the firm:

Current Spot rate

Rs./100 ¥   40.52

Rs./$ 48.55

Forward rate quoted by an Indian Bank

November 21   Rs./100 ¥   40.25

December 22   Rs./$ 49.40

IMM Futures quote

December   ¥ Futures $ 0.00805

1 month Interest rates

Rupee   5% p.a.

Dollar   2% p.a.

You are required to:

a. Explain how the yen futures can be used to hedge both the exposures?

b. Calculate the number of futures contracts required to hedge the exposure.

c. If on 21.11.02, spot rate is ¥/$ 121.78 and December futures closes at $0.0082, compare the forward market hedge and the futures market hedge.

43. On December 09, 2002 an investor bought 10 T-Bill futures contracts trading on IMM at 96.72. The initial margin requirement is $ 2000 per contract with a maintenance margin of $1500 per contract. The settlement prices of T-Bill futures contract for 9 trading days are as follows:

Date	Settlement Price
December 9	96.75
December 10	96.68
December 11	96.63
December 12	96.59
December 13	96.54
December 16	96.50
December 17	96.55
December 18	96.60
December 19	96.64

On December 20, the investor closes his position when futures price was 96.67.

You are required to prepare the margin account showing all the cash flows and calculate profit/loss. (Assume no amount is withdrawn from the margin account).

44. Consider the following information:

Current BSE sensex	4235
3-month futures contract on BSE sensex	4450
Dividend yield on sensex	2.5%
Risk-free interest rate	8%
Multiple for the futures contract	5

All the stocks included in the sensex are expected to pay dividends in the next 3-months.

You are required to

a. Compute the fair price of the 3-month futures contract.

b. Explain how an arbitrageur can exploit the opportunity if the future contract is not priced fairly. Explain with supporting calculations.

45. On July 3, 2001, Mr. Garman had bought one 90-day US Treasury Bill futures contract for delivery on September 25, 2001 quoted at 94.55. On July 28, 2001, Mr. Garman sold the futures contract when it was being quoted at 95.05. The size of T-Bill futures contract is $1,000,000.

You are required to find out the annualized yield realized by Mr. Garman from the investment.

46. On March 01, 2002, MNC Inc. a US company expecting to generate in June a surplus of $5 million for 3 months. The company has decided to invest the funds for 3-months in T-bills. The present economic scenario suggests that Federal Bank may cut interest rates further, so the yield may decline after 3 months. So it decided to hedge the fall in interest rate through 3-month T-bill futures. The June T-bill futures are quoting currently at 96.25. Standard size of T-bill futures is $1 million and the tick size is $25.

You are required to

a. Explain, how the company can hedge through T-bill futures.

b. Calculate the annualized discount yield. If in June 3 month T-bills are quoted at 96.50 and 95.75.

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47. A fund manager in the USA is holding 50 US Treasury bonds of 18 years and 9 months to maturity. Current quotes in the market are as follows:

Price of T-bond   131-02

Coupon rate   12%

Conversion factor   1.3782

The fund manager is concerned about a potential rise in interest rate and has decided to fully hedge the portfolio through Treasury bond futures. He has decided to protect the portfolio for 3 months and identified the following T-bond futures for hedging:

T-bond futures price 94-22

Short-term financing rate   8% p.a.

You are required to

a. Suggest the fund manager whether to buy or sell the futures, and how many futures contract to be used?

b. Calculate the annualized return earned on the portfolio if the T-bond price and futures price after 3-months closes at

    i. 130-05, 94-03

    ii. 131-31, 94-45.

48. On February 15, 2002 the following prices are observed on the IMM and the interbank foreign exchange market:

	$/Euro	$/Yen
Spot	0.8666	0.0076
Futures:		
March	0.8738	0.0075
June	0.8800	0.0074
September	0.8860	0.0073

A speculator is looking at the above prices and arrived at the conclusion that in long-term Euro will move against Yen in the opposite direction of what cross-market quotes are implying. So he is planning to adopt some spread strategies to profit from this view.

You are required to

a. Find the market long-term view of euro's prospect against yen.

b. Explain what spread strategy the speculator will adopt to profit from his view.

c. If in May, the futures prices are turned out as

	$/Euro	$/Yen
June	0.8805	0.00735
September	0.8836	0.00745

Calculate the profit/loss of the speculator.

Options

49. Consider a trader who buys a European call option on British pound with a strike price of $1.5920 and a premium of 3 cents ($0.030). The current spot rate is $1.5860. Calculate his gain/loss when the option expires if the spot rates are as given below:

1.5720; 1.5830; 1.5860; 1.5870; 1.5930; 1.6020; 1.6050.

50. Suppose you contemplate to buy a call option with strike price Rs.42/$ as you expect the following spot rates with their probabilities

Rs./$	40.00	41.50	43.00	44.50	46.00
Probability	0.15	0.25	0.30	0.20	0.10

What should be the option premium to enable you to break even?

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51. A US firm expects to receive Can $300 million six months hence. It decides to write 6000 American call options (each with a face value of Can $50,000). The available options are as given hereunder.

Strike Price	Option Price (US$) (per contract)
0.68	598.50
0.69	325.00
0.70	156.50

The firm must pay lump sum brokerage fees of US$ 24,000 for writing the options. A flat exercise fee of US$210,000 is payable by the firm to the clearing corporation if the options are exercised.

Draw up a pay-off table for the various strike prices given above if the spot rates at the time of maturity of the receivables are $0.6750, $0.6850 and $0.6950 and $0.7050.

52. What is a strangle? What will be the pay-off profile of a trader who adopts a strangle strategy given the following details.

Option	Strike Price	Premium
Put	1.71	0.10
Call	1.75	0.05

53. What is a straddle? If a trader goes long by adopting a straddle strategy what will be his/her pay-off profile given the following option details.

Type of the option	Strike price	Premium
Call	$0.5890/CAD	0.015
Put	$0.5980/CAD	0.020
Put	$0.5890/CAD	0.018
Call	$0.6110/CAD	0.010

54. A trader sells 2 options simultaneously

Type	Exercise Price $/£	Premium
Call	1.5880	0.12
Put	1.5880	0.14

Under what conditions will he make profits?

55. During the month of October, European pound sterling options are quoted as follows. The quotes are in terms of US$

Call Option Premium	Strike Price
0.04	1.6300
0.03	1.6500
0.01	1.6600

Determine the conditions under which profits can be made for each option separately by the (i) option buyer (ii) option writer.

56. Suppose you write a European put option with strike price AUD 1.28/SF. You decide to cover yourself by going short on SF in the spot market at AUD1.30/SF. On the expiry date, the spot price may range from AUD 1.25/1SF to AUD 1.32/SF. If the premium is AUD 0.20/SF, construct the pay-off table.

57. The details of a declaration policy of the fire insurance are as follows:

i. Insured amount is Rs.2 crore

ii. Provisional premium is Rs.40,000

iii. Declaration is on monthly basis

iv. Period of insurance is 12 months starting from April 1, 1999.

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v.   Declarations made were:

April,1999	Rs.199.8 lakh
May,1999	Rs.199.2 lakh
June, 1999	Rs.198.8 lakh
July, 1999	Rs.199 lakh

You are required to

a.   Calculate the actual payment by the insurance company if the last declaration made should have been Rs.199.5 lakh and property worth Rs.40,000 was damaged by fire during July, 1999.

b.   Independent of (a) above, if the insured desires to cancel the insurance policy from August, 1999, calculate the amount refunded by the insurance company. Assume the premium retained at the short period rate is 50% of the premium on the average declaration amount.

58.   A stock trades at 110 and there are two European options currently available.

Put	Strike Price	Premium
A	114	5
B	117	9

Explain how a speculator can make arbitrage profits (no interest costs).

59.   Suppose you sell a European put option which expires 3-months hence. The strike price is Rs.40.0/Euro and the premium is Re.0.60/Euro. To cover your exposure you sell Euro 3-months forward at a rate of Rs.40.60/Euro. If the spot price can vary from Rs.38/Euro to Rs.42/Euro at maturity, construct the pay-off table.

60.   A trader has a single underlying stock on which there are 2 call options. The details are given below:

Call A –   Call price: $30 Exercise price: $115 Time until expiration = 6 months

Call B –   Call price: $25 Exercise price: $110 Time until expiration = 6 months.

Prove the following proposition: Lower the exercise price, the more valuable the call. What will be the options available to the trader if,

i.   The stock price is $110

ii.   The stock price is $\leq$ $110

iii.   The stock price is $120

iv.   The stock price is $117.

61.   A trader has a single underlying stock on which there are 2 call options. The details are given below:

Call A : Price: $6 Exercise price: $100 Time to maturity 3 months.

Call B : Price: $5 Exercise price: $100 Time to maturity 6 months.

Prove that the price of call B should be greater than or equal to the price of call A.

62.   Prove the following proposition:

Before expiration, an American put must be worth at least the difference between the exercise price and the stock price.

63.   For the following data, prove that before expiration a European put must be worth at least the difference between the present value of the exercise price and the stock price.

Spot price of the stock	:	$95
Exercise price of the option	:	$100
Price of the put	:	$3
Time to expiration	:	3 months
Risk-free rate of interest	:	6%

64. The longer time to expiration, the more valuable an American put. Is it true? If so, or not prove.

65. A particular stock trades at $110 and there are two options, which have the same time until expiration.

Put C has an exercise price of $120 with a price of $11.

Put D has an exercise price of $115 and a price of $12.

How can the arbitrage profit be obtained so as to prove that higher the exercise price, more valuable the put?

66. Take an example and prove that the price difference between two American puts cannot exceed the difference in exercise prices?

67. Suppose that there are two European put options which are to expire in 6-months. The risk-free interest rate is 8%. Put 1 is traded at $3 and has an exercise price of $105. Put 2 is traded at $7 and has an exercise price of $110. Is it possible to make an arbitrage profit with these 2 option quotes. If so/not, how?

68. An investor intends to have a price for a December 2000 European call option and a put option on a particular stock. This option is due to expire on December 25th 2000. The option is bought on November 16th 2000. The stock does not pay dividends. The following information is available about the call and the put option.

Stock sells at Rs.145

Strike price of the call option is 140

Strike price of the put option is 140

Interest rate is 10%. The standard deviation of the stock returns is 20%. Compute the value of the call and the put option.

69. On November 3, 2000 an investor plans to buy a December 2000 call option and a put option on a particular stock. The option is due to expire on December 15, 2000. There is no dividend payment on the stock. The following information is given.

Stock is trading at Rs.130

Strike price of the call option: Rs.120

Strike price of the put option: Rs.120

Interest rate is 9% and the standard deviation of the stock returns is 18%. Compute the value of the call and the put option.

70. Use the Black-Scholes model to value the following call option.

Stock price	:	Rs. 210
Strike price	:	Rs.220
Time to expiration	:	167 days
Risk-free interest rate	:	10%
Variance of annual stock returns	:	20%

71. Consider a call option on a stock with the following parameters

Strike price	:	Rs.70
Risk-free rate of interest	:	6%
Time to expiration	:	90 days
Standard deviation of returns on a stock	:	0.4
Spot price of the stock	:	Rs.60

Compute

   i.   Price of the call option

   ii. Its Delta

   iii. Gamma

   iv. Theta

   v.   Vega

   vi. Rho.

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72. In the problem no.71, if volatility were to increase by 0.2, and the other parameters remain the same. What would be the increase in the price of the call option?

73. A call has 91 days for its expiration. The risk-free interest rate is 8% p.a. The strike price of the call is 60. The price of the stock is 65. The standard deviation of the stocks monthly returns is 15.8%. Compute the value of the call using Black-Scholes model. Find the delta of the call.

74. If a speculator has sold a butterfly, based on the following call options, work out the pay-off profile. What do you think is the view of the speculator about the movement of the US ranging from $42 to $44.5 with the difference of $0.5.

Strike rate (Rs./$)	Premium (Rs.)
42.50	1.25
43.00	1.00
43.50	0.75

75. A Japan manufacturer of a product X supplies goods worth $10 million to an American customer the payment of which is due in 2 months.

Current ¥/$ rate   :   111.05

Two-month forward rate   :   110.82

An American put option on dollar is available in the interbank market with maturity of 3-months and a strike price of ¥112.20. The premium chargeable is ¥0.0035/$.

The firm purchases a put on $1.5 million. What will be the effect of buying a put option if

i. $ depreciates to ¥ 110.65/$

ii. $ appreciates to ¥ 113.2/$.

76. Assume that you buy a call with an exercise price of $100 at a cost of $9 and at the same time you sell a call with an exercise price of $110 at a cost of $5. The two calls have the same underlying asset and same time to expiration.

a.   Explain the behavior of the strangle for the stock price between $98 and $112.

b.   What is the best outcome and for what range of stock prices does it occur?

77. A 3-month put option on the June Eurodollar futures contract has a strike price of $90. Other information is given below:

a.   It is an American option

b.   Time to maturity 91 days

c.   Face value: $1 million

d.   Cost of the option 0.70

e.   Current 3-month LIBOR interest rate: 7%

      i.   Calculate the value of the put option when the Eurodollar futures prices is $89.

      ii.   At what level of the futures price will the cost of the option and the pay-off be equal?

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78. Suppose you had purchased 3 March British Pound calls with a strike price of \$1.475/£ at the price shown in the following extract from a financial newspaper:

Foreign Currency Options Monday November 20, 1999 BRITISH POUNDS (PHLX) 25,000 Pounds; Cents per pound

\$/£ Strike Price	Calls-Settle in Cents			Puts-Settle in Cents		
	Dec-C	Mar-C	Jun-C	Dec-P	Mar-P	Jun-P
1.425	6.40	7.05	7.75	0.05	2.00	3.65
1.450	3.95	5.35	6.35	0.10	2.85	4.60
1.475	1.65	4.20	5.15	0.35	4.00	5.70
1.500	0.50	3.20	4.20	1.65	r	

a. How much upfront fee would you have paid? (Ignore brokerage fees).

b. What is ceiling cost of £75,000 that you would have locked-in?

c. Suppose after holding the options for 45 days, you had sold them at a price of "5.20" (cents per pound). What would be your net profit? Assume that you have to pay a brokerage of \$10 per option both when buying and selling and that your interest cost is 8% p.a. (360 days).

79. An Australian firm buys a call on \$1,000,000 with a strike of AUD1.60/\$. The interest opportunity cost is 6% p.a. and the maturity is 180 days. The call option premium is AUD 0.03/\$.

a. What is the break even maturity spot rate beyond which the firm makes a net gain?

b. Suppose the six-month forward rate at the time the option was bought was AUD 1.62/\$. What is the range of maturity spot rate for which the option would prove to be better than the forward cover? For what range of values would the forward cover be better?

80. A French exporter to UK has a 90 day sterling receivable. He purchases a put option on £2,50,000 at a strike of €/£ = 0.6568 at a premium of €/£ = 0.03. The current spot rate is €/£ = 0.6565 and the 90-day forward is €/£ = 0.6567. The interest opportunity cost for the firm is 4% p.a

a. Calculate the maximum €/£ rate at the end of 90 days below which the firm will make a net gain from the put.

b. Calculate the range of maturity spot over which the option would be better than the forward and vice versa.

81. You have a 12-month payable of AUD 1,00,000. The current Rs./AUD spot rate is Rs.20, rupee interest rate is 21% p.a. and AUD interest rate is 10% p.a. You are considering a forward hedge at the current forward rate of Rs.22. A friend tells you that he recently bought a call on AUD 1,00,000 at a strike price of Rs.20 and is willing to sell it to you at the historic premium of Rs.1 per AUD or Rs.1,00,000 for the entire contract. The call matures at the same time as your payable and is a European call. What should you do?

82. An American importer has a payable in Yen six months latter. The market quotes are as under:

Spot ¥ /\$ 125.00

Forward 6-m ¥/\$ 122.30

Nature of Option	Strike Rate (¥/$)	Premium
Call (6-m)	122.30	3.25%
Call (6-m)	120.00	2.15%
Put (6-m)	126.00	2.15%
Put (6-m)	127.50	1.75%

Which of the following alternatives is preferable when comparable to a forward contract?

a. Buy a 6-m call at ¥/$ 122.30.

b. Buy a 6-m call at ¥/$ 120 and write a put at ¥/$ 126.

c. Write a 6-m put at ¥/$ 127.50.

83. An option with face value of $1 million has a maturity of 183 days. The 6-month LIBOR is 15%. There is 50% probability of that rate raising to 16% in the next 6-months, while there is also a 50% chance of the rate falling to 14%. The expected spot rate is 12%. Using the binomial model, calculate

i. (a) Value of the call option (b) Value of the put option.

ii. The forward price of 182 day loan with a forward value of $1.

iii. The forward rate at which both the call and the put have equal value.

84. A 6-month call option on a 6-month LIBOR has a strike level of 8% and a face value of $15 million. It costs $35,000 today.

i. What is the value of the option if current LIBOR rate is 9%?

ii. At what level of the 6-month LIBOR in 6 months time would the total borrowing cost be the same with and without the call option?

85. The following quotes are available on ABC Motors (ABC) Options. The stock closed on this day at Rs.40. ABC was paying an annual dividend of Rs.2.80 per share at the time.

	Calls			Puts		
Strike	March	June	September	March	June	September
30	9.0000	10.000	N.A.	0.0625	0.250	0.625
35	4.0000	6.000	7.0	0.1250	1.125	1.750
40	0.5000	2.500	3.5	1.5000	2.250	3.500
45	0.0625	0.875	1.5	6.1250	6.250	6.500

a. Which call options are in-the-money?

b. Explain the rationale behind

i. Buying a Sept./45 call rather than buying the stock.

ii. Selling (writing) five June/40 calls and simultaneously buys 500 shares of ABC at a cost of Rs.40 per share.

c. Investors certainly have different expectations concerning the overall direction of the market at any given time. Match the outlook described below in column (A) with the appropriate strategy in column (B) relative to the ABC Motors options.

A	B
Investor Outlook	Strategy
1. Very optimistic	A. Buy stock and buy two June 40 puts
2. Moderately optimistic	B. Buy stock, sell Sept./40 call + Sept./45 call
3. Neutral	C. Buy Mar./35 put
4. Moderately pessimistic	D. Buy stock on margin and sell Mar./30 put
5. Very pessimistic	E. Buy stock, sell Mar./45 call

d. Define the limits of profit and loss and an expected break even price if you are engaged in a bearish spread involving the June/30 and June/35 calls.

86. An investor bought a 3-month call option on a stock at Rs.325 when the current stock price is Rs.315. The call option is priced at Rs.12.

    a. What is the initial margin to be posted by the writer of the option?

    b. What will be the price of a corresponding put option, if risk-free rate is 9%?

    c. If the underlying stock has an expected return of 20% and volatility of 30%, what is the expected price of the stock two weeks latter?

87. The current price of a stock is Rs.43.50.

    A speculator found the following options traded in the market.

Strike price	Call premium	Put premium
43.30	0.90	0.40
43.50	0.50	0.60
43.70	0.30	1.00

    She is of the opinion that the price is likely to experience wide variation though the direction is not clear. Suggest a suitable strategy and work out the pay-off profile over a range of prices from Rs.43.00 to Rs.44.00. (Round off the price to 10 paise).

88. Consider the following hypothetical information on three-month options on the share price of ABC Ltd.

Strike Price (Rs.)	Premium (Rs.)	
	Call	Put
43.00	55	10
43.25	25	25
43.40	5	60

    A speculator expects that the share price, which is now 43.25, may move to 40.00 or 46.00 in the next three months and wants to speculate on it for an amount of Rs.1,00,000. He thinks taking a combination of bullish spread and bearish spread is superior to a straddle or a strangle. Do you agree with him? Give your answer based on a comparison of the strategies with respect to:

    a. Net premium inflow/outflow.

    b. Break even prices.

    c. Profit potential.

89. A speculator expects steep movements in the stock price of XYZ Ltd. from the current level of Rs.44.50 in the next three months. He is not sure of the direction in which the price change may take place. He wants to adopt a strategy suitable for his view. The following is the information relating to three month options on the stock of XYZ Ltd.

Call options		Put options	
Strike price (Rs.)	Premium (paise)	Strike price (Rs.)	Premium (paise)
44.25	55	44.25	5
44.50	25	44.50	10
44.75	5	44.75	60

    The speculator believes that increase in the stock price as likely as its decrease.

    You are required to

    a. State the strategies the speculator may adopt.

    b. Calculate the maximum loss the speculator may incur if his expectations do not come true, for each of the strategies mentioned in (a) above.

    c. Calculate the break even price(s) for each of the strategies mentioned in (a) above.

    d. Indicate the maximum profit that can be earned from each of the strategies mentioned in (a) above.

90. An investor wrote a naked call option. The premium was Rs.2.50 per share and the market price and the exercise price of the share are Rs.37 and Rs.41 respectively. What is the amount that is required to be deposited with the clearing house (the contract is for 100 shares)?

91. Ms. Geeta established the following spread on the Delta Corporation's stock:

    i. Purchased one 3-month call option with a premium of Rs.30 and an exercise price of Rs.550.

    ii. Purchased one 3-month put option with a premium of Rs.5 and an exercise price of Rs.450.

    The current price of Delta Corporation's stock is Rs.500. Determine Ms. Geeta's profit or loss if

    a. The price of Delta Corporation stays at Rs.500 after 3 months

    b. The price of Delta Corporation falls to Rs.350 after 3 months

    c. The price of Delta Corporation rises to Rs.600.

92. Compute the value of the March 482 call on futures contract on December 25, 1999. The futures price is 465.75 and strike price is $482. The risk-free interest rate is 8% per year. The last trading day for the futures call is March 15, 2000. The standard deviation is 30%.

93. Carbon Jewelers Ltd., has imported diamonds worth $50 million from a company in South Africa. The payment for the imports has to be settled in dollars after one month. Treasurer of the company is thinking to cover the payable through options. Following European options on dollars of maturity after one month are quoted at the market:

Strike price (Rs.)	Option	Premium (Rs.)
47.00	Call	0.50
47.00	Put	0.05

The treasurer is considering the following three alternatives:

i. Buying a call option

ii. Writing a put option

iii. Buying a call and writing a put option simultaneously.

Due to recent wide fluctuations in the rupee-dollar exchange rate, the treasurer is of the opinion that exchange rate of dollar may remain between Rs.46 and Rs.48 after one month.

You are required to show the pay-off profile of all the three alternatives and suggest the treasurer about the best alternative of hedging with reasons for the same.

94. A speculator is expecting significant depreciation of Yen against dollar over the next six months. The current $/100 ¥ spot rate is 0.8805. The following European call options are traded at the market:

Option	Strike price ($/¥)	Premia ($/¥)	Maturity
Call	0.0087	0.00015	6m
Call	0.0083	0.00025	6m

The speculator wants to make profit by using above call options.

You are required to

a. Suggest an appropriate spread strategy explaining the reason for the same.

b. Show the pay-off profile and pay-off diagram for the strategy for a range of values between 0.0080 $/¥ to 0.0090 $/¥.

c. Calculate break-even rate, maximum profit and maximum loss from the strategy.

95. Current rupee-dollar exchange rate is Rs.47.95/$. The following 3 months European options are quoted at the market:

Strike price	Premium		Maturity
	Call	Put	
Rs.48.00/$	Rs.0.60	Rs.0.02	3 months
Rs.48.50/$	Rs.0.12	Rs.0.25	3 months

A speculator is expecting a fairly strong depreciation of rupee against dollar over the next three months period. The speculator is trying to make profit from this view by trading in the above two call options.

You are required to

a. Suggest an appropriate option strategy (using only call options) to the speculator to make profit from the forecast explaining the reason for the same.

b. Give the pay-off profile and draw the pay-off diagram indicating break-even rate(s), maximum possible profit and loss from the same strategy.

c. If the speculator is not sure of the direction of fluctuations of the exchange rates, what other option strategies he/she can adopt.

96. The following options are quoted at the market:

Option	Expiration	Strike price	Premium
Call	1 month	Rs.48.50/$	Rs.0.30
Put	1 month	Rs.48.50/$	Rs.0.05

A trader is looking at the above options and planning to adopt long strip or long strap strategy to make profit from the rupee-dollar exchange rate volatility.

You are required to

a. Show the pay-off profile and indicate break even points for strip and strap strategies in a price range of Rs.47 – Rs.50 for a dollar.

b. Comment on the desirability of the above two option strategies.

97. The current stock price of Telesoftek Ltd., is quoting at Rs.75. The standard deviation of continuously compounded annual rate of return from the stock is 25%. The risk-free rate in the economy is 8%.

You are required to

a. Calculate the value of a call option with strike price Rs.100 and time to expiration 6 months using Black Schole's option valuation model.

b. Calculate the value of a put option with strike price Rs.100 and time to expiration 6 months.

98. An Indian ready-made wear manufacturer exported goods worth $10 million to US. The payment for the exports will be received after three months. Current rupee-dollar exchange rate is Rs.49/$. Due to the fluctuating rupee-dollar exchange rate the company is planning to hedge the foreign exchange exposure through options market.

Following European option on dollar of maturity three months are available at the market.

Strike Price (Rs.)	Option	Premium (Rs.)
50	Call	0.20
50	Put	0.50

The company is considering the following three alternatives for hedging the receivable:

i. Writing a call option

ii. Buying a put option

iii. Writing a call and buying a put together.

You are required to show the pay-off profile of all the three alternatives for a price range of Rs.49 – Rs.51 and suggest about the best alternative of hedging.

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99. A company's stock is currently traded at the market at Rs.80. A two year American call option on the company's stock with strike price of Rs.75 is available at the market. The price of the stock in the two years time either move up or down by 10% in each year. The risk-free interest rate is 8%.

You are required to use Two-step Binomial Model to find out the price of the two year American call option on the company's stock.

100. The stock of a company is currently quoted in the market at Rs.150. The price of the stock is expected to go up or down by 10% in next one year and by 15% in the second year. The risk-free interest rate in the economy is 6%.

Required:

Using two-step Binomial Model, find out the price of a 2-year American put option on the company's stock with strike price of Rs.175.

101. Current dollar-euro spot rate is $0.9825/Euro. A speculator is expecting that in the next two-three months euro will not fluctuate much from the current spot rate against $. The following call options are available in the market:

Option	Strike price ($/Euro)	Premium ($)	Maturity
Call	0.96	0.022	3 months
Call	0.97	0.014	3 months
Call	0.98	0.008	3 months
Call	0.99	0.003	3 months

The speculator wants to make a profit from his view by adopting an option strategy using all the four call options given above, and would like to limit his maximum potential loss.

You are required to suggest a strategy to the speculator and prepare pay-off profile indicating maximum profit, maximum loss, and break even points. Also, draw the pay-off diagram for the strategy.

102. The mounting fiscal deficits and the lower than expected GDP growth is likely to put pressure on the Indian rupee. A speculator thinks that in two months time rupee will become volatile against dollar from the current stable state. To profit from his view the speculator is contemplating the following strategy:

i.   Buy dollar 2 month forward at Rs.48.60/$

ii.   Buy European put option on the dollar at a strike price of Rs.48.50 and a premium of Rs.0.05.

If option is not exercised on the expiry date the speculator will cancel the forward contract. The current rupee-dollar exchange rate is Rs.48.25/$.

You are required to prepare the pay-off profile of the strategy if the maturity spot price ranges between Rs.48.30/$ - Rs.49.00/$, taking an interval of 5 paise. Also, draw the pay-off diagram indicating the break even point(s).

103. The stock of X Ltd. is currently quoted in the market at Rs.195. The company has declared a dividend of Rs.8 per share recently, which will be distributed to the shareholders after two months. The volatility of X's stock price is 15% annually. The risk-free interest rate prevailing in the economy is 6% p.a.

Using Black-Scholes option valuation model, you are required to calculate the price of a 6 month put option on the company's stock at an exercise price of Rs.225.

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104. The current ¥/$ spot rate is 121.00. A speculator believes that in the next three months yen will fluctuate significantly against dollar, but he is not sure of the direction of the movement. The following 3-month European put options are traded in the market:

Strike Price	Premium
$0.0086	$0.00040
$0.0083	$0.00015
$0.0080	$0.00008

You are required to suggest the speculator a profitable spread strategy using all the above options so that the speculator is exposed to a limited loss. Also, prepare the pay-off profile of the strategy showing maximum possible profit, maximum possible loss and breakeven point(s), if spot rate after 3 months ranges between $0.0075 - $0.0090.

105. A treasurer of a multinational company has invested $10 million in a 5-year FRN which pays a semi-annual interest of 0.25% over 6 month LIBOR. The 6 month LIBOR for the first semester is fixed at 3.25%. The treasurer believes that the Federal Reserve will reduce the dollar interest rate in the future. To hedge the interest rate risk, the treasurer has also purchased a 5 year floor on 6 month LIBOR at a strike price of 3% by paying premium of 2% on the face value of $10 million.

You are required to compute the effective rate of return on the investment showing all the cash flows if the 6 months LIBOR at the next 9 reset days turns out to be: 3.08%, 2.90%, 2.75%, 2.60%, 2.50%, 2.45%, 2.80%, 3.05%, 3.15% respectively. (Use a discount rate of 3% to amortize the premium).

Sensitivity of Option Premium

106. Following information is available for call options on the stock of Micon Ltd.

Current market price	Rs.120
Strike price	Rs.110
Time to expiration	30 days
Standard deviation of return on the stock	25%
Risk-free rate of interest	8%

You are required to compute for the call option
a. Value using Black-Scholes Model
b. Gamma
c. Theta
d. Rho.

107. The share of HPCL is currently being quoted at Rs.240. The three month European call option on the stock of HPCL, with strike price of Rs.260, is commanding a premium of Rs.10 in the market. No dividend is expected in the next three months. The standard deviation of returns on the HPCL stock is 25% p.a. and the risk-free rate of interest is 6% p.a.

You are required to calculate the change in the value of call option on HPCL's stock if
i. The time to expiration decreases by 1 month
ii. Interest rate increases by 1%
iii. Volatility of the stock increases by 2%.
(Assume only one variable will change at a time)

Financial Swaps

108. The following information is taken from the books of a bank relating to an interest rate swap

Remaining term to maturity	3 years
Fixed rate paid by bank	10%
Floating rate received by bank	6m Libor
Current 6m Libor	9%
Market quote for 3 year swap	10.5% semi-annual vs. Libor

Find out the value of the swap, if the bank has received the latest interest payment.

109. Three companies X, Y and Z have come together to reduce their interest cost. Following are the requirement of those companies and interest rates offered to them in different markets:

Company	Requirement	Fixed $	Floating $	Fixed Euro
X	Fixed $ Funds	5.75%	LIBOR + 0.90%	6.00%
Y	Floating $ Funds	5.25%	LIBOR + 0.75%	6.50%
Z	Fixed Euro Funds	6.00%	LIBOR + 0.60%	6.25%

The amounts required by the companies are equal and are for three years on bullet payment basis.

You are required to arrange a swap between three parties in such a way so that the benefit of swap is equally divided among the three companies.

110. Monte Carlo Garments Ltd., a large export house from India entered into a five-year interest rate swap with the State Bank of India, under which it has contracted to pay 10% and receive six-month LIBOR semi-annually, on a notional principal amount of US $ 10 million. This deal was set-up on July 1, 1999. On July 1, 2001, after the swap payments were settled, the Finance Manager suggested that the swap be cancelled as the rates in the market have dropped considerably. He approached the bank which agreed to cancel the deal at 8%, which is also the current rate for the 3 years swap deal for fixed vs. LIBOR.

You are required to find out the following:

a. If the deal was to be cancelled on July 1, 2001, what amount of money would be required to be paid? By whom?

b. Instead of canceling the existing deal, if a new deal was made and allowed to run for 3 years (till the maturity of the original deal), what would be the cash-flow on the fixed leg of the new deal? (Assume that each period is exactly 6 months).

111. The following are the requirement of the type of funds and the borrowing rates faced by three companies X, Y, Z in different markets:

Company	Requirement	LIBOR Rate	T-bill Rate	Fixed $
X	LIBOR based funds	LIBOR + 0.75%	T-bill + 0.40%	5.0%
Y	T-bill based funds	LIBOR + 0.50%	T-bill + 0.25%	4.5%
Z	Fixed $	LIBOR + 1.00%	T-bill + 0.50%	5.5%

Three companies approach a Bank individually for swap deals so that they can reduce their cost of borrowing.

You are required to structure swap transactions between three parties keeping Bank as an intermediary so that after keeping a margin of 10 basis points by the Bank for each leg of swap, the rest of the gain is distributed equally between the three parties. Also, calculate the effective cost of borrowing to the three parties.

112. A Japanese firm had swapped ¥ 100 million fixed rate liability into $ 0.9091 million floating rate liability when the exchange rate was ¥/$ 110. At that time fixed ¥ vs. 6 month dollar LIBOR swap rate was 3%. The interest payments on both fixed and floating rates are semi-annual. The swap presently has a remaining maturity of 4 year 9 months. The present yen-dollar exchange rate is ¥/$ 120 and current 5 year fixed ¥ vs. 6 month dollar LIBOR swap is 2%. The present 6 month LIBOR set three months back is 6%, while current 3 month LIBOR is 5%.

You are required to find the value of the swap to the Japanese firm.

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113. Asterix Inc. had raised floating rate funds two years ago at 6-month Prime + 1.25%. Now it wants to convert this liability into fixed rate funding for 3 years. It approaches Bank of New York for a swap. Bank of New York is quoting 6-month Prime/Fixed rate swap at 80/100 basis points over 5-year US treasuries which are yielding 4.55%. The Bank agrees to do the swap with Asterix.

Bank of London is launching a Eurobond issue at a fixed dollar cost of 5.25%. The bank prefers a 6-month LIBOR based funding. Bank of New York is quoting 6-month LIBOR/Fixed rate swap at 100/125 basis points over 5 year US treasuries. The Bank of London entered into a fixed-to-floating rate swap with Bank of New York.

Bank of Riverside has Prime based assets funded with LIBOR based deposits. It wants to remove the mismatch of its assets and liabilities. It is willing to pay 6 month Prime + 0.25% in return for 6 month LIBOR.

You are required to:

a. Calculate the fixed rate achieved by Asterix by entering into the swap.

b. Mention what are the risks taken up by the Bank of New York by entering into swap with Asterix?

c. Calculate the floating rate cost achieved by the Bank of London.

d. Show the assets and liabilities position of Bank of New York after entering into swap with Asterix and Bank of London. Does the swap with Bank of Riverside helps the Bank of New York?

e. Find out the net gain of Bank of New York after all the three swaps. Show all the swaps entered by the Bank of New York through a diagram.

114. Three companies, Alpha, Beta and Gamma required $100 million each for next five years. The following are the requirement and the costs of borrowings faced by them in different markets:

Company	Requirement	PLR	LIBOR	Fixed $
Alpha	PLR based $ funds	PLR + 0.30%	LIBOR + 0.50%	3.35%
Beta	LIBOR based $ funds	PLR + 0.05%	LIBOR + 0.30%	3.25%
Gamma	Fixed $ funds	PLR + 0.05%	LIBOR + 0.15%	3.10%

Alpha, Beta and Gamma, not being satisfied with the costs of borrowing at the markets of their choice, have come together to reduce their interest burden.

You are required to arrange a swap between these three parties in such a way that the benefit of swap is equally divided among the three parties. Also, calculate the effective cost of borrowing to each party, after the swap.

115. Consider the following information relating to a swap deal with a notional amount of $500 million entered by a client with a swap bank:

Remaining term to maturity	4 year 9 months
Reset frequency	Semi-annual
Interest rate of the fixed leg	4%
Interest rate of the floating leg	LIBOR
LIBOR applicable to the current half- year	3.25%
Present market quote for a 5-year swap	5-year US T-note yield + 20/30 bp vs LIBOR
Current yield on 5-year US T-note	3.10%
Current 3-month LIBOR	2.95%

Considering that the client pays the fixed leg, you are required to find out value of the swap for the client.

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116. A corporate has a target Debt to Equity (D/E) of 2:1, for a new project, the firm plans to mobilize Rs.30 lakh by issuing equity shares. Its current profit after tax is Rs.18 lakh and return on equity is 20%. The firm would like to maintain its current ROE. The tax rate applicable to the firm is 50%. It is expected that the project will generate additional profit before tax of Rs.18 lakh every year. Explain how the firm can use an interest rate swap to achieve its target ROE and D/E given the following:

	Fixed Rate	Floating Rate
Corporate	10.5	Libor + 2%
Bank	8.0	Libor + 1%

117. Two firms A and B face the following interest rates.

	Dollars	Sterling
A	8.0%	10.6%
B	10.0%	11.0%

A wants to borrow in sterling and B prefers to borrow in $. Assume that the exchange rate is $1.5/£. Explain how a currency swap can be structured.

118. An interest rate cap has a term of 5 years with a trade date of November 08 and May 08. The underlying interest rate is a 6-month LIBOR at 6% with a face value of $100 million. This level is expected to raise to 7% at time t_1 and will remain at that level for the next 5 years. Upfront fees for the cap is 2%. Assume that semi-annual interest rate is 3%. Compute the net cost of the capped loan.

119. M/s Liberal Finance Co., has accepted 3 year deposits from public to the tune of Rs.50 crore at a cost of 15% and deployed the funds for a 3 year term at a floating rate of 4% above 364 day T-bill rate. On the other hand M/s Numeans Intermediari Ltd. has accessed the market for Rs.50 crore with a 3-year floating rate bond, the interest on which is 2% above 364 day T-bill rate. These funds are deployed in a 3-year asset which gives a yield of 17.5%.

a. Arrange a Swap transaction so that M/s Liberal Finance earns a spread of 3%.

b. The 364 day T-bill rate turned out to be as under for each of the half-yearly payment of interest.

Time period	Interest rate
6 M	12.98
12 M	13.10
18 M	13.20
24 M	13.00
30 M	12.95
36 M	12.75

Who is benefitted by the swap arranged by you on terms of the spread?

120. A US based MNC manufactures and sells paper and wood products. It has subsidiaries in Canada, UK and Ireland. Each subsidiary specializes in a particular product but all products are sold in all markets. This gives rise to a network of intra-corporate payments and receipts. Each subsidiary handles its own exposure and financing needs. Corporate policy is to cover all exposures unless there is a definite trend or cost of cover is too high. The interpretation of "definite trend" and "too high" is left to the subsidiaries. A daily bulleting informs all treasurers of financing needs and exposures of all others.

Today's situation is as follows:

a. UK needs working capital. It seems the Bank of England has restricted bank borrowing. Business is strong but credit is needed to take advantage of it.

b. Canada has excess liquidity.

c. Irish situation is normal.

d. HQ also needs financing but the Federal Reserve is in a relaxed mood and credit is readily available in the US. HQ has a payable due to Canada in two days and to UK in one month in their respective currencies. There are no capital or exchange controls but HQ's cost of borrowing in the home money market is somewhat lower than in the Euro market.

The HQ treasurer is trying to figure out whether he can simultaneously solve the financing problems and cover his own exposure. His main concern is that, in doing so he must not incur a higher cost of cover than what it would be if he leaves the subsidiaries to solve their own financing and exposure problems. The accessible market rates are as follows:

$/£ Spot 2.2795

1-month forward: 75 points discount on sterling

Domestic $ borrowing rate: 14.50% p.a.

Euro-£ deposit rate: 17.75%

Euro-£ borrowing rate: 18.75%

Advise the HQ treasurer and justify your advice.

121. A Russian manufacturer of fine crystal has received an order from a Japanese department store. The buyer wishes to be invoiced in its home currency. The Russian firm agrees to this because it wishes to gain a foothold in a new market. The order is for ¥250 million with payment due three months from delivery. The Russian firm is confident about completing delivery 3-months from today. The market rates today are as follows:

Ru/$ spot	33.5600/33.5825	¥/$ Spot 121.50/122.00
3-month	450/400	2.50/2.00
6-month	600/525	4.80/420
The interest rates are:		
Domestic Ru	3-month 6.25%	6-month 6.50%
Euro Ru	3-month 6%	6-month 6.25%
Domestic Yen	3-month 4.5%	6-month 5%
Euroyen	3-month 4.25%	6-month 4.75%

The Russian firm wishes to know how it should cover its receivable. The Japanese buyer may also be willing to pay on delivery if an appropriate discount is offered. Evaluate the various alternatives.

122. The treasurer of an insurance company expects to have a surplus of £5 million 6 months from now. She has decided to park the funds in a 3-month euro sterling deposit whose rate is hovering at 9% currently. A 6/9 £5 million FRA is being quoted at 8.75%. The treasurer sells an FRA to protect herself from falling rate. Compute the annualized return in the following cases if on day 182.

a. The 3-month deposit rate is 9.5%

b. The 3-month deposit rate is 8%.

123 A bank has received a one year (365 days) sterling deposit for which it has to pay 9.125% ($9\frac{1}{8}$%). It can loan it back in the Euroloan market at 9.1875% ($9\frac{3}{16}$%). However, it finds

the margin of 1/16% to be unattractive. The current 6-month LIBOR is 8.875% ($8\frac{7}{8}$%). It

is contemplating the following two strategies:

a. Loan the funds for 6 months. Reinvest the proceeds of the loan for a further 6 months at the then 6-month LIBOR.

b. Loan the funds for 6 months and sell a 6/12 FRA for a face amount equal to the loan proceeds at a rate of 9.22%. Invest the loan proceeds at the then 6-month LIBOR.

Compare the outcomes of the two strategies for alternative values of 6-month LIBOR, 6 months from now, in the range 7% to 11% in steps of 0.5%.

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124. A company has decided to take a 3 year floating rate loan of $200 million to finance an acquisition. The loan is indexed to 6-months LIBOR with a spread of 0.125% (1/8%). The current level of LIBOR is 7.62%. The company thinks that the projected cash flows from the acquisition would enable it to live with an interest cost not exceeding 10.125%. A 3 year interest rate cap with a face amount of $200 million and a strike rate of 10.125% is available for a premium of 4.5%. Calculate the effective cost of the capped loan for the following scenario of LIBORS on the next five rollover date: 5%, 7%, 9%, 11%, 13% (Use a rate of 9% to amortize the premium).

125. A $25 million borrowing requirement 6 months from now for six months is to be hedged. The current 6-month LIBOR is 8%. The following alternatives are being considered:

   a.   Remain unhedged.

   b.   Buy a 6/12 FRA at 8.5%.

   c.   Buy a call on 6 month LIBOR, expiring in 6 months. Calls with strike rate of 8.5% have a premium of $75,000 and with strike rate of 9.5% the premium is $30,000.

   d.   Write puts on 6-month LIBOR. Puts with strike rate of 8.5% carry a premium of $75,000 and puts with strike rate of 9.5% carry a premium of $40,000.

   e.   Buy a put with maturity of 6 months on Eurodollar futures contracts. Puts with strike price of 91.5 carry a premium of 0.75.

   f.   Write a 6-month call on eurodollar futures with a strike price of 91.5 carrying a premium of 0.75.

   Compare these alternatives. Determine the ranges of values of 6-month LIBOR 6 months from today over which each alternative dominates the other. Draw the pay-off diagram.

126. Sometime ago a French firm swapped a FFr (now Euro) 6 million fixed rate liability into a US$ 1 million floating rate liability. At the time, the ∈/$ exchange rate was 5.00 and the fixed FFr vs. 6-month dollar LIBOR swap rate was 13%. Both the fixed and floating payments are semi-annual. Since then the fixed FFr rate has fallen and the current 5-year swap rate is 10%. Also, the dollar has depreciated to FFr.4.50/$. The swap has 5 years and 3-months ago at 11% while the current 3-month dollar LIBOR is 9.5%. The firm reckons that it can lock-in a nice profit by selling the swap. Find the market value of the swap?

127. An interest rate swap was entered into at a fixed rate of 13% against LIBOR both annual. The swap has 5.25 years to go. The current 5-year swap rate is 10%, the 3-month LIBOR is 7% and the one year LIBOR at the last reset date 9 months ago was 11%. Compute the swap's value.

128. Companies A and B have been offered the following rates per annum on a $10 million five year loan.

	Fixed Rate	Floating Rate
Company A	10%	Libor + 0.2%
Company B	11.2%	Libor + 0.6%

   Company A requires a floating rate loan, while company B requires a fixed rate loan. Design a swap that will appear equally attractive to both companies.

129. White Ltd. and Black Ltd. both wish to borrow $210 million for five years and have been offered the following rates.

Borrowing rates

	Fixed	Floating
White Ltd.	11%	Libor + 0.4%
Black Ltd.	12.6%	Libor + 1.0%

   White Ltd. requires a floating rate loan while Black Ltd. requires a fixed rate loan. Design a swap that will net a bank, acting as intermediary 0.1 percent per annum and that will appear equally attractive to both companies.

Value at Risk

130. The XYZ Bank is long on call options on £100 million. It paid an option premium of £2 million. The spot rate is $1.4566/£. The delta of the option is 0.5. The volatility of the option is 15% annualized. Calculate the potential gain/loss on the position at 68% and 95% confidence levels. Assume there are 250 working days in a year.

131. A mutual fund has a call option on one million shares of Microsoft. Each option is worth $5 and each share of $100.

Option delta = 0.5, Calculate the potential gain/loss on the position with 68% and 95% confidence. Assume that daily volatility is 1%.

132. Compute the value at risk for the following bond, whose holding period is one quarter. The following information is given, 2-year treasury note.

Price = $100

Yield = 5.8%

Coupon = 5.8%

Annual standard deviation of 2-year Treasury yields = 1.25%.

133. The 'ABC' Bank has a one-year Forex contract to buy Rs.1 million against $ at the forward rate of Rs.48.02 per $. Also, the following information is given.

Forward rate	= 48.77 Rs./$
Spot rate	= 47.20 Rs./$
$i_{Rs.}$	= 8.5%
$i_\$$	= 5%
Rs./$ volatility	= 0.963%
$i_{Rs.}$ yield volatility	= 1.38%
$i_\$$ yield volatility	= 1.98%

The Bank, can replicate its forex forward position in following three ways.

i. Borrow $94,170,000 for one year at an interest rate of 6.19% (Maturity value is $100 million).

ii. Buy rupees in the spot forex market at a rate of Rs.46.47 per US$, receive Rs.14,47,39,290.

iii. Invest Rs.14,47,39,290 for one year at an interest rate of 9.5%. (Maturity value is Rs.4,877 million).

Compute in US$, the value at risk of the forex forward position and price volatility of the bonds and the value at risk. Also, indicate how the Bank's long forex position can be decomposed?

Note: These are equilibrium rates and there is no scope for covered interest arbitrage.

134. Suppose you invest $100 each in assets. A and B with the following characteristics.

Variance of A = 64

Variance of B = 25

Correlation = ρ_{AB} = 0.25

Compute the total variance. What is the benefit of diversification? Also, compute the VAR as well as the benefits of diversification for the following correlations

i. ρ_{AB} = 1

ii. ρ_{AB} = −1

iii. ρ_{AB} = 0

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135. The annual standard deviation of 5-year T-note yield is 0.85. Current yield is 6.21. Coupon is also 6.21%; it is a par bond. Compute the range of potential yields and the corresponding prices for 1, 1.65 and 2 standard deviations for a holding period of 1 day, 1 week, and 1 month. Assume number of trading loss a year as 250.

136. Assume that the Forex rate between Indian Rupees is 47.25 Rs.per dollar. Based on the analysis of the historical data for the past five years, the daily volatility is computed to be 0.716%. Compute the range of Rs./$ rates over a day under 68%, 90%, 95% and 98% confidence intervals.

137. Mr. Pranoy has recently purchased 100 shares of Super Tools Ltd. at Rs.300 per share. The volatility of the stock is 15% per annum. Mr. Pranoy has decided to hold the shares for 6 months. The 6-month European call option on the shares of Super Tools Ltd. is available at Rs.28 per share. The contract size for the option is 100 shares and the delta of call option is 0.35.

You are required to calculate for 90% confidence level

a.   VaR for long stock position

b.   VaR for long call option position.

(Assume 250 trading days in a year).

138. Mr. Binoy has invested Rs.50,000 each in the stocks of Alpha and Beta. The variance of stocks of Alpha and Beta are $18(\%)^2$ and $30(\%)^2$ per annum respectively. The correlation of returns from the two stocks is 0.40.

You are required to

a.   Find out the variance of the portfolio.

b.   Find out the benefit of diversification.

c.   Find out the benefit of diversification if the correlation of return between the two stocks is – 1.

d.   Calculate the Value at Risk (VaR) of the portfolio for the correlation of 0.40 at 95% confidence level. (Assume 250 trading days in a year).

139. HDLL Bank Ltd. has a long position in Euros worth 50 million on the spot market. The volatility of INR/Euro is 20% and the exchange rate is Rs.41.30/Euro. Assume 300 working days per annum.

You are required to:

Calculate the VaR position of HDLL Bank Ltd. at 95.5% confidence level.

140. An investor has purchased 300 shares of ACC at a price of Rs.160 per share. To hedge against any fall in the stock value the investor also purchased put option on 300 shares with strike price of Rs.160. The premium is Rs.5 for each share. The delta of put option on ACC's stock is 0.30, and the standard deviation of the price of ACC stock is 25% p.a.

You are required to calculate 30-day VaR at 90% confidence level for

i.   The long position in the stock

ii.   The long position in the put

iii.   The combined position of long stock and long put.

(Assume 250 trading days in a year).

141. The following bonds are being traded in the market:

Bond	Face Value	Redemption value	Remaining maturity	YTM
A	£100	Face value	6 months	4%
B	$100	1.5% over face value	6 months	2.5%

An investor has taken a long position in 10000 units of bond A and short position in 15000 units of bond B. He decides to hold them till their maturity. The current dollar-sterling exchange rate is $1.537/£. The daily volatility of a six-month zero-coupon sterling bond (when its price is converted into dollars) is 0.5% and the daily volatility of a six-month zero-coupon dollar bond is 0.2%. The correlation between returns from the two bonds is 0.75.

You are required to calculate:

a. Daily volatility of the investor's position in dollars.

b. VaR at 99.7% confidence level over a period of 15 days.

142. Mr. Marshal has invested in the following bonds:

i. 100 zero-coupon bonds (face value Rs.1,000) at Rs.935 per bond which are due to be redeemed after one year.

ii. 500 8% annual coupon bonds (face value Rs.100) at Rs.98.2 per bond. Next interest payment is due after one year and redemption is due after 3 years.

The annual yield volatility of zero-coupon bond is 5% and that of 8% coupon bond is 6%. The correlation between the return from two bonds is 0.90.

You are required to calculate 1 month Value-at-Risk (VaR) at 95% confidence level for the Marshal's position.

Introduction to Insurance: Life and Non-Life

143. Alpha Trading Company Ltd. has obtained a declaration policy from the GIC. The policy is for its godown containing stocks against damage from fire and it is a declaration policy. The amount insured is Rs.25 lakh. The policy will be in force from Jan. 1, 1999, for a period of 12 months. Declaration of stocks made during January, February and March were Rs.24 lakh, Rs.24.20 lakh and Rs.24.50 lakh respectively. On April 21st, a fire accident took place in the godown and goods worth Rs.0.75 lakh were damaged. While verifying the stocks after that, the company found that the last declaration was wrongly made (as Rs.24.50 lakh) and it should have been Rs.24.75 lakh. What is the amount that will be paid by the insurance company for the damage to the goods?

144. From the following information you are required to calculate the amount payable on settlement of claim under the property insurance scheme of Magic Insurance Co. Ltd.:

Sum insured = Rs.75,000

Value of insured property at the time of loss = Rs.1,50,000

Amount of loss = Rs.45,000

145. A property worth Rs.8 lakh has been insured with three insurance companies – A, B and C. The sum insured by each of these A – Rs.1 lakh, B – Rs.2 lakh and C – Rs.3 lakh. What will be the liability of each insurer if the property loss was to the extent of Rs.60,000 according to (a) the rateable proportion method (b) Pro rata average method?

146. Sunrise Banking Corporation Ltd. has taken an individual fidelity guarantee policy on 10 cashiers' post for Rs.10 lakh. If the rate of premium is 1 percent and the per capita is Rs.50, what will be the total premium?

147. Sum Insured: Rs.50,00,000. Declaration is on monthly basis. Period of insurance is 12 months starting 1st January, 1997. Provisional premium is Rs.25,000. There was fire on 15th March, 1997 that damaged property worth Rs.32,000. Declarations made for the month of January and February is Rs.49,80,000 and Rs.49,00,000 respectively. However, the last declaration that should have been made is Rs.49,60,000. Calculate the actual payment by insurance company.

148. Rubber Industries Ltd. has obtained a fire insurance policy from the GIC. It is a declaration policy for Rs.28 lakh. Declaration have to be made on a monthly basis and the provisional premium was fixed at Rs.14,000. The policy will be in force for 12 months starting from Jan. 1, 1999. The stocks declared during January, February and March were Rs.27.40 lakh, Rs.26.90 lakh and Rs.25 lakh. The company had second thoughts about the policy and conveyed to the GIC on April 18, 1999 that it wants to cancel the policy. What is the amount that will be refunded to the company?

149. Sum Insured: Rs.50,00,000. Declarations are made on a monthly basis with a provisional premium of Rs.25,000. The period of insurance is for 12 months starting from 01 January, 1997. There was a fire that occured on 27th May, 1997 that damaged property worth: Rs.24,80,000. Declarations made for January, February, March and April were 49,60,000, 46,00,000, 48,00,000 and 48,00,000 respectively. There were no under-declarations. However, insurer wants to cancel the policy from the date of loss. Adjust the loss and close the policy account.

150. Dhanalakshmi Distributors Ltd. has obtained a fire insurance policy from the GIC for the stocks in its godown. It is a declaration policy for Rs.40 lakh. The policy will be in force from January 1, 1999 for 12 months. The provisional premium on the policy is Rs.20,000. The declarations made under the policy from January through April were Rs.39.60 lakh, Rs.36.40 lakh, Rs.38.00 lakh and Rs.38.00 lakh respectively. On May 25, 1999, a fire accident occurred at the godown and the entire stock in the godown, worth Rs.19.84 lakh was destroyed.

There were no underdeclarations. The company wants to cancel the policy from the date of the loss. What is the amount that will be paid by the GIC to the company?

Part II: Solutions

Corporate Risk Management

1. PV (convenience yield) = Spotprice $- \dfrac{\text{Futures price}}{(1+r_f)^t} + $ PV of storage cost

$$= \$12,600 - \frac{\$13,800}{1.08} + \$250 = \$12,600 - \$12,778 + \$250 = \$72.$$

2. a. In order to minimize his risk, the investor should short sell Rs.1 million x 0.85 = 0.85 million of gamma.

   b. This hedge ratio is 0.85.

   c. He can create a zero value hedge by borrowing 1 – 0.85 = 0.15 million.

3. a. In case the price of the stock rises, the manager should invest 1.40 x 10 million = 14 million to mitigate his risk;

   b. He can create a zero value hedge by borrowing Rs.4 million from the bank;

   c. When the market index and the stock price changes as given he should invest in the following way:

   When market index falls by 10% and the stock price goes up by 5%; the investment in the market portfolio will be (Rs.12.6 ml/10.5 ml) i.e., 120% of the short position in alpha. In order to restore the hedge ratio to 1.4 he must invest Rs.2.10 million in the market portfolio.

4. The amount required to be set aside in order to meet the obligation at the end of six months is $\dfrac{4,445}{(1.08)^{0.5}} = 4,277$

   Since the amount to be set aside is equal to the pay-off;

   4,277 $\quad$ = Spot price – PV of dividend

   $4,277 \quad = 4,330 - \dfrac{(4,330)(X)}{(1.08)^{0.5}}$

   $\dfrac{(4,330)(X)}{(1.08)^{0.5}} = 4,330 - 4,277$

   $\dfrac{(4,330)(X)}{1.039} = 53$

   $4,330(X) \quad = 53 \times 1.039$

   $4,330(X) \quad = 55.08$

   $X \qquad = \dfrac{55.08}{4,330} = 1.27\%$

   Dividend yield on the stocks in the index is 1.27%.

   Therefore, average annual dividend yield = 2.54%.

5. $\dfrac{\text{Futures price}}{(1+r_f)^t} = $ Spot price + Present value of storage costs – Present value of convenience yield.

   Present value of convenience yield = Spot price + Present value of storage costs $- \dfrac{\text{Futures price}}{(1+r_f)^t}$

   $$= 5,200 + 300 - \frac{5,700}{[(1.085)]} = 5,200 + 300 - 5,253 = 247.$$

6. a. By short selling 0.6 x 1 million = 0.6 million of B, risk is minimized.

b. 0.6 is the hedge ratio.

c. A zero value hedge can be constructed by borrowing 0.4 million from bank.

Futures

7.

Initial margin requirement per contract	= $3000.
Hence, initial margin requirement for two contracts	= $6000
Maintenance margin per contract	= $1500
Maintenance margin for two contracts	= $3000

The daily change in margin account is tabulated below.

Day	Change in Price (cents/lb)	Change in Contract Value ($)	Margin Call	Margin Withdrawal	Balance Account
1	19.00 – 19.44 = –0.44	(0.44)/(100)(60000)(2) = 528	–	–	5472
2	19.40 – 19.00 = +0.40	(0.40)/(100)(60000)(2) = 480	–	–	5952
3	19.60 – 19.40 = +0.20	(0.20)/(100)(60000)(2) = 240	–	192	6000
4	19.80 – 19.60 = +0.20	(0.20)/(100)(60000)(2) = 240	–	240	6000

While solving this problem, students should carefully note the following:

a. Initial and maintenance margin requirements are normally specified per contract.

b. At the end of each trading day, the contract is repriced on the basis of the closing price.

c. Many futures exchanges allow money in excess of the initial margin to be withdrawn.

8. The suggested strategy would be to sell September futures now and reverse latter as they expect the dollar to depreciate

Sale price = 47.06

Buy-back price = 47.10

Total loss per contract = Rs.1,000,000 x (47.06 – 47.10) = Rs.40,000

i.e., there will be a loss of Rs.40,000 per contract. The loss is due to the dollar not moving as per their expectations. The dollar has actually appreciated against the rupee.

9. The trader can buy November futures and sell August futures. He can close out latter by reversing these transactions.

In December, 2000

Inflows	:	0.890
Outflows	:	0.879
Net inflows	:	0.011

In February, 2001

Inflows	:	0.926
Outflows	:	0.915
Net inflows	:	0.011
So, net profits	:	0.011 + 0.011 = 0.022

If the standard contract size is Yen 12,500,000, the profit made by dealing in one contract each of August and November futures = (12,500,000)(0.022)/100 = $2750.

10. The $/£ quote on August 1 is computed below.

$$\$/£ = \$/Rs. \times Rs./£$$

$$= \frac{1}{Rs./\$} \times \frac{Rs.}{£}$$

$$= \frac{1}{46.00} \times 68.93$$

$$= 1.4985$$

The $/£ quote on December 1 is computed below.

$/£ = 1/46.73 × 68.45 = 1.4648

The pound sterling has depreciated against dollar on the spot market.

Notional loss in the spot market = [1,00,000 (1.4985 – 1.4648)] = $3,370

Since we are dealing with receivables, hedging will be done by selling two standard sterling futures contracts.

Gain by trading in futures = $[2 x 62,500 x (1.4750 – 1.4544)] = $2,575

Net loss to Microsoft = $(3,370 – 2,575) = $795.

11. The company can hedge risk using the following strategies.

    i. By Selling Futures:

        No. of euro futures required for hedging

        = [(2,000,000)/(0.8949)]/(125,000)

        $\cong$ 18 contracts

        Loss incurred in spot market $= \in \left[\dfrac{2,000,000}{0.8760} - \dfrac{2,000,000}{0.8949} \right] = \in 48,218$

        Gain in the futures market $= \$[18 \times 125,000 \times (0.8876 - 0.8695)]$

        $= \$40,725$

        $= \in \dfrac{40,725}{0.8760}$

        $= \in 46,490$

        (The gain/loss can be converted into $\in$ at the spot rate prevailing in December.)

        Net loss = $\in$(48,218 – 46,490) = $\in$1,728

        After reversing position in the futures market, the German company can buy dollars in the spot market.

        Effective cost = $\in$ [(2,000,000/0.8760) + 1,728] = $\in$22,84,833

    ii. By entering into a forward contract:

        Effective cost = $\in$2,000,000/0.8850 = $\in$22,59,887

In this case, there is a wide divergence between futures and spot prices during the delivery month, possibly due to market disturbances and the forward cover has turned out to be more profitable.

12. The corporate can hedge its risk by selling four Yen futures. It will sell futures because in this case receivables are being hedged.

Gain by trading in futures = (0.00892 – 0.00885) (50,000,000) = $3,500

Net inflows after three months = (50,000,000) (0.00885) + $3,500 = $446,000

So, the effective price realization = (446,000)/(50,000,000) = $0.00892 per yen

If the trader had left the risk uncovered and used the spot market, he would have obtained a net inflow of (50,000,000)(0.00885) = $442,500

Thus, by hedging with futures, the corporate has benefitted to the extent of $3,500.

13. Optimal hedge ratio = [(Standard deviation of change in spot price)/(Standard deviation of change in futures price)] x [Correlation coefficient] = (0.03/0.036) (0.72) = 0.60.

14. In this case, the exporter wants to hedge $ receivables. Based on the data given, it is clear that the exporter does not have access to $ − $\in$ futures. The Euro Guilder is, however, strongly pegged to the pound. So, the exporter would use cross currency hedging and sell $ futures priced in terms of pound.

   Selling rate for futures   :   £0.672

   Buy-back rate   :   £0.662

   Profit   :   £0.01

   We assume the standard size of the futures contract is $1,000,000.

   Total profits = (0.01) (1,000,000) = £10,000

   This can be converted into $\in$ (10,000) (1.112)/(0.665) = $\in$ 16,722

   The dollar receivable can be sold in the spot market to get (1,000,000)(1.112) = $\in$1,112,000

   So, net inflows after three months = 1,112,000 + 16,722 = $\in$ 1,128,722

15. Gain for increase by one basis point = (1,000,000) (0.01) (0.25)/(100) = $25

Date	Opening balance	Change (basis point)	Profit/Loss	Deposit/ Withdrawal	Closing balance
March 2	$2000	–7	–7 x 25 = –175	–	$1825
3	$1825	–3	–3 x 25 = –75	–	$1750
4	$1750	+2	2 x 25 = +50	–	$1800
5	$1800	–4	4 x 25 = –100	–	$1700
6	$1700	–3	–3 x 25 = –75	–	$1625
7	$1625	–2	–2 x 25 = –50	–	$1575
8	$1575	–5	–5 x 25 = –125	+$550	$2000
9	$1500	+5	5 x 25 = 125	–	$2125
10	$1625	+2	2 x 25 = 50	–	$2175

16. r_d = 6.56% p.a

   r_f = 4.8% p.a

   Spot rate   = 0.8453 $/$\in$

   T   = 92 days (Oct. 31st 2000 to Jan 31st 2001)

   $$F = \frac{\$[1 + r_d(T/365)]}{[1 + r_f(T/365)]} = 0.8453 \times \frac{[1 + 0.0656 \times 92/365]}{[1 + 0.0480 \times 92/365]}$$

   = 0.8453 x 1.0044 = 0.8490

   The theoretical futures price is $0.8490/$\in$.

   Since, the actual futures price is more than the theoretical futures price, the arbitragers would borrow at 6.56% p.a. for 92 days and buy the present value of 125,000 euros at the current spot rate of $ 0.8453/$\in$, invest these euros at 4.8% p.a. for 92 days to obtain 125,000 euro and sell one euro future at $0.8635.

   [125,000 euro is the standard size of one contract].

   The arbitrage profit = 125,000 (0.8635 – 0.8490) = 1812.5.

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17. S   = $/£ 1.4544

F   = $/£ 1.4625

T   = 90 days

r_f = 5.84% p.a

$$IRR = \left[\frac{F(1 + r_f \times T/365) - S}{S} \right] \times \frac{365}{90}$$

$$= \left[\frac{1.4625(1 + 0.0584 \times \frac{90}{365}) - 1.4544}{1.4544} \right] \times \frac{365}{90} = 0.0813 \text{ or } 8.13\%.$$

Since the IRR is more than the actual rate, 6.6%, the futures are overpriced. Therefore the arbitrage strategy would be to sell futures now and buy them later.

That is, sell £ at $ 1.4544 and the present value of £ 25,000 at 5.84% for 90 days. Borrow $ at 8% for 90 days sell 1£ futures contract at $1.4625.

(Standard size of 1£ futures contract is £ 25,000).

18. a.

Contract price entered into	: 0.008920 $/£
Size of the contract	: 12.5 million yen
No. of contracts	: 6

Marking-to-market cash flows:

As the firm is long on futures contract, it incurs cash inflows if the settlement price at the end of the day is less than the previous day's settlement price, it incurs cash outflows.

Date	Contract Price ($/£)	Settlement price	Price change	Cash flows
Sep. 22nd	0.008920	0.008854	(–)0.000066	(–)4950
Sep. 25th		0.008665	(–)0.000189	(–)14175
Sep. 26th		0.008456	(–)0.000209	(–)15675
Sep. 27th		0.008704	(+)0.000248	(+)18600
Sep. 28th		0.008548	(–)0.000156	(–)11700

Price change = (The day's settlement price) – (Previous day's settlement price)

Cash flow   = (Price change) x (Contract size) x (No. of contracts)

= (Price change) x 12.5 million x 6

(–ve) cash flows imply that the firm has made a loss.

(+ve) cash flows imply that the firm has made a profit.

b.   Initial margin/contract = $3000

Total margin to be posted by the firm = $3000 x 6 = $18,000

The maintenance margin/contract = $1750/contract

The maintenance margin for 6 months = $1750 x 6 = $10500.

Margin Account

Date	Cash Flow	Margin A/c 18,000 (Initial Margin)	Additional Deposit
Sep. 22nd	(–)4,950	13,050	–
Sep. 25th	(–)14,175	18,000	19,125
Sep. 26th	(–)15,675	18,000	15,675
Sep. 27th	(+) 18,600	36,600	–
Sep. 28th	(–)11,700	24,900	–

19. a. The firm is long on pounds in spot and has to hedge against depreciation of pounds, hence it goes short on futures contracts. The number of futures contract it shorts

$$= \frac{1,000,000}{62,500} = 16$$

b. i. If on December 20th,

Spot $/£ – 1.4676,

June £ futures – 1.4544

The pound has depreciated against the dollar, so the firm receives fewer dollars now than on November 7th.

The firm makes a gain in the futures contract as it closes its position by buying the contract at $1.4544/£.

Loss on the receivables	= 1,000,000 [1.475 – 1.4676] = $7,400
Gain on the future contract	= 1,000,000 [1.4825 – 1.4544] = $28,100
Net gain	= 28,100 – 7,400 = $20,700
The net receivables of the firm	= [1,000,000 x 1.4676] + 28,100 = 1,495,700

The net rate for the firm $= \dfrac{1,495,700}{1,000,000} = 1.4957\$/£$

ii. On November 7th, if the rates are:

Spot $/£ – 1.4826

June £ futures $/£ – 1.4865

The pound has appreciated against the dollar. The firm makes a gain on the receivables as it gets more dollars now than it would have got on Nov. 7th.

The firm closes out its position in the futures by buying the contract at 1.4865 $/£ resulting in a loss on the futures.

The gain on the receivable	= 1,000,000 [1.4826 – 1.475] = $7,600
The loss on the future	= 1,000,000 [1.4865 – 1.4825] = $4,000
The net gain	= 7600 – 4000 = $3,600
The net receivables for the firm	= [1,000,000 x 1.4826] – $4000
	= $1,478,600

∴ The net rate for the firm $= \dfrac{1,478,600}{1,000,000} = 1.4786\$/£$

20. a. The strategy is to go long on euro futures contract to hedge against any appreciation of euro. Since the standard size of the contract is euro 125,000, the no. of contracts the firm has to go long is $\dfrac{1,000,000}{125,000} = 8$

b. If the rates on December 10th are:

i. Spot $/∈ = 0.8972

December ∈ futures = 0.8985

The euro has appreciated against the dollar.

The firm closes its futures position by selling the future at 0.8985. It makes a gain on the futures contract.

The firm buys euro spot at 0.8972, paying more now than in September to buy euro, hence it makes a loss on the payable.

The loss on the payable = 1,000,000 (0.8972 – 0.8950) = $2,200

The gain on the futures = 1,000,000 (0.8985 – 0.8967) = $1,800

The net loss $= 2,200 – 1,800 = $400

The net effective cost $= (1,000,000 \times 0.8972) – 1,800 = $895,400$

The net effective \$/∈ rate for the firm $= \dfrac{\$895,400}{∈1,000,000} = \$0.8954/∈$

ii.   If the spot \$/∈ = 0.8942

December ∈ future = 0.8939

The firm closes out its position in the future by selling them at 0.8939. It makes a loss on the futures contract. The firm makes a gain on the payable, as it has to pay less now than in August.

The gain on the payable = 1,000,000 (0.8950 – 0.8942) = $800

The loss on the futures = 1,000,000 (0.8967 – 0.8939) = $2,800

The net loss = 2,800 – 800 = 2,000

The net effective cost = (1,000,000 x 0.8942) + 2800 = 8,97,000

The net effective \$/∈ rate for the firm $= \dfrac{897,000}{1,000,000} = \$0.8970/∈$

21. $F = \dfrac{0.8452\left[1+(0.035)\times 80/365\right]}{\left[1+0.03\times 80/365\right]} = \$0.8461/∈$

22.   a.   Spot Index (S) on September 15 = 1195

December future index on September 15 = 1225
Dividend Yield (d) = 3%
3-m T-bill yield (r) = 9.5%

Time-to-maturity (T) = 91 days (September 15 – December 15)

Theoretical Futures Price $F = S + S\,(r – d)\dfrac{T}{365}$

$F = 1195 + 1195\,(0.095 – 0.03) \times \dfrac{91}{365} = 1214.36$

Hence, the December future was overpriced on September 15.

b.   Since the actual futures price was overpriced, the arbitrage is a cash and carry arbitrage, i.e., sell the futures contract and borrow to buy the stock.

c.   September 15

Transaction	Cash flow
Buy (1195 x 100) = Rs.119500 worth of stock @ 1195	(–) 119500
Borrow 119500 @ 9.5% for 91 days	(+) 119500
Sell a futures contract @ 1225	0
	0

i. If on December 15, the futures price is 1260

Transaction	Cash flow
Repay Rs.119500 @ 9.5% for 91 days $119500 [1 + .095 \times \dfrac{91}{365}]$	(–) 122330.35
Make delivery on futures contract Less: (1260 – 1225) x 100	(–) 3500
Sell 119500 worth stock @1260 Proceeds: $119500 \times \dfrac{1260}{1195} = 126000$	(+) 126000
Dividends earned @ 3% $119500 \times \dfrac{3}{100} \times \dfrac{91}{365}$	(+) 893.79
Gain due to arbitrage	(+) 1063.44

ii. If on December 15 futures index is 1175

Transaction	Cash flow
Repay Rs.119500 @ 9.5%	(–) 122330.35
Make delivery on futures contract Gain = (1225 – 1175) x 100	(+) 5000
Sell Rs.119500 worth stocks @ 1175 Proceeds $119500 \times \dfrac{1175}{1195} = 117500$	(+) 117500
Dividends earned @ 3%	(+) 893.79
Gain due to arbitrage	(+) 1063.44

23. The amount of £62,500 represents the standard size of the contract traded on the International Monetary Market.

The first four columns indicate opening, highest, lowest and closing price of the futures which are to be delivered in the month mentioned in the first column. Fifth column indicates the change in the settlement price over the previous day. The number in the last column indicates the outstanding contracts at the end of the day. The opening and closing prices are announced by the exchange by taking the average of the prices of a 'opening range' and 'closing range'. There may not have been an actual trade at that price.

24. At the time of expiration of the contract the basis is generally zero, as on the date of expiration the spot price and the futures price is one and the same.

After four months the farmer sells the crop at spot rate of Rs.4.15 per bushel. The cash inflow from this trade would be Rs.4.15 x 10 x 5,000 = Rs.2,07,500.

Since the farmer requires to close his position, he buys 10 contracts at Rs.4.15 per bushel. Since he sold the futures contract at Rs.4.00 per bushel, the net cash flow on account of settling the contract is 5,000 x 10 x (4.00 – 4.15) = –7,500

Therefore, the net loss on futures transactions is Rs.7,500. However, the farmer gained Rs.7,500 in the spot market as compared to the futures price of Rs.4.00 four months ago, and a profit of Rs.42,500 [(4.15 – 3.30) x 10 x 5,000] as compared to the spot price four months ago.

25.

Daily Gains and Loss Table with Cumulative Trading Profits and Losses

Days	Trade price (cents/bushel)	Settlement price (cents/bushel)	Marking-to-market (in $s)	Cumulative (in $s)
1	225 (bought two contracts)	225	–	–
2		228	300	+300
3		230	200	+500
4		227	–300	+200
5		223	–400	–200
6		225	+200	0
7	229 (Sold two contracts)	229	+400	+400
8	233 (Sells two contracts)	233	–	–
9		236	–300	+100
10	239 (Bought two contracts)	239	–300	–200

Equity and Margin Account

Day	Transactions	Equity			Margin Account		
		Beginning	Cash flow	Ending	Margin call	Deficiency	Excess
0	Deposits $100						100
1	Buys two contracts	100		100	700	700	
2	Deposits $700	800	300	1100			300
3		1100	200	1300			500
4		1300	–300	1000			200
5		1000	–400	600	200	200	
6	Deposits $200	800	200	1000			200
7	Sells two contracts	1000	400	1400			600
8	Sells two contracts	1400	–	1400			600
9		1400	–300	1100			300
10	Bought two contracts	1100	–300	800			0

We observe that the speculator made a profit of $400 when he first bought two contracts and sold them. Further, he made a loss of $600, when he sold two contracts short and bought them later. Therefore, the speculator had a net loss of $200.

26. The jeweler requires gold three months hence. In the mean time if the price of gold increases, a larger cash outgo is required for the jeweler. To avoid this, he can lock-in a price by buying futures contract for 500 troy ounces of gold. That is, by buying five futures contracts to be matured three months hence. But the jeweler has bought only 3 contracts. This means, he has hedged only 300 troy ounces of gold against any price increase beyond Rs.23,000. If he is to be fully hedged against any price increase, he should have bought 5 contracts. Therefore, the hedging is not perfect for the jeweler.

The contract purchased at 23,000 is sold for 18,000.

So, loss on settlement of futures = (23,000 – 18,000) x 3 = Rs.15,000

Notional gain in spot market = 2,000 x 5 = 10,000

Net loss = 5,000

Total Cost = (18,000 x 5) + 15,000 = 1,05,000

27. Position: long

Contract size   : $1,000,000

Futures price   : $0.7025

Initial margin   : $3000

Maintenance margin : $3000

Day	Price	Loss/gain	Total Loss/gain	Margin call	Margin withdrawn	Balance
0	0.7025	–	–	–	–	18000
1	0.7030	0.0005	3000	–	3000	18000
2	0.7020	–0.0010	–6000	6000	–	18000
3	0.7040	0.0020	12000	–	12000	18000

28. Discount = $100 - 95.02 = 4.98$

$$\text{Discount} = \frac{1,000,000 - P}{1,000,000} \times \frac{12}{3} \times 100$$

$$4.98 = \frac{1,000,000 - P}{1,000,000} \times 4 \times 100$$

$P = \$987,550$

29. The fair price of the index futures contract is given by

FC $= 1,380 + [(1,380 \times 0.12 \times 0.5 - (1,380 \times 0.048 \times 0.5)]$

     $= 1,380 + (82.8 - 33.12) = 1,429.68$

The index future is overpriced.

Arbitrage process

i.   Buying a portfolio which is identical to the index.

ii.   Going short on the index futures contract.

Return earned if index closed below 1,380.

For example, if index closes at 1020

Profit from short sales of futures $(1,434 - 1,020) \times 100$	= 41,400
Cash dividends received on portfolios $(1,380 \times 0.048) \times 0.5 \times 100$	= 3,312
Loss on sale of underlying portfolio $(1,020 - 1,380) \times 100$	= (–)36,000
Net profit	= 8,712
Semi-annual rate of return on investment $(8,712/1,38,000) \times 100$	= 6.313%
Annualized rate of return on investment $(1.06313)^2 - 1$	= 13.02%

Return earned if index closes above 1,380

For example, if index closed at 1,560

Profit on sale of underlying portfolios $(1,560 - 1,380) \times 100$	= 18,000
Cash dividends on portfolio $(1,380 \times 0.048 \times 0.5 \times 100)$	= 3,312
Loss on short sale of futures $(1,560 - 1,434) \times 100$	= 12,600
Net profit	= 8,712
Semi-annual rate of return $8,712/1,38,000 \times 100$	= 6,313%
Annualized rate of return $[(1.06313)^2 - 1] \times 100$	= 13.02%

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30. The portfolio is now worth 250 times the index. It is necessary to buy 25 put options on the sensex with a strike price of 3,800 to insure the portfolio against loss in value when the sensex falls below 3,800.

If the sensex falls to 3,700,

Loss on the portfolio $= \dfrac{10,00,000}{4,000}$ (4,000 – 3,700) = 75,000

Gain on the option = 100 x 10 x 25 = 25,000

Loss = 75,000 – 25,000 = 50,000

Thus, a put option on the index immunizes the portfolio against all losses when the sensex falls below 3,800.

31. The cash inflow on selling 15 contracts of wheat bushels at 9.00 per bushel is

Rs.9.00 x 5,000 x 15 = Rs.6,75,000

At the time of harvest the farmer sells the wheat at Rs.9.50 per bushel. The cash inflow will be

Rs.9.50 x 5,000 x 15 = Rs.7,12,500

Since he has to close his position, he buys 15 contracts at Rs.9.65* per bushel. The cash outflow will be

Rs.9.65 x 5,000 x 15 = Rs.7,23,750

*(The futures price of Rs.9.65 is obtained as follows. We know that

Basis = Current cash rice – Futures price

–0.15 = 9.50 – Futures price

Futures price = 9.50 + 0.15 = Rs.9.65)

The loss to the farmer from the futures transactions is

Rs.6,75,000 – Rs.7,23,750 = (–)Rs.48,750

However, the gain from selling the wheat in the spot market is Rs.7,12,500 – Rs.6,75,000 = Rs.37,500. Therefore, the net loss to the wheat farmer is the difference between a loss of Rs.48,750 and a gain of Rs.37,500 which is Rs.11,250.

32. Fair price of the index futures is:

FC = 3,500 + (3,500 x 0.12 x 0.5) – (3,500 x 0.06 x 0.25) = 3,657.5

Index futures is overpriced.

Go long on stocks and short on index futures.

Index closes at 4,500

Loss on index futures = (50,000)

Gain on stocks = 100,000

Dividends received = 5,250

Net profit = 55,250

Index closes at 3000

Gain on index futures = 100,000

Loss on stocks = (50,000)

Dividends received = 5,250

Net profit = 55,250

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33. a. FC $= 3,000 + (3,000 \times 0.1 \times 0.5) - (3,000 \times 0.06 \times 0.5) = 3,060$

Index futures is under priced

Go long on futures and short on stocks

Index closes at 4,000

Gain on futures	=	2,00,000
Loss on stocks	=	(1,00,000)
Risk-free return	=	15,000
Net profit	=	1,15,000

Index closes at 1,000

Loss on futures	=	(1,00,000)
Gain on stocks	=	2,00,000
Risk-free return	=	15,000
Net profit	=	1,15,000

b. Risks:

1. Large orders are not guaranteed price.
2. There can be potential tracking error.
3. Since mispricing does not stay for long, the arbitrageur needs to be a very good forecaster.

34. a. Investor who has gone long at 1,760

Day	Settlement Price	Opening Balance	Mark- to-Market Cash	Margin Call	Closing Balance
1	1,800	5,000	4,000	–	9,000
2	1,752	9,000	(4,800)	800	5,000
3	1,780	5,000	2,800	–	7,800
4	1,824	7,800	3,400	–	11,200

Net profit/loss $= 4,000 + (4,800) + 2,800 + 3,400 = 5,400$

b. Investor who has gone short at 1,760

Day	Settlement Price	Opening Balance	Mark- to-Market Cash	Margin Call	Closing Balance
1	1,800	5,000	(4,000)	4,000	5,000
2	1,752	5,000	4,800	–	9,800
3	1,780	9,800	(2,800)	–	7,000
4	1,814	7,000	(3,400)	1,400	5,000

Net profit/loss $= (4,000) + 4,800 + (2,800) + (3,400) = 5,400$ (loss).

35. The fair price of the futures index is:

FC $= IC + (R_f - D)$

$= 3,450 + (0.1 \times 0.5 \times 3,450) - (0.04 \times 0.5 \times 3,450)$

$= 3,450 + 1,72.5 - 69 = 3,553.5$

The future is overpriced.

To reap the arbitrage profit:

1. Go short in futures;
2. Go long on stocks.

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Suppose the index closes at 1,000

Gain on futures	=	2,58,500
Loss on stocks	=	(2,45,000)
Dividend received	=	6,900
Net profit	=	20,400

Suppose the index closes at 4,000

Loss on futures	=	(41,500)
Gain on stocks	=	55,000
Dividends received	=	6,900
Net profit	=	20,400

36. a. Fair price of the index futures is:

$FC = IC + (R_f - D) = 2,300 + (2,300 \times 0.1 \times 0.5) - (2,300 \times 0.03 \times 0.6)$

$= 2,300 + 115 - 41.4 = 2,373.6$

The futures is overpriced.

Index closes at 2,400

Gain on futures	=	10,000
Gain on stocks	=	10,000
Dividends received	=	4,140
Net profit	=	24,140

Index closes at 2,600

Loss on futures	=	(10,000)
Gain on stocks	=	30,000
Dividends received	=	4,140
Net profit	=	24,140

   b. Risks:

   1. Since mispricing does not persist for a long period of time, the arbitrageur has to have superior forecasting ability otherwise he may incur loss.

   2. Large orders are not guaranteed price and prices can change rapidly.

   3. Arbitrageur's portfolio need to be identical to the composition of the index underlying the futures otherwise there will be tracking error.

37. a. The fair value of the index futures is:

$FC = IC + (R_f - D) = 3,375 + (3,375 \times 0.08 \times 0.5) - (3,375 \times 0.6 \times 0.035)$

$= 3,375 + 135 - 70.875 = 3,439.125$

The futures is overpriced.

   b. Since the futures is overpriced there is scope for arbitrage profit.

   1. Go short in futures;

   2. Go long on stocks.

   Index closes at 3,500

Gain on futures	=	2,500
Gain on stocks	=	12,500
Dividends received	=	7,087.5
Net profit	=	22,087.5

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Index closes at 3,000

Gain on futures	=	52,500
Loss on stocks	=	(37,500)
Dividends received	=	7,087.5
Net profit	=	22,087.5

c. The portfolio manager will go short on futures and hence reduce his portfolio beta.

This approach is devoid of the problems encountered in the spot stock market. The advantages of this approach are:

1. The target beta is achieved almost immediately;

2. The transaction costs are lower;

3. The optimal stock mix is maintained.

38. a. Initial margin for 5 contract = 5 x $50,000 = $2,50,000

Maintenance margin for 5 contracts = 5 x $30,000 = $1,50,000

Day	Futures Price	Daily gain/loss	Balance in Margin A/c	Profit withdrawn	Margin call
1	26.19	(65,000)	1,85,000	–	–
2	26.30	55,000	2,40,000	–	–
3	26.45	75,000	3,15,000	65,000	–
4	26.48	15,000	2,65,000	15,000	–
5	26.34	(70,000)	1,80,000	–	–
6	26.21	(65,000)	1,15,000	–	1,35,000
7	25.98	(1,15,000)	1,35,000	–	1,15,000
8.	25.87	(55,000)	1,95,000	–	–
9.	25.90	15,000	2,10,000	–	–
10.	25.95	25,000	2,35,000	–	–

b. Profit/loss

= Closing balance in Margin account + Profit withdrawn – [Opening balance in margin account + Margin calls]

= 2,35,000 + (65,000 + 15,000) – [2,50,000 + (1,35,000 + 1,15,000)]

= ($1,85,000)

39. a. Futures price at time 't' with time to maturity 'T' is given by

$$F_{t, T} = C_t + C_t \times S_{t, T} \times \frac{T - t}{365} + G_{t, T}$$

We can change the formula as follows: $F_{t,T} = C_t + C_t \times S_{t,T} \times \frac{T - t}{12} + G_{t,T}$

Fair price of futures = $7.511 + 7.511 \times 0.11 \times \frac{8}{12} + 0$ = $ 8.061 per ounce.

b. Futures are now priced at $8.456 per ounce. But the fair price is only $8.061 per ounce, so the futures is overpriced.

So, the strategy should be: Sell futures and buy spot.

April 27, 2001

Cash silver : $ 7.511/ounce

Annualized

Eurodollar Rate : 11%

December 2001

Future Price : $ 8.061/ounce

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	Actions	Cash Flows ($)
1.	On April 27, 2001	
	• Sell December 2001 futures	0
	• Borrow $ 7.511	+7.511
	• Buy Cash Silver @ $ 7.511	−7.511
	Net	0
2.	On December 27, 2001	
	• Deliver cash silver against futures	+8.456
	• Pay-back borrowed amount with	
	• Principal	− 8.061
	• Net Arbitrage Profit	0.395/ounce

40. The firm has a receivable $ 20,000,000

The value of receivable at current spot rate (DKK/$=6.5898) is 20 x 6.5898

=DKK 131.796 million.

Value of receivable on 15th December = 20 x 6.4921 = DKK 129.8420 million

Loss on receivable at spot market = DKK 1.9540 million

A. **Hedging through €futures**

As the customer has a receivable in $, he will go long in € futures as it amounts to go short in USD: buy € futures.

Standard size of € futures is 125,000

So, the number of contracts of Euro to be brought $= \dfrac{20,000,000}{1.1008 \times 125,000}$ ⎕得6wu5(n)-55(o)1sb(1.19.2118.19.9

Gain/loss from the contract

$\quad$ = $\quad$ [Closing balance in margin account + Money withdrawn] – [Opening balance in margin account + Margin call]

$\quad$ = $\quad$ [0 + 350 + 400 + 350 + 300 + 10,300] – [10,000 + 2,750 + 2,850]

$\quad$ = $\quad$ \$ 11,700 – \$15,600 = –\$3,900.

42. $\quad$ a. $\quad$ As the Indian exporter is long on yen so it should go short on ¥ futures i.e., sell yen futures, and as it short on dollar so it should go long on dollar futures. In IMM ¥ – futures are quoted in terms of dollar. So, if the firm sell yen futures to hedge % receivable so simultaneously this contract gives the firm a long position in dollar futures prices. So, both the exposures can be hedged through ¥-futures. Also, all the cash flows of ¥-futures will be in \$-terms, so \$-proceeds from the settlement of yen futures can be used to settle the payables.

$\quad$ b. $\quad$ Standard size of yen futures contract = ¥ 12.5 million

$\quad\quad$ ∴ Number of yen futures contract to be sold $= \dfrac{500}{12.5} = 40$.

$\quad$ c. $\quad$ The firm has sold 40 ¥ futures contract at 0.00805.

$\quad\quad$ On 21.11.02, December futures closes at \$0.0082 and Spot ¥/\$ at 121.78.

$\quad\quad$ The firm will close his futures position.

$\quad\quad$ Loss on futures = (0.008 – 0.00805) x 40 x 12.5 = \$ 0.075 million

$\quad\quad$ Inflow of \$ at spot market = ¥ 500 million x $\dfrac{1}{¥\,121.78/\$}$ = \$ 4.1058 million

$\quad\quad$ ∴ Net inflow = 4.1058 – 0.075 = \$4.0308 million

$\quad\quad$ If this is invested for 1 month \$ inflow on 22.12.2002

$\quad\quad = 4.0308\left[1+\dfrac{0.02}{12}\right]$ = \$4.0375 million

$\quad\quad$ So after paying \$4 million, surplus remains \$0.0375 million. Assuming forward rate will be same as spot rate on 22.12.02,

$\quad\quad$ Rupee inflow = 0.0375 x 49.40 = Rs.1.8525 million

$\quad\quad$ If covered through forward market:

$\quad\quad$ Yen inflow on 21.11.2002 = 500 x 0.4025 = Rs.201.25 million

$\quad\quad$ Future Value for 1 month = $201.25\left[1+\dfrac{0.05}{12}\right]$ = 202.09 million

$\quad\quad$ Rupee outflow on 22.11.2002 = 4 x 49.40 = Rs.197.6 million

$\quad\quad$ ∴ Net rupee inflow on 22.12.2002 = 202.09 – 197.6 = Rs.4.49 million

$\quad\quad$ So, net rupee inflow in case of forward cover is higher.

43. $\quad$ Initial margin = \$2,000 x 10 = \$ 20,000

$\quad\quad$ Maintenance margin = \$1,500 x 10 = \$15,000

Date	Futures Price	Daily gain/loss (\$)	Balance in Margin a/c (\$)	Margin call (\$)	Balance in Margin a/c after margin call
	96.72		20,000	–	
December 9	96.75	750	20,750	–	20,750
December 10	96.68	–1,750	19,000	–	19,000
December 11	96.63	–1,250	17,750	–	17,750
December 12	96.59	–1,000	16,750	–	16,750
December 13	96.54	–1,250	15,500	–	15,500
December 16	96.50	–1,000	14,500	5,500	20,000
December 17	96.55	1,250	21,250	–	21,250
December 18	96.60	1,250	22,500	–	22,500
December 19	96.64	1,000	23,500	–	23,500
December 20	96.67	750	24,250	–	24,250

Gain/loss from futures contract = Closing balance – Opening balance – Margin call

$\quad\quad\quad$ = 24,250 – 20,000 – 5,500 = –\$ 1,250.

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44. a. Fair price of the futures contract = $4235 + [(4235 \times 0.08 \times \frac{3}{12}) - (4235 \times 0.025)]$

= $4235 + [84.7 - 105.88] = 4213.82$

So, we see that the futures contract is overvalued.

b. An arbitrageur can exploit the situation by going short on the index futures contract and buying a portfolio which is identical to the sensex.

Suppose, index closes at 4200 on the expiration date.

Profit from sale of futures [(4450 – 4200) x 5]	Rs.1250
Dividend earned on portfolio (4235 x 5 x 0.025)	529.38
Loss on sale of portfolio [(4200 – 4235) x 5]	(-)175
Total gain	Rs.1604.38

45. The T-bill futures when it was bought was quoted at 94.55 and remaining maturity of 84 days.

So purchase price of T-bill futures = $\$1,000,000 \left[1 - 0.0545 \times \frac{84}{360}\right] = \$987,283.33$

The T-bill futures when it was sold was quoted at 95.05 and remaining maturity of 59 days.

∴ So, selling price of T-bill futures = $\$1,000,000 \left[1 - 0.0495 \times \frac{59}{360}\right] = \$991,887.5$

∴ Annualized realized yield = $\frac{(\$991,887.5 - \$987,283.3)}{\$987,283.3} \times \frac{360}{25} = 6.715\%$

46. a. As the company will invest the funds for 3-months so it will buy the 3-month T-bill futures to lock-up in a yield of (100 – 96.25)% = 3.75%. If the yield on the date of investment i.e., in June declines, the loss in spot market will be offset by the gain in the futures market, however, if interest rate rises, the gain in spot market will offset the loss in futures market. Thus, by buying T-bill futures company can lock-up in a yield of 3.75%.

b. If June futures are at 96.50 in June.

Price of cash T-bill = $\$5,000,000 \times (1 - 0.035 \times 3/12) = \$4,956,250$

Gain in futures = $(96.50 - 96.25) \times \frac{\$25}{1 \text{ b.p.}} \times 5 = \$0.25 \times 25 \times 100 \times 5 = \$3125.$

∴ Effective purchase price = $\$4,956,250 - \$3,125 = \$4,953,125$

∴ Annualized discount yield = $\frac{5,000,0000 - 4,953,125}{5,000,000} \times \frac{12}{3} \times 100 = 3.75\%$

If June futures are at 95.75 in June.

Price of cash T-bills = $(5 \times 1,000,000)((1 - 0.0425 \times 3/12) = \$4,946,875$

Loss in futures = $(95.75 - 96.25) \times \frac{\$25}{1 \text{ b.p.}} \times 5 = -\$0.50 \times 25 \times 100 \times 5 = \$6250$

∴ Effective purchase price = $\$4,946,875 + \$6250 = \$4,953,125$

∴ Annualized discount yield = $\frac{5,000,0000 - 4,953,125}{5,000,000} \times \frac{12}{3} \times 100 = 3.75\%$

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47. a. As the fund manager is expecting a rise in interest rate that will reduce the value of the portfolio. So to hedge the interest rate risk the fund manager should sell the T-bond futures, as rise in interest rate will reduce the futures price, and hence he can make gain by selling futures now, which will reduce the loss in portfolio's value.

The number futures contract required

$$= \frac{\text{Face value of T-bonds}}{\text{Face value of futures contract}} \times \text{Conversion Factor}$$

$$= \frac{\$5,000,000}{\$1,000,000} \times 1.3782 = 68.91 \ \sqcup \ 69 \text{ contracts}$$

b. Value of the holding at the time of entering into hedge $= \$5,000,000 \left[\dfrac{131\frac{2}{32}}{100} \right]$

$$= \$5,000,000 (1.310625) = \$6,553,125$$

i. Portfolio value $= \$5,000,000 \left[\dfrac{130\frac{5}{32}}{100} \right]$

$$= \$5,000,000 (1.3015625) = \$6,507,812.50$$

Change in basis points in futures = 19 bp

Gain in futures = 19 x $31.25 x 69 = $40,968.75

Accrued interest for three months $= \$50,00,000 \times 0.12 \times \dfrac{3}{12} = \$150,000$

Annualized return

$$= \frac{(6,507,812.5 + 40,968.75 + 150,000) - 6,553,125}{6,553,125} \times \frac{12}{3}$$

$$= \frac{145,656.25}{65,53,125} \times \frac{12}{3} = 8.891\%$$

ii. Portfolio value $= \$5,000,000 \left[\dfrac{131\frac{31}{32}}{100} \right]$

$$= \$5,000,000 (1.3196875) = \$6,598,437.50$$

Change in basis points in futures = 23 bp

Loss in futures = 23 x $31.25 x 69 = $49,593.75

Accrued interest for three months $= \$50,00,000 \times 0.12 \times \dfrac{3}{12} = \$150,000$

Annualized return $= \dfrac{(6,598,437.50 - 49,593.75 + 150,000) - 6,553,125}{6,553,125} \times \dfrac{12}{3}$

$$= \frac{145,718.75}{65,53,125} \times \frac{12}{3} = 8.895\%$$

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48. a.

Market rates	\$/Euro	\$/Yen	Implied Yen/Euro
Spot	0.8666	0.0076	114.03
Futures:			
March	0.8738	0.0075	116.51
June	0.8800	0.0074	118.92
September	0.8860	0.0073	121.37

The market's long-term view of euro against yen is that the yen will depreciate against euro.

b. As the market is expecting that yen will depreciate, the speculator's view is that the yen will appreciate. This means according to him yen is under priced and euro is overpriced. So he will buy September Yen futures and sell September euro futures. He will trade in September futures, since the chances that his view will be reflected in the prices is in long-term.

c. Gain from euro futures = 0.8860 – 0.8836 = \$ 0.0024

Gain from yen futures = 0.00745 – 0.0073 = \$0.00015

Total gain = \$ (0.0024 + 0.00015) = \$0.00255.

Options

49. Gain or loss with the given spot rates are tabulated below.

Spot rate	Gain/Loss
1.5720	– 0.030
1.5830	– 0.030
1.5860	– 0.030
1.5870	– 0.030
1.5930	– 0.029
1.6020	– 0.020
1.6050	– 0.017

50. Let the option premium be 'C'. Then the pay-off table for the option would be as follows.

Probability	Spot rate	Option exercised/not	Profit
0.15	40.0	No	– C
0.25	41.5	No	– C
0.30	43.0	Yes	– C + (43 – 42) = – C + 1
0.20	44.5	Yes	– C + 2.5
0.10	46.0	Yes	–C + 4

To break even, expected profit is zero

– C(0.15) – C(0.25) + (– C + 1) (0.3) + (– C + 2.5) (0.2) + (– C + 4) (0.1) = 0

0.15C – 0.25C – 0.3403 – 0.2C + 0.5 – 0.1C + 0.4 = 0

– C + 1.2 = 0

C = 1.2

Maximum premium acceptable will be Rs.1.2.

51. The pay-off table giving the net cash inflows for each of the possible situations is given below.

Exercise Price	Spot price			
	0.6750 (m)	0.6850 (m)	0.6950 (m)	0.7050 (m)
0.68	206.067	207.357	207.357	207.357
0.69	204.426	207.426	208.716	208.716
0.70	203.415	206.415	209.415	210.705

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When the exercise price is 0.68 and spot price is 0.6750, option is not exercised.

∴ Cash inflow: (0.6750 x 300) + ((6,000 x 598.50) – 24,000) = 206.067 million

When the exercise price is 0.68 and spot price is 0.6850, option is exercised.

∴Cash inflow: (0.6800 x 300) + [(6,000 x 598.5) – 24,000 – 2,10,000] = 207.357 million

When the exercise price is 0.68 and the spot price is 0.6950, option is exercised.

∴Cash inflow: (0.68 x 300) + (6,000 x 598.5 – 24,000 – 2,10,000) = 207.357 million

When the exercise price 0.69, and the spot price is 0.6950 option is exercised.

∴Cash inflow: = (0.69 x 300) + [(6,000 x 325) – 24,000 – 2,10,000] = 208.716 million.

When the exercise price is 0.70 and the spot price is 0.6950, option is not exercised.

∴Cash inflow: (0.6950 x 300) + ((6,000 x 156.5) – 24,000) = 209.415 million

When the exercise price is 0.70 and the spot price is 0.7050, option is exercised.

∴Cash inflow: (0.70 x 300) + ((6,000 x 156.5) – 24,000 – 2,10,000) = 210.705 million.

52. A strangle consists of a call and a put with the same expiration date and the same underlying asset with different exercise prices.

1f $S \leq 1.71$, only put option is exercised.

Profit = 1.71 – S – 0.1 – 0.05 = 1.56 – S

Profits can be made only when S < 1.56

If $1.71 < S \leq 1.75$, neither option is exercised.

Loss = 0.10 + 0.05 = 0.15

If S > 1.75, only call option is exercised.

Profit = S – 1.75 – 0.1 – 0.05 = S – 1.90

Profits can be made only when S > 1.90

In this case, loss is made in the range 1.56 < S < 1.90, and the maximum loss is restricted to 0.15

Outside this range, unlimited profits can result, if movements are wide enough in either direction.

53. A straddle consists of a call and a put option with the same exercise price and the same expiration date.

Let spot price be S.

When S < $0.5890/CAD, only put option is exercised.

Profit = (0.5890 – S) – (0.015 + 0.018) = 0.556 – S

When S < 0.556 profits are made

When S > 0.5890, only call option is exercised

Profit = (S – 0.5890) – (0.015 + 0.018) = S – 0.622

So profits are made when S > 0.622.

In the range, 0.556 < S < 0.622, loss is incurred.

Combining the two conditions, we find that profits are possible only when S < 0.556 and S > 0.622. For the strategy to be profitable, a wide movement in prices in either direction is necessary so that the spot price goes outside the bounds 0.556 and 0.622.

54. When the spot price is > 1.5880, call option will be exercised by the buyer.

Profit for the buyer will be $(S – 1.5880) – 0.12 – 0.14$

Put option will not be exercised.

Option seller's profit is $(0.14 + 0.12) – (S – 1.5880)$

$$= 0.26 – (S – 1.5880) = 1.848 – S \qquad \ldots 1$$

When $S < 1.5880$, put option will be exercised call option will not be exercised.

Option seller's profit is $(0.14 + 0.12) – (1.5880 – S)$

$$= 0.26 – 1.5880 + S = S – 1.328 \qquad \ldots 2$$

Considering (1) and (2), we find that the option seller makes profits when spot price is in the range (1.328 – 1.848).

55. Let S be the spot rate at the end of expiry period. Call option will be exercised only if S is greater than the strike price. Thus, profit for the buyer (for option of strike 1.6300) is $S – 1.6300 – 0.04$ or $S – 1.6700$

Profits will be made only when $S > 1.6700$

Profit for writer of option $= 1.6300 + 0.04 – S < 1.6700 = 1.6700 – S$

Profit will be positive only if $S < 1.6700$

Similarly, we can work out for other options.

Option buyer will make profits when $S > 1.6800$ for option with strike price 1.6500 and will make profits when

$S > 1.6700$ for option with strike price 1.6600.

The option writer will make profits when,

$S < 1.6800$ for option with strike price 1.6500

$S < 1.6700$ for option with strike price 1.6600.

56.

Spot price AUD/SF	Option exercised	Outflow at maturity AUD/SF	Profit AUD /SF
1.25	Yes	1.28	1.3 – 1.28 + 0.2 = 0.22
1.26	Yes	1.28	1.3 – 1.28 + 0.2 = 0.22
1.27	Yes	1.28	1.3 – 1.28 + 0.2 = 0.22
1.28	No	1.28	1.3 – 1.28 + 0.2 = 0.22
1.29	No	1.29	1.3 – 1.29 + 0.2 = 0.21
1.30	No	1.30	1.3 – 1.30 + 0.2 = 0.20
1.31	No	1.31	1.3 – 1.31 + 0.2 = 0.19
1.32	No	1.32	1.3 – 1.32 + 0.2 = 0.18

57. a. As the declaration prior to the loss is undervalued, the loss recoverable is $\dfrac{\text{Rs.199 lakh}}{\text{Rs.199.5 lakh}}$ x 40,000 = Rs.39,900

b. Since the cancelation is at the insured's instance, the adjustment will be at short period rates.

Average declaration $= \dfrac{199.8 + 199.2 + 198.8 + 199}{4}$ = Rs.199.2 lakh

Premium that can be refunded is the lower of

i. 50% of average declaration x $\dfrac{40,000}{200}$

$= 0.5 \text{ x } \dfrac{199.2 \text{ lakh}}{200 \text{ lakh}} \text{ x Rs.40,000 } = \text{Rs.19,920}$

ii. 35% of Rs.40,000 (Provisional premium) $= \dfrac{35}{100}$ x Rs.40,000 = Rs.14,000.

As 35% of the provisional premium is less than the 50% of the annual premium, the insurance company will refund Rs.14,000.

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58. We buy put A and sell put B

Let the Spot price = S on the date of maturity

If S < 114, both options are exercised.

Profit = –5 + 9 + (114 – S) – (117 – S) = 4 + 114 – S – 117 + S = 4 – 3 = +1

If 114 < S < 117, only option B is exercised.

Profit = –5 + 9 – (117 – S) = S – 113

This is always positive.

If S > 117, neither option is exercised

Profit = –5 + 9 = 4

Since profits are always generated, irrespective of the spot price on the date of maturity, arbitraging is possible by simultaneous purchase of put A and sale of put B.

59.

Spot price (Rs./Euro)	Option exercised	Outflow at maturity (Rs./Euro)	Profit (Rs./Euro)
38.00	Yes	40.00	1.2
39.00	Yes	40.00	1.2
40.00	No	40.00	1.2
41.00	No	41.00	0.2
42.00	No	42.00	–0.8

Note: Profit = Forward sales price + Premium – Outflow at maturity.

60. Both the calls have the same expiration date but different exercise prices.

Assume that these 2 calls violate the proposition given. (i.e.) Lower the exercise price, the more valuable, the call.

∴ Call A will have a higher exercise price and a higher call price. Then this will give rise to arbitrage opportunities.

Sell call A + 30

Buy call B –25

Net cash flow : $5

We have a sure profit of at least $5.

i.   If stock price is $110 neither option is exercised.

ii. If stock price ≤ 110, both expire worthless and you retain $5 initial flow.

iii. If stock price is $120, call A is exercised by the buyer.
     ∴ Loss to the trader = $5

     Call B is exercised by the trader, profit = $10.

     Net cash flow = $(10 – 5) = $5

     Total profit = $5 + $5 = $10

iv. If the stock price is $117, call A will be exercised against the trader at $115. Loss: $2. Profit on call B: will be $7. Net profit = 7 – 2 = $5, Total profit = $10.

     Under the assumption, we see that whatever be the spot price of the stock there is a profit of at least $5. Thus, there is an arbitrage profit of $5. To avoid this arbitrage possibility, call should be priced in such a way that the call having a higher exercise price should be priced lower than that having a lower exercise price.

Profit and losses at expiration from a butterfly spread with calls
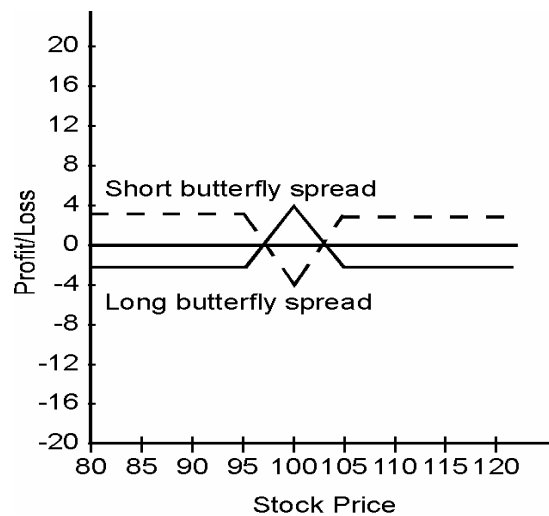
61. Call A and call B are priced in such a way that call B is priced lower than call A which violates the proposition that call B should be priced greater than or equal to the price of call A.

Sell call A at	$6
Buy call B at	$5
Profit	$1

Without any investment, a trader is able to make a profit of $1.

Case (i)

Assume that call A and B are American options. This will allow the trader to exercise call B before expiration.

It is assumed that the Spot Price is $105

Transaction:
Call A is exercised against the trader.
Loss: $5.

Trader exercises call B.

Profit   = $5.
Net cash flow = $5 – $5 = 0.

Out of this transaction, there is no net cash flow, so the trader still has a profit of $1.

Case (ii)

Assume that call A and call B are European options.

The trader cannot exercise call B when call A is exercised against him.

Call A is exercised against the trader.

Loss = $5

Trader sells call B.

Receives $S – Xe^{-rt}$

∴ Net cash flow ≥ 0.

Thus, the trader has a profit of at least $1 from the initial transaction to which he can add on more profits if the risk-free rate of interest is less.

Thus, to avoid arbitrage profits the calls should be priced in such a way that the greater the time to maturity, higher the price of the call other things remaining the same.

62. Take some hypothetical data to prove the given proposition.

Consider the following data.

Spot price of the stock	= $105
Exercise price of the option	= $110
Price of the put	= $3.

As the price of the put is less than the difference between the exercise price and the spot price arbitrage profits can be made.

Transaction	Cash flow
Buy put	−3
Buy stock	−105
Exercise option	+110
Net cash flow	+2

This profit was possible only because the option was an American option and it could be exercised immediately. If the price of the put is at least $5, arbitrage could have been avoided.

63. To prove:

$$P_t \geq X_e^{-r(T-t)} - S_t$$
$$P_t \geq 100_e^{-0.06(0.25)} - 95$$
$$\geq 98.51 - 95$$
$$\geq 3.51.$$

One can profit by the way of arbitrage as the put is actually worth $3.51 but the price is only $3.

Transaction	Cash flow
Borrow $98 at 6% for 3 months	+98
Buy put	−3
Buy stock	−95
Net cash flow	0

Once the option expires, the following transaction takes place for obtaining the arbitrage profit.

Transaction	Cash flow
Exercise option, deliver stock; collect exercise price	100.00
Repay debt = $98e^{-(0.06)(0.25)}$	99.48
Net cash flow	0.52

With zero cash flow in the beginning, we are able to obtain a profit of $0.52.

64. The longer the time to maturity, the more valuable an American put. If the statement is not true then a trader can make arbitrage profits.

Consider 2 puts with the following characteristics—

Put A   Maturity time-8 months   exercise price-$100   premium-$5

Put B   Maturity time-6 months   exercise price-$100   premium-$6

Here the trader can buy Put option A and sell Put option B

If the price falls below $100 within 6 months time, then Put B is going to be exercised. The trader would then exercise Put A and offload the underlying security at no risk.

He also earns a profit of $(6 − 5) = $1. Thus, an arbitrage profit of $1 is possible. Thus, the statement should be true to avoid any arbitrage profits.

65. Put D has a higher price when compared to put C. Therefore, arbitrage can be resorted with the following transactions.

Transaction	Cash flow
Sell put D	+12
Buy put C	−11
Net cash flow	+1

Put D is exercised against the trader when the stock price is $110.

Transaction	Cash flow
Put D is exercised against the trader	
Receive stock worth $110	+110
Pay exercise price	−115
Trader exercises put C	
Delivers stock of $110	−110
Receives exercise price of $120	+120
Net cash flow	+5

Thus, whatever be the stock price, the option will have a profit of at least $5 + $1 = $6.

66. Suppose a particular stock trades at $105 and there are 2 options which have the same time until expiration.

Put A has an exercise price of $110 with a put price of $4

Put B has an exercise price of $115 with a price of $10

Difference in the put prices = 10 – 4 = $6.

Difference between their exercise prices = $(115 – 110) = $5

There is an arbitrage profit of at least $1.

Case (i)

Sell put B at   +$10

Buy put A   –$4

Net cash flow   +$6

Put B is exercised against the trader when the stock price is $105.

Transaction	Cash flow
Put B is exercised against the trader	
Receive stock worth $105	+105
Pay exercise price	−115
Trader exercises put E	
Delivers Stock of $105	−105
Receives exercise price of $110	+110
Net cash flow	−$5

Total arbitrage profit/loss = $6 – $5 = $1.

Case (ii)

If the stock price exeeds $115, none of the puts are exercised and the trader retains the $6 profit. Thus, the price difference between two American puts cannot exceed the difference in exercise prices to avoid any arbitrage.

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67. The present value of put 1 $= 105\,e^{-0.08 \times 0..5} = \$100.88$

The present value of put 2 $= 110e^{-0.08 \times 0.5} = \$105.69$

The difference between the present values $= 105.69 - 100.88 = \$4.81$ whereas the difference between the exercise prices is $5.

This leads to arbitrage profit.

Sell put 2 at $7

$ But put 1 at $3

Net cash flow $4.

The cash inflow of $4 is invested for 6 months at 8%. At expiration, the investment will be worth $4e^{+0.08 \times 0.5}$ $4.16. Whenever the stock price is less than $105, this will sustain the loss.

68. $S = 145;\ X_c = 140;\ X_p = 140;\ r_f = 10\%;\ \sigma = 20\%$
No. of days left to expire = 39 days
(Nov.16 – Dec.25)

Value of the call option;
$C = SN(d_1)\,Xe^{-r_f t} - N(d_2)$

$d_1 \quad = \dfrac{In(S/x)+(r+\sigma^2/2)(T-t)}{\sigma\sqrt{T-t}} = d_1 = 0.7329$

$d_2 \quad = d_1 - \sigma\sqrt{T-t} = 0.6675$

$N(d_1) \quad = N(0.7329) = 0.7682$

$N(d_2) \quad = N(0.6675) = 0.7478$

$C \quad = 145(0.7682) - 140\,e^{-0.1\left(\frac{39}{365}\right)}(0.7478) = 7.81$

Using put-call parity (Since both call and put have the same exercise price)

$C - P = S - PV(X)$

$P \quad = - S + PV(X) + C$

$\quad = -145 + 138.51 + 7.81 = 1.32$

69. Time to expire: 42 days

$\$ \quad = 130;\ X = 120;\ r = 9\%;$
$\sigma \quad = 18\%.$ No dividends.

$C \quad = SN(d_1) - PV(X)N(d_2)$

$d_1 \quad = \dfrac{In(S/x)+(r+\sigma^2/2)(T-t)}{\sigma\sqrt{T-t}} = \dfrac{In\left(\frac{130}{120}\right)+\left(0.09+\frac{0.18^2}{2}\right)\left(\frac{42}{365}\right)}{0.18\sqrt{42/365}} = 1.5110$

$d_2 \quad = d_1 - \sigma\sqrt{T-t}$
$\quad = 1.5110 - 0.18\sqrt{42/365} = 1.4499$

$N(d_1) = 0.9346,\ N(d_2) = 0.9265$

$C \quad = 11.46$

$P \quad = PV(x) - S + C = 120\,e^{-0.09 \times \frac{42}{365}} - 130 + 11.46 = 0.2237.$

70. $S = 210; X = 220; T-t = \dfrac{167}{365}$ years.

$r_f = 10\%; \sigma^2 = 20\%; \sigma = \sqrt{0.2}$

$$d_1 = \frac{In(S/x)+(r+1/2\,\sigma^2)(T-t)}{\sigma\sqrt{T-t}}$$

$$= \frac{In\left(\dfrac{210}{220}\right)+\left[0.1+1/2(0.2)\right]\left(\dfrac{167}{365}\right)}{0.4472\sqrt{167/365}} = 0.0915/0.3025 = 0.3025$$

$d_2 = d_1 - \sigma\sqrt{T-t} = 0.3025 - 0.4472\sqrt{167/365} = 0.3025 - 0.3025 = 0.$

$N(d_1) = 0.6189.$

$N(d_2) = 0.5$

Value of call option $= SN(d_1) - Xe^{-r(T-t)}N(d_2) = 210(0.6189) - 220e^{-0.1\left(\frac{167}{365}\right)}(0.5)$

$= 129.969 - 105.08 = 24.89.$

71. $S = 60; X = 70; r = 0.06; T-t = 0.2466; \sigma = 0.4$

$$d_1 = \frac{In(S/x)+(r+1/2\,\sigma^2)(T-t)}{\sigma\sqrt{T-t}} = \frac{In\left(\dfrac{60}{70}\right)+\left(0.06+\dfrac{0.16}{2}\right)0.2466}{0.4\sqrt{0.2466}} = -0.6022$$

$d_2 = -0.6022 - 0.4\sqrt{0.2466} = -0.8008.$

$N(d_1) = 0.2750$

$N(d_2) = 0.2121$

i. $c = 60\,(0.2750) - 70\,e^{-0.06 \times 0.2466}(0.2121) = 1.87$

ii. Delta $= N(d_1) = 0.2750$

iii. Gamma $= \dfrac{N^1(d_1)}{S\sigma\sqrt{T-t}}$

$N^1(d_1) = \dfrac{1}{\sqrt{2\pi}}e^{-0.5d_1^2} = \dfrac{1}{\sqrt{2\pi}}e^{-0.5(-0.6022)^2} = 0.332$

Gamma $= \dfrac{0.332}{60 \times 0.4\sqrt{0.2466}} = 0.028$

iv. Theta $= \dfrac{-SN^1(d_1)\sigma}{2\sqrt{T-t}} - r_f\,Xe^{-r_f(T-t)}N(d_2)$

$= \dfrac{-60 \times 0.332 \times 0.4}{2\sqrt{0.2466}} - 0.06 \times 70\,e^{-0.06 \times 0.2466} = -8.910$

v. Vega $= S\sqrt{T-t}\,N^1(d_1) = 60\sqrt{0.2466}\,(0.332) = 9.89$

vi. Rho $= X(T-t)e^{-r_f(T-t)}N(d_2)$

$= 70\,(0.2466)e^{-0.06 \times 0.2466}(0.2121) = 3.607.$

72. σ = 0.6 in the above problem

$$d_1 = \frac{\ln(60/70)+(0.06+\frac{1}{2}(0.6^2))(0.2466)}{0.6\sqrt{0.2466}} = -0.32$$

$$d_2 = -0.32 - 0.6\sqrt{0.2466} = -0.617$$

$N(d_1) = 0.3745$

$N(d_2) = 0.2709$

Value of the call option $= 60(0.3745) - 70e^{-0.06 \times 0.2466}(0.2709) = 3.79$

Change in the price of the call option $= 3.79 - 1.87 = 1.92$

This is an increase of 102.67%.

73. Monthly SD σ = 0.158

Monthly variance $\sigma^2 = 0.02496$

Yearly variance $= 0.02496 \times 12 = 0.29952 \sim 0.3$

$(T-t) = 91/365 = 0.2493$

$$d_1 = \frac{\ln(S/x)+(r+\sigma^2/2)(T-t)}{\sigma\sqrt{T-t}} = \frac{\ln\left(\frac{65}{60}\right)+\left(0.08+\frac{0.3}{2}\right)(0.2493)}{\sqrt{(0.3 \times 0.2493)}} = 0.5024$$

$$d_2 = 0.5024 - \sqrt{(0.3 \times 0.2493)} = 0.2289$$

$N(d_1) = 0.6923$

$N(d_2) = 0.5906$

$C = 10.2632$

Delta $= 0.6923$.

74. i. If the stock price = $95
- The call of X = $95 is worthless and the long position will incur a loss of $7 (i.e. cost of the premium).
- The long position on X = $105 also cannot be exercised and the loss will be $3 (i.e. cost of the premium).
- The short position at an exercise price of $100 will give a profit of $4 per option (as 2 calls are sold, profit will be $8 (i.e. $4 x 2).

Therefore, the net loss on the spread = Loss of $7 + Loss of $3 + Profit of $8 = $2.

ii. If the stock price = $100
- The long position on the call of X = 95 will incur a loss of $2 (i.e. Premium loss of $7 – Profit of $5).
- The long position on X = $105 will lead to a loss of $3 (i.e. cost of the premium).
- The short position at an exercise price of $100 will give a profit of $4 per option (as 2 calls are sold, profit will be $8 (i.e. $ x 2).

Therefore, the net profit on the spread = Loss of $2 + Loss of $3 + Profit of $8 = $3.

iii. If the stock price = $105
- The call of X = $95 can be exercised as the long position will result in a profit of $3 (i.e. Premium cost of $7 – Profit of $10)
- The long position on X = $105 will lead to a loss of $3 (i.e. cost of the premium)
- The short position at an exercise price of $100 will give a loss of $2 (i.e. Profit of $8 – Loss of $10)

Therefore, the net loss on the spread = Profit of $3 + Loss of $3 + Loss of $2 = $2.

75. The premium paid is 0.0035 (15) $0.0525 million

The firm has a floor on the value of its receivables at (112.20 – 0.0035)/$ =112.1965¥/$.

Case (i)

$ depreciates to ¥110.64/$

The firm will exercise its put option and delivers $15mn to the bank at the price of 112.2¥/$

Case (ii)

$ depreciates to 113.2¥/$.

The firm allows the option to expire and sells the receivables in the spot market. It obtains an effective rate of (113.2 – 0.0035)¥/$ = 113.1965 which is greater than the forward rate.

76. This position is a bull spread with calls, because it is designed to profit if the stock price rises.

Value of the bullish call spread at expiration:

$C_t(S_T, X_1) = \text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$

Using the above equation

a.   i.   When the stock price is $98

Value	$= \text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$
	$= \text{Max}(0, 98 - 100) - \text{Max}(0, 98 - 110)$
	$= \text{Max}(0, -2) - \text{Max}(0, -12)$
	$= 0 - 0$
	$= 0$
Profit/Loss	$= -4 + 0 = -\$4$

     ii.   When the stock price is $99

Value	$= \text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$
	$= \text{Max}(0, 99 - 100) - \text{Max}(0, 99 - 110)$
	$= \text{Max}(0, -1) - \text{Max}(0, -11)$
	$= 0 - 0$
	$= 0$
Profit/Loss	$= -4 + 0 = -\$4$

     iii.   When the stock price is $100

Value	$= \text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$
	$= \text{Max}(0, 100 - 100) - \text{Max}(0, 100 - 110)$
	$= \text{Max}(0, 0) - \text{Max}(0, -10)$
	$= 0 - 0$
	$= 0$
Profit/Loss	$= -4 + 0 = -\$4$

     iv.   When the stock price is $101

Value	$= \text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$
	$= \text{Max}(0, 101 - 100) - \text{Max}(0, 101 - 110)$
	$= \text{Max}(0, 1) - \text{Max}(0, -9)$
	$= 1 - 0$
	$= 1$
Profit/Loss	$= -4 + 1 = -\$3$

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v. When the stock price is \$102

Value = $\text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$

= $\text{Max}(0, 102 - 100) - \text{Max}(0, 102 - 110)$

= $\text{Max}(0, 2) - \text{Max}(0, -8)$

= $2 - 0$

= 2

Profit/Loss = $-4 + 2 = -\$2$

vi. When the stock price is \$103

Value = $\text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$

= $\text{Max}(0, 103 - 100) - \text{Max}(0, 103 - 100)$

= $\text{Max}(0, 3) - \text{Max}(0, -3)$

= $3 - 0$

= 3

Profit/Loss = $-4 + 3 = -\$1$

vii. When the stock price is \$104

Value = $\text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$

= $\text{Max}(0, 104 - 100) - \text{Max}(0, 104 - 110)$

= $\text{Max}(0, 4) - \text{Max}(0, -6)$

= $4 - 0 = 4$

Profit/Loss = $-4 + 4 = \$0$

viii. When the stock price is \$105

Value = $\text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$

= $\text{Max}(0, 105 - 100) - \text{Max}(0, 105 - 110)$

= $\text{Max}(0, 5) - \text{Max}(0, -5)$

= $5 - 0 = 5$

Profit/Loss = $-4 + 5 = \$1$

ix. When the stock price is \$106

Value = $\text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$

= $\text{Max}(0, 106 - 100) - \text{Max}(0, 106 - 110)$

= $\text{Max}(0, 6) - \text{Max}(0, -4)$

= $6 - 0 = 6$

Profit/Loss = $-4 + 6 = \$2$

x. When the stock price is \$107

Value = $\text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$

= $\text{Max}(0, 107 - 100) - \text{Max}(0, 107 - 110)$

= $\text{Max}(0, 7) - \text{Max}(0, -3)$

= $7 - 0 = 7$

Profit/Loss = $-4 + 7 = \$3$

xi.   When the stock price is $108

    Value $= \text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$

                           $= \text{Max}(0, 108 - 100) - \text{Max}(0, 108 - 110)$

                           $= \text{Max}(0, 8) - \text{Max}(0, -2)$

                           $= 8 - 0 = 8$

    Profit/Loss $= -4 + 8 = \$4$

xii.   When the stock price is $109

    Value $= \text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$

                           $= \text{Max}(0, 109 - 100) - \text{Max}(0, 109 - 110)$

                           $= \text{Max}(0, 9) - \text{Max}(0, -1)$

                           $= 9 - 0 = 9$

    Profit/Loss $= -4 + 9 = \$5$

xiii.   When the stock price is $110

    Value $= \text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$

                           $= \text{Max}(0, 110 - 100) - \text{Max}(0, 110 - 110)$

                           $= \text{Max}(0, 10) - \text{Max}(0, 0)$

                           $= 10 - 0 = 10$

    Profit/Loss $= -4 + 10 = \$6$

xiv.   When the stock price is $111

    Value $= \text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$

                           $= \text{Max}(0, 111 - 100) - \text{Max}(0, 111 - 110)$

                           $= \text{Max}(0, 11) - \text{Max}(0, 1)$

                           $= 11 - 1 = 10$

    Profit/Loss $= -4 + 10 = \$6$

xv.   When the stock price is $112

    Value $= \text{Max}(0, S_T - X_1) - \text{Max}(0, S_T - X_2)$

                           $= \text{Max}(0, 112 - 100) - \text{Max}(0, 112 - 110)$

                           $= \text{Max}(0, 12) - \text{Max}(0, 2)$

                           $= 12 - 2$

                           $= 10$

    Profit/Loss $= -4 + 10 = \$6$

If the stock price is $104, the entire position has a zero profit. At this point, the call with the exercise price of $100 can be exercised for a $4 exercise profit. This $4 exercise value exactly offsets the price of the spread. When the stock price is $100 or below, the worst loss occurs. This is so as the option with the $100 exercise cannot be exercised and the entire position is worthless. This gives a $4 loss.

b.   The best outcome occurs for any stock price of $110 or above and the total profit is $6.

77. The put option pay-off will be zero if the Eurodollar futures price on the expiration date is greater than \$90 since the pay-off from the option is negative or zero.

    i.   As the futures price is \$89, it pays to exercise the put option. Therefore, value of the put option will be:

$$P_c = 1 \text{ million} \times (90 - 89) \times \frac{90}{360} \times \frac{1}{100} = \$2,500$$

$(\frac{1}{100}$ is to adjust for the fact that the quotation is in points of a 100)

    ii.   If the break even level for the futures price is F, the pay-off from a long position in the put option on the futures contract on the expiration date is,

$$= \$ 1 \text{ million} \times 1/100 \times \frac{90}{360} \times (90 - F)$$

Cost of the option today is, $1 \text{ million} \times \frac{1}{100} \times \frac{90}{360} \times 0.7 = 1750$

∴ Future value of this payment in 3 months or 91 days time is

$$1,750 \times \left[1 + \frac{91}{360}(0.07)\right] = \$1,780.97$$

The break even point is determined by equating the cost of the option and the pay-off.

$$1 \text{ million} (90 - F) \times \frac{1}{100} \times \frac{90}{360} = 1780.97$$

$$90 - F = 0.7123$$
$$F = 89.29$$

78. Quotations are as under: Standard Size: 25000

\$/£	Calls-Settle in Cents			Puts-Settle in Cents		
Strike Price	Dec-C	Mar-C	Jun-C	Dec-P	Mar-P	Jun-P
1.425	6.40	7.05	7.75	0.05	2.00	3.65
1.450	3.95	5.35	6.35	0.10	2.85	4.60
1.475	1.65	4.20	5.15	0.35	4.00	5.70
1.500	0.50	3.20	4.20	1.65	r	r

    a.   Call option is purchased at a strike price of 1475

        Upfront fee = 25,000 × 0.0420 × 3 = \$1050 × 3 = \$3,150

    b.   Amount locked in £75,000

        Ceiling cost = 75,000 × (1.475 + 0.042) = 75,000 × 1.517 = \$113,775

    c.   Options bought at 4.20 and sold for 5.20 after 45 days

Day 1 Cash Outflow	= 25,000 × 0.0420 × 3	=	\$ 3150
Day 46 Cash Inflow	= 25,000 × 0.0520 × 3	=	\$ 3900
Cash Inflow	= 3900 – 30	=	\$ 3870
Cash Outflow	= 3150 + 30	=	\$ 3180
Cost of funds at 8% on 3180 for 45 days		=	\$ 31.80
Net Profit		=	\$ 658.20

79.

Size of call options	\$1,000,000
Strike price	AUD 1.60/\$
Premium	AUD 0.03/\$
Opportunity cost	6%
Maturity	180 days

a. What is the break even maturity spot rate

Cash outflow premium = 1,000,000 x 0.03	=	AUD 30,000
Interest Cost = 6% for 180 days on AUD 30,000	=	900
		30,900
Value of $1,000,000 at strike price	=	1,600,000
		1,630,900

Break even rate $= \dfrac{1,630,900}{1,000,000} = $ AUD 1.6309 / $

b. Forward Rate for 6-m = AUD 1.62/$

Option would prove better so long as the cost under option is cheaper than that of the forward.

Cost under forward is AUD 1.6200/$

Break Even Rate under option is AUD 1.6309/$

The cost under call option is the cost of option premium together with cost of funds and the maturity spot price so long as the maturity spot price is less than or equal to the option strike price. If the maturity spot price is more than the strike price, then the cost is strike price + Option premium together with cost of funds.

Maturity Spot Rate	Cost Under Option	Cost Under Forward
1.5800	1.6109	1.62
1.5890	1.6199	1.62
1.5891	1.6200	1.62
1.5892	1.6201	1.62
1.5900	1.6209	1.62
1.6000	1.6309	1.62
1.6100	1.6309	1.62
1.6200	1.6309	1.62

Hence, option proves to be beneficial so long as the Maturity Spot Rate is less than 1.5891 whereas for the rates above 1.5891 forward proves to be better.

80. Profit $= (X - S_T - C)$ for $X > S_T$

$(S_T - C)$ for $X < S_T$

a. Option premium = 250000 x 0.03= € 7500

Interest cost at 4% = 7500 x 0.04 x 90/365 = € 73.97

Total cost of the option = € 7573.97

Cost per £ — €/£ 0.0303

Hence, maximum spot rate = Strike price – Cost =0.6568 – 0.0303 = 0.6265.

b. A forward is said to be better if the inflow is more under forward than under option and option is better than forward if the inflow under option is more.

	Spot rate	Option rate	Forward rate
1	0.6521	0.6265	0.6567
2	0.6568	0.6265	0.6567
3	0.6589	0.6286	0.6567
4	0.6870	0.6567	0.6567
5	0.6901	0.6598	0.6567
6	0.6907	0.6604	0.6567

Option is more profitable if the spot rate on maturity is more than 0.6870 and forward is more profitable if the spot rate is less than 0.6870.

81.

Spot Rate Rs./AUD	= 20
Interest Rate (Rs.)	= 21%
Interest Rate (AUD)	= 10%
Forward Rate	= Rs.22

Firm has a payable of AUD 100,000

If the payable is covered through Forward Rate

Day 1 – Outflow is NIL

Day Maturity (Rs. outlay) = AUD 1,00,000 x 22 = 22,00,000

If the payable is covered through Option

Day 1 Outflow (Rs.)	Rs.1,00,000
Interest Cost at 21%	21,000
	1,21,000
Rs. Outlay at strike price of 20	20,00,000
	21,21,000

The price under option is ≤ 21,21,000 which is less than the cash outflow on account of forward contract. Hence, it is preferable to cover through option. Though money market and forex market is not discussed here, but if working is done, it would be observed that interest rate parity holds good.

82. The forward quotation in $/¥ will be: 0.8177 cents per Yen.

Option	Strike rate (Cents/¥)	Premium (Hundredth of Cent per ¥)
Call (6-m)	0.8177	2.66
Call (6-m)	0.8333	1.79
Put (6-m)	0.7937	1.71
Put (6-m)	0.7843	1.37

Let the payable be $6,250,000.

If a forward contract is taken, the outflow will be:

¥6,250,000 x $\dfrac{0.8177}{100}$ = $51,106.25

a. If the call option is bought at ¥/$ 122.30, the outflow on exercise will be $51,106.25. The premium is ¥6,250,000 x 0.000266 = $1662.50. Total outflow = $52,768.75.

Effective rate = ¥118.44/$.

b.

Premium paid	= ¥6,250,000 x 0.000179 = $1118.75
Premium received	= ¥6,250,000 x 0.000171 = $1068.75
Net premium paid	= $50.00

Outflow if the put is exercised = 6,250,000 x $\dfrac{0.7937}{100}$ = $49,606.25

Net outflow	= $49,656.25

Outflow if the call is exercised = 6,250,000 x $\dfrac{0.8333}{100}$ = $52081.25

Net outflow	= $52131.25

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c. Premium received $= 6,250,000 \times 0.000137 = \$856.25$

Outflow if the put is exercised $= 6,250,000 \times \dfrac{0.7843}{100} = \$49018.75$

Net outflow $= \$48,162.50$

83. Present value of the call/put option is given by:

Discount factor x [(Probability) x (Pay-off)]

i.   a.   Value of the call option:

$$c = \left[\frac{1}{1+(0.15 \times 183 \times /360)}\right] \times \left[(0.5 \times 4676.73) + (0.5 \times 0)\right]$$

$c = \$2172.70$

    b.   Value of the put option:

$$p = \left[\frac{1}{1+(0.15 \times 183/360)}\right] \times \left[(0.5 \times 4721.38) + (0.5 \times 0)\right]$$

$p = \$2540.692$

ii.   Forward price is given by:

$$F = \left[0.5 \times \left(\frac{1}{1+(0.16 \times 182/360)}\right)\right] + \left[0.5 \times \left(\frac{1}{1+(0.14 \times 182/360)}\right)\right]$$

$F = 0.4625 + 0.4699 = \$0.9294$

iii.   To determine the forward rate f, the following relation is used:

$$0.9294 = \left[\frac{1}{1+(f \times 182/360)}\right]$$

Therefore, f = 15.02

If the call and the put option are at the forward rate of 15.02, both have the same value.

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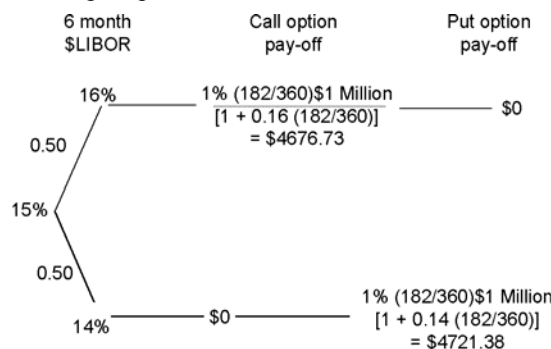
84. The call option pay-off will be zero if the LIBOR rate is less than or equal to 8% strike rate (ceiling rate)

i. As the LIBOR rate of 9% is greater than 8%, the call option will be exercised.

Therefore, value of the call option will be:

C_C = ($15 million) x (9% – 8%) x 182/360 = $75,833.33

ii. If the interest rate is assumed as i,

Cash flow on repayment of the $15 million loan will be:

$15 million [1 + (i% x 182/360)]

With the call option, the interest rate on the loan itself would be capped at 8%. Hence, the total payment on the loan on the maturity date would be:

= $15 million [(1 + (8% x 182/360)] = $156,00,000

To determine the cost on the maturity date, amount of $35,000 being the cost of the option should be compounded forward.

Compounded cost of the option will be:

$35,000 [1 + (8% x 182/360)]

The break even point is the interest rate i at which the total cost of the loan is the same with and without the option

= $15,000,000 [1 + (8% x 182/360)] + $35,000 [1 + (8% x 182/360)]

Therefore, i = 8.52.

85. a. The call options with strike prices of 30 and 35 are in-the-money.

b. i. The call provides a downside protection with the maximum loss restricted to Rs.1.5 per share in the event of decline in the stock price. Secondly, we can have leverage at payments front. For instance, if he buys, say, 100 shares he has to pay Rs.4,000; on the other hand, buying of a call option will lead to outflow of just Rs.150.
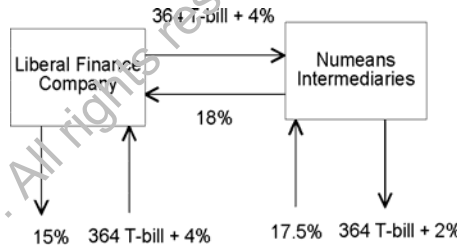
ii. This is a covered call strategy. Writer would lose only if price goes below Rs.37.50 or above Rs.42.50 and would be having a cushion of by Rs.5 (42.50 – 37.50).

c. 1. D   2. E   3. B   4. A   5. C

d. Sell June 30 call +10

Buy June 35 call –6

Expiration Day Table

Price on expiration date	Buy June 30 call	Sell June 35 call	CF(T)	C_{f0} + CF(T)
10	0	0	0	4
20	0	0	0	4
30	0	0	0	4
40	–10	5	–5	–1
50	–20	15	–5	–1

Maximum profit is Rs.4 and Maximum loss is Re.1.

Cf_0 = Rs.4

86. a. The option is out of money

The margin is higher of the calculated

i. margin = 12 x 100 + 0.20 x 315 x 100 – 100(325 – 315) = 6500

ii. margin =100 x 12 + 0.10 x 315 x 100 = 4350

So the margin is Rs.6,500/-

87. If wide variations are expected in the stock prices, the following strategies may be adopted:

a. **Selling a butterfly:** This strategy involves buying two options (put or call) with the middle strike price and selling the options (put or call) with the lower and higher strike prices.

b. **Buying a straddle:** In this strategy investor buys a call option and sells a put option at the same strike price and maturity date. The call option may be bought with a strike price of Rs.43.30 and the put option at Rs.43.70.

c. **Buying a strangle:** This strategy involves buying a call above the current spot rate and a put below the current spot rate.

However, it is sufficient if students explain one of the three.

Selling a Butterfly

Investment = 0.90 + 0.30 – 0.50 x 2 = +0.20

Spot rate	Short call at 43.30	Long two calls at 43.50	Short call at 43.70	Total pay-off	Total profit
43.00	0	0	0	0	0.20
43.10	0	0	0	0	0.20
43.20	0	0	0	0	0.20
43.30	0	0	0	0	0.20
43.40	–0.10	0	0	–0.10	0.10
43.50	–0.20	0	0	–0.20	0.00
43.60	–0.30	+0.20	0	–0.10	0.10
43.70	–0.40	+0.40	0	0	0.20
43.80	–0.50	+0.60	–0.10	0	0.20
43.90	–0.60	+0.80	–0.20	0	0.20
44.00	–0.70	+1.00	–0.30	0	0.20

Buying a Straddle

Investment = –0.50 – 0.60 = –Rs.1.10, assuming that both the options are bought at Rs.43.50.

Spot Rate	Long Call at 43.50	Long Put at 43.50	Total Pay-off	Total Profit
43.00	0	0.50	0.50	–0.60
43.10	0	0.40	0.40	–0.70
43.20	0	0.30	0.30	–0.80
43.30	0	0.20	0.20	–0.90
43.40	0	0.10	0.10	–1.00
43.50	0	0	0	–1.10
43.60	0.10	0	0.10	–1.00
43.70	0.20	0	0.20	–0.90
43.80	0.30	0	0.30	–0.80
43.90	0.40	0	0.40	–0.70
44.00	0.50	0	0.50	–0.60

Buying a Strangle

Investment = –0.30 – 0.40 = –0.70

Spot Rate	Long Call at 43.70	Long Put at 43.30	Total Pay-off	Total Profit
43.00	0	0.30	0.30	–0.40
43.10	0	0.20	0.20	–0.50
43.20	0	0.10	0.10	–0.60
43.30	0	0	0	–0.70
43.40	0	0	0	–0.70
43.50	0	0	0	–0.70
43.60	0	0	0	–0.70
43.70	0	0	0	–0.70
43.80	0.10	0	0.10	–0.60
43.90	0.20	0	0.20	–0.50
44.00	0.30	0	0.30	–0.40

88.

	Net premium inflow/outflow	Break even prices	Profit potential
Combination of Bull spread + Bear spread	$-5+55-55+5=0$	All prices are break even	No pay-off
Straddle	$-25-25=-50$	$43.25+0.50=43.75$	at $46=2.75-0.50=2.25$
		$43.25-0.50=42.75$	at $40=3.25-0.50=2.75$
Strangle	$-5-10=-15$	$43.40+0.15=43.55$	at $46=2.60-0.15=2.45$
		$43.00-0.15=42.85$	at $40=3.00-0.15=2.85$

Profit potential in combination of bull spread and bear spread is not superior to either straddle or strangle.

89.   a.   The strategies are straddle and strangle

   b.   Straddle: Total premium paid = 0.25 + 0.10 = Rs.0.35

   Strangle: Total premium paid = 0.05 + 0.05 = Rs.0.10

   c.   Straddle: Break even price

   i.   Strike price – Premium = 44.50 – 0.35 = 44.15

   ii.   Strike price + Premium = 44.50 + 0.35 = 44.85

   Strangle: Break even price

   i.   Higher strike price + Premium = 44.75 + 0.10 = 44.85

   ii.   Lower strike price – Premium = 44.25 – 0.10 = 44.15

   d.   Straddle

   i.   Unlimited profit on upward movement

   ii.   Limited to 44.50 – 0.35 = 44.15 on downward movement

   Strangle

   i.   Same as straddle on upward movement

   ii.   Limited to 44.15 on downward movement.

Note: A short butterfly strategy is also suitable, but it provides modest profits.

90. You observe this contract is "out of money" by Rs.4.00. In this problem the margin will be calculated by two methods and the largest amount obtained by either of the methods will be deposited as the margin.

First method: In this method margin is calculated as follows.

Margin = Option premium x 100 + 100 x 0.20 (Market value of the share) – 100
(Exercise price – Market price)

= 2.50 x 100 + 100 x 0.20(37) – 100(41 – 37)

= 250 + 740 – 400 = Rs.590.00

Second method: In this method we employ the following formula.

Margin = Option premium x 100 + 100 x 0.10 (Market value of the share)

= 2.50 x 100 + 100 x 0.10(37)

= 250 + 370 = Rs.620.00

Since the amount obtained by the first method (Rs.590) is lower than the amount obtained in the second method (Rs.620), the investor should deposit Rs.620 as margin amount.

91. a. Total premium paid on purchasing a call and put option

= (Rs.30 per share x 100) + (Rs.5 per share x 100) = 3,000 + 500 = Rs.3,500

In this case, Ms. Geeta exercises neither the call option nor the put option as both will result in a loss for her.

Ending value = – Rs.3,500 + zero gain
= –Rs.3,500

i.e. Net loss = Rs.3,500

b. Since the price of the stock is below the exercise price of the call, the call will not be exercised. Only put is valuable and is exercised.

Total premium paid = Rs.3,500

Ending value = –Rs.3,500 + Rs.[(450 – 350) x 100]
= –Rs.3,500 + Rs.10,000 = Rs.6,500

∴ Net gain = Rs.6,500

c. In this situation, the put is worthless, since the price of the stock exceeds the put's exercise price. Only call option is valuable and is exercised.

Total premium paid = Rs.3,500

Ending value = –3,500 + [(600 – 550) x 100]
= –3,500 + 5,000 = Rs.1,500.

92. In the pricing of Futures option Black's Model is applicable.

$$d_1 = \frac{\ln(F/x) + (\sigma^2/2)(T-t)}{\sigma\sqrt{T-t}}$$

$$d_2 = d_1 - \sigma\sqrt{T-t}$$

$$C = e^{-r(T-t)}[FN(d_1) - XN(d_2)]$$

$$P = e^{-r(T-t)}[XN(d_2) - FN(-d_1)]$$

In this case F = 465.75, X= 482, (T – t) = 81/365, σ = 0.3, r = 8%

d_1 = – 0.1720
d_2 = – 0.3133
$N(d_1)$ = 0.43172
$N(d_2)$ = 0.37705
C = 18.99.

93. Pay-off profile of buying a call option:

Spot Price	Option Exercised	Premium	Net cost per dollar	Net cash outflow
46.00	No	– 0.50	46.50	2325
46.20	No	– 0.50	46.70	2335
46.50	No	– 0.50	47.00	2350
46.70	No	– 0.50	47.20	2360
47.00	No	– 0.50	47.50	2375
47.20	Yes	– 0.50	47.50	2375
47.50	Yes	– 0.50	47.50	2375
48.00	Yes	– 0.50	47.50	2375

Pay-off profile of writing a put option:

Spot Price	Option Exercised	Premium	Net cost per dollar	Net cash outflow
46.00	Yes	0.05	46.95	2347.5
46.20	Yes	0.05	46.95	2347.5
46.50	Yes	0.05	46.95	2347.5
46.70	Yes	0.05	46.95	2347.5
47.00	No	0.05	46.95	2347.5
47.20	No	0.05	47.15	2357.5
47.50	No	0.05	47.45	2372.5
48.00	No	0.05	47.95	2397.5

Pay-off profile of buying call and writing a put option:

Spot Price	Option Exercised		Premium	Net cost per dollar	Net cash outflow
	Call	Put			
46.00	No	Yes	– 0.45	47.45	2372.5
46.20	No	Yes	– 0.45	47.45	2372.5
46.50	No	Yes	– 0.45	47.45	2372.5
46.70	No	Yes	– 0.45	47.45	2372.5
47.00	No	No	– 0.45	47.45	2372.5
47.20	Yes	No	– 0.45	47.45	2372.5
47.50	Yes	No	– 0.45	47.45	2372.5
48.00	Yes	No	– 0.45	47.45	2372.5

So if the treasurer buys the call options, the maximum possible outflow will be Rs.2,375 million. If exchange rate of dollar remain below Rs.47/$, the outflow will be lower.

If the treasurer writes the put options the minimum outflow is capped at Rs.2,347.5 million but there is a risk of greater outflow if rupee depreciates beyond Rs.47 per dollar.

For buying call and writing put, outflow is capped at Rs.2,372.5 million.

So, if the treasurer expects rupee-dollar exchange rate will remain below Rs.47, buying call option alone is best alternative. If he expects that rupee will depreciate beyond Rs.47, buying call and writing put simultaneously is the best alternative.

94. a. As the speculator is bearish on yen, so he will go for bearish call spread on Yen options. So he will buy the higher strike call and sell the lower strike call. The spread strategy will give profit if Yen depreciates against dollar.

b. **Pay-off Profile**

Buy call at 0.0087 at premium 0.0015 and sell call at 0.0083 at premium 0.0025

Spot ($/¥)	Gain/loss on C = 0.0087	Gain/loss on C = 0.0083	Net gain/ loss
0.0080	– 0.00015	0.00025	0.0001
0.0081	– 0.00015	0.00025	0.0001
0.0082	– 0.00015	0.00025	0.0001
0.0083	– 0.00015	0.00025	0.0001
0.0084	– 0.00015	0.00015	0
0.0085	– 0.00015	0.00005	–0.0001
0.0086	– 0.00015	–0.00005	–0.0002
0.0087	– 0.00015	–0.00015	–0.0003
0.0088	– 0.00005	–0.00025	–0.0003
0.0089	0.00005	–0.00035	–0.0003
0.0090	0.00015	–0.00045	–0.0003

Pay-off diagram
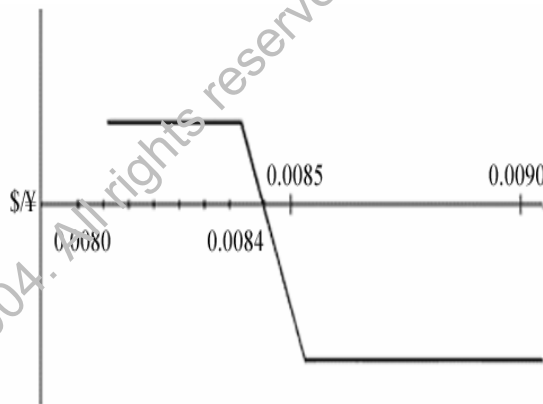
c. Break even rate = 0.0084 $/¥

Maximum profit = 0.0001 $/¥

Maximum loss = – 0.0003 $/¥

95. a. The speculator is expecting the rupee to depreciate, and dollar to appreciate. The options are available on dollar, so he/she will adopt a bullish spread using call options, so that if dollar appreciates, the strategy will give profit. In a bullish spread the speculator will buy call with low strike price and sell call with higher strike price.

b. Buy X = 48.00 (Call)

Sell X = 48.50 (Call)

Initial cash outflow = 0.60 – 0.12 = 0.48

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Pay-off profile

Spot	Exercised		Profit/loss		Initial Outflow	Net gain/loss
	X = 48.00	X = 48.50	X = 48.00	X = 48.50		
47.50	No	No	—	—	0.48	-0.48
47.80	No	No	—	—	0.48	-0.48
48.00	No	No	—	—	0.48	-0.48
48.10	Yes	No	0.10	—	0.48	-0.38
48.20	Yes	No	0.20	—	0.48	-0.28
48.40	Yes	No	0.40	—	0.48	-0.08
48.48	Yes	No	0.48	—	0.48	0
48.50	Yes	No	0.50	—	0.48	+0.02
48.55	Yes	Yes	0.55	– 0.05	0.48	+0.02
48.60	Yes	Yes	0.60	– 0.10	0.48	+0.02
48.80	Yes	Yes	0.80	– 0.10	0.48	+0.02
49.00	Yes	Yes	1.00	– 0.50	0.48	+0.02
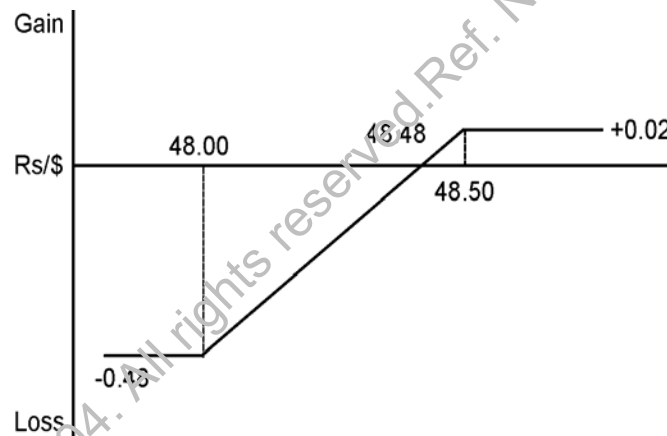
Break even Rate = Rs.48.48/$

Maximum profit   = Rs.0.02/$

Maximum loss   = Rs.0.48/$

c. If the speculator is not sure whether dollar will appreciate or rupee will appreciate he/she can adopt either long straddle or a long strangle strategy. These strategies will give profit if exchange rates fluctuate significantly.

In a long straddle, the speculator will buy a call and a put with same exercise price and same expiry date.

In a long strangle, the speculator will buy a call at a strike price 48.50 and buy a put at 48.00.

96. a. Strip Strategy

Buy one call at 48.50

Buy two puts at 48.50

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∴ Total initial outflow = 0.30 + 2 x 0.05 = Rs.0.40

Spot price	Exercised		Profit from		Initial outflow	Net inflow
	Call	Puts	Call	Puts		
47.00	No	Yes	–	3.00	0.40	2.60
47.50	No	Yes	–	2.00	0.40	1.60
48.00	No	Yes	–	1.00	0.40	0.60
48.10	No	Yes	–	0.80	0.40	0.40
48.30	No	Yes	–	0.40	0.40	0
48.50	No	No	–	–	0.40	– 0.40
48.75	Yes	No	0.25	–	0.40	0.15
48.90	Yes	No	0.40	–	0.40	0
49.00	Yes	No	0.50	–	0.40	0.10
49.50	Yes	No	1.00	–	0.40	0.60
50.00	Yes	No	1.50	–	0.40	1.10

Break – even points are 48.30 and 48.90.

Strap Strategy

Buy two calls at 48.50

Buy one put at 48.50

Total initial outflow = 2 x 0.30 + 0.05 = Rs.0.65.

Spot price	Exercised		Profit from		Initial outflow	Net inflow
	Calls	Put	Calls	Put		
47.00	No	Yes	–	1.50	0.65	0.85
47.50	No	Yes	–	1.00	0.65	0.35
47.85	No	Yes	–	0.65	0.65	0
48.00	No	Yes	–	0.50	0.65	– 0.15
48.50	No	No	–	–	0.65	– 0.65
48.825	Yes	No	0.65	–	0.65	0
49.00	Yes	No	1.00	–	0.65	0.35
49.15	Yes	No	1.30	–	0.65	0.65
49.50	Yes	No	2.00	–	0.65	1.35
50.00	Yes	No	3.00	–	0.65	2.35

Break even points are 47.85 and 48.825.

b.   The buyer of strip and strap expects there will be a significant movement in the spot price. Strip strategy is more desirable if the spot price is more likely to fall than to rise and strap strategy is desirable if spot price more likely to rise. Strip will give profit if spot price falls below 48.30 or rises above 48.90. Strip will give profit if price falls below 47.85 or rises above 48.825. So, the trader will buy strip if he expects rupee to appreciate and will buy strap if he expects rupee to depreciate significantly.

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97. a. Value of a call option $C = SN(d_1) - Xe^{-rt}N(d_2)$

Where, S = Rs.75

X = Rs.100

r = 0.08

t = 0.50 years

σ = 0.25

and d_1 = $\dfrac{\ln(S/X) + \left(r + \dfrac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$

$= \dfrac{\ln(75/100) + \left(0.08 + \dfrac{0.25^2}{2}\right)0.5}{0.25\sqrt{0.50}}$

$= \dfrac{-0.2877 + 0.05563}{0.17678}$

$= -1.3028$

d_2 = $d_1 - \sigma\sqrt{t}$

$= -1.3128 - 0.25\sqrt{0.5}$

$= -1.3128 - 0.17678 = -1.4896$

$\therefore N(d_1)$ = $N(-1.3128)$

$= 0.50 - 0.4049 = 0.0951$

and, $N(d_2)$ = $N(-1.4896)$

$= 0.50 - 0.4319 = 0.0681$

$\therefore C$ = $SN(d_1) - Xe^{-rt}N(d_2)$

$= 75 \times 0.0951 - 100 \times e^{-0.08 \times 0.50} \times 0.0681$

$= 7.1325 - 100 \times 0.9608 \times 0.0681$

$= 7.1325 - 6.5430 = Rs.0.59$

b. Value of put option, $P = Xe^{-rt}N(-d_2) - SN(-d_1)$

$N(-d_1)$ = $N(1.3128)$

= $0.50 + 0.4049$

= 0.9049

$N(-d_2)$ = $N(1.4896)$

= $0.50 + 0.4319 = 0.9319$

$\therefore P$ = $100 \times e^{-0.08 \times 0.50} \times 0.9319 - 75 \times 0.9049$

= $100 \times 0.9608 \times 0.9319 - 67.8675$

= $89.5370 - 67.8675 = Rs.21.67.$

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98. **Writing a call option**

Spot	Call at 50 exercised	Premium inflow	Net inflow	Total inflow (Rs. Mln.)
49.00	No	0.20	49.20	492.0
49.25	No	0.20	49.45	494.5
49.50	No	0.20	49.70	497.0
49.75	No	0.20	49.95	499.5
50.00	No	0.20	50.20	502.0
50.25	Yes	0.20	50.20	502.0
50.50	Yes	0.20	50.20	502.0
50.75	Yes	0.20	50.20	502.0
51.00	Yes	0.20	50.20	502.0

Buying a put option

Spot	Put at 50 exercised	Premium outflow	Net inflow	Total inflow (Rs. Mln.)
49.00	Yes	0.50	49.50	495.0
49.25	Yes	0.50	49.50	495.0
49.50	Yes	0.50	49.50	495.0
49.75	Yes	0.50	49.50	495.0
50.00	No	0.50	49.50	495.0
50.25	No	0.50	49.75	497.5
50.50	No	0.50	50.00	500.0
50.75	No	0.50	50.25	502.5
51.00	No	0.50	50.50	505.5

Writing a call and buying a put

Premium outflow = 0.50 – 0.20 = 0.30

Spot	Exercised		Gain/loss on call	Gain/loss on put	Premium outflow	Inflow at spot	Net inflow	Total inflow
	Call	Put						
49.00	No	Yes	–	1.00	0.30	49.00	49.70	497.0
49.25	No	Yes	–	0.75	0.30	49.25	49.70	497.0
49.50	No	Yes	–	0.50	0.30	49.50	49.70	497.0
49.75	No	Yes	–	0.25	0.30	49.75	49.70	497.0
50.00	No	No	–	–	0.30	50.00	49.70	497.0
50.25	Yes	No	– 0.25	–	0.30	50.25	49.70	497.0
50.50	Yes	No	– 0.50	–	0.30	50.50	49.70	497.0
50.75	Yes	No	– 0.75	–	0.30	50.75	49.70	497.0
51.00	Yes	No	– 1.00	–	0.30	51.00	49.70	497.0

By writing a call maximum inflow is locked at Rs.502 million but there is downside potential for dollar values less than Rs.50. By buying a put option minimum inflow is locked at Rs.495 million and there is upside potential if rupees depreciation beyond Rs.50. By simultaneously writing a call and buying put the inflow can be locked at Rs.497 million for any values of dollar. So, if the company expects that the dollar will remain around Rs.50 writing a call will be better, if it expects rupee will depreciate beyond Rs.50, buying a put is the appropriate hedging strategy, otherwise alternative (iii) is the best hedging strategy for the company as there is no downside potential.

99. The situation can be represented in the following way:
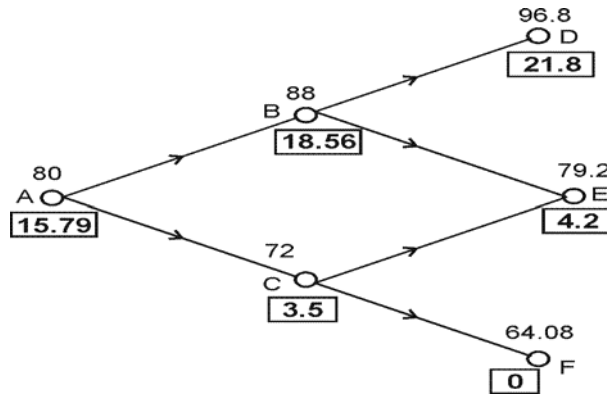
Using single-period model, the probability of price increase,

$$p = \frac{R-d}{u-d} = \frac{1.08-0.90}{1.10-0.90} = 0.90$$

$\therefore$ Probability of price decrease $= 1 - 0.90 = 0.10$

The value of American call option at node D, E and F will be equal to the value of European call option on these nodes.

Value at node D : 96.8 – 75 = 21.8

Value at node E : 79.2 – 75 = 4.2

Value at node F : As stock price is less than strike price, so call has zero value.

Using single-period model, the value of call option at node B is

$$C = \frac{C_u p + C_d (1-p)}{R}$$

$$= \frac{21.8 \times 0.9 + 4.2 \times 0.1}{1.08} = 18.56$$

At node B pay-off from early exercise is Rs.13, which is less than the value calculated using single-period model. Hence, at node B early exercise is not advisable and value of American call option will be Rs.18.56.

Value at node C is

$$C = \frac{4.2 \times 0.9 + 0 \times 0.1}{1.08} = 3.50$$

At node C, value of early exercise is zero, hence at node C value of call is Rs.3.50.

Value of American call option at node A is

$$C = \frac{18.56 \times 0.9 + 3.5 \times 0.1}{1.08} = 15.79$$

The value of early exercise at node A is Rs.5, which is less than the value arrived through single-period binomial model. Hence, the value of two-year American call option is Rs.15.79.

100.

Current stock price	=	Rs.150
Price after first year	=	±10%
Price after second year	=	±15%
Risk-free rate	=	6%

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The situation can be represented in the following way:
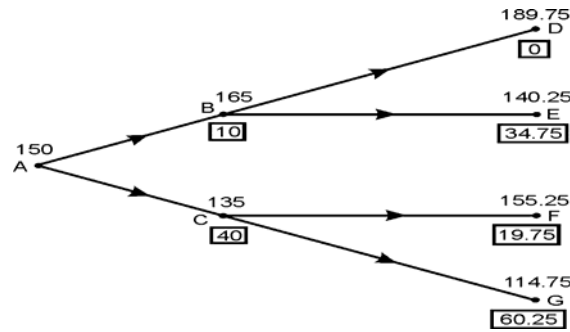
The value of American put option at node D, E, F and G will be equal to the value of European put option on these nodes.

Value at node D : as put is out-of-money, so value is zero

Value at node E : 175 – 140.25 = 34.75

Value at node F : 175 – 155.25 = 19.75

Value at node G : 175 – 114.75 = 60.25

Probability of price increase in second year, $P_2 = \dfrac{1.06 - 0.85}{1.15 - 0.85} = 0.70$

Probability of price decrease $= 1 - P_2 = 0.3$

Using single-period model, the value of put at node B is

$$P = \frac{P_u P_2 + P_d (1 - P_2)}{R}$$

$$= \frac{0 \times 0.70 + 34.75 \times 0.30}{1.06} = 9.83$$

At node B, pay-off from early exercise is Rs.10, which is more than the value calculated as per single-period model. So value of put at node B is 10.

The value of put at node C is

$$P = \frac{19.75 \times 0.70 + 60.25 \times 0.30}{1.06} = 30.09.$$

Pay-off from early exercise is 40, whereas single-period model gives a value of 30.09 which is lower, so value of put will be 40.

Probability of price increase in first year,

$$P_1 = \frac{1.06 - 0.90}{1.10 - 0.90} = 0.80$$

Probability of price decrease $= 1 - P_1 = 0.20$.

The value of put at mode A,

$$P = \frac{10 \times 0.80 \times 40 \times 0.20}{1.06} = 15.09$$

Whereas the value due to early exercise is Rs.25 which is more than the value given by single period model.

Hence, the value of two year American put option is Rs.25.

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101. The condor spread strategy is a suitable strategy for the speculator. Condor spread can be created by buying two options at 0.96 and 0.99, and selling two options at 0.97 and 0.98.

Initial outflow = 0.022 + 0.03 – (0.014 + 0.008)

      = $0.003

Pay-off Profile

Spot price	Gain/loss				Initial outflow	Net gain/loss
	(+) C = 0.96	(–) C = 0.97	(–) C = 0.98	(+) C = 0.99		
0.940	–	–	–	–	0.003	–0.003
0.950	–	–	–	–	0.003	–0.003
0.960	–	–	–	–	0.003	–0.003
0.963	0.003	–	–	–	0.003	0
0.965	0.005	–	–	–	0.003	+0.002
0.970	0.010	–	–	–	0.003	+0.007
0.975	0.015	–0.005	–	–	0.003	+0.007
0.980	0.020	–0.01	–	–	0.003	+0.007
0.985	0.025	–0.015	–0.005	–	0.003	+0.002
0.987	0.027	–0.017	–0.007	–	0.003	0
0.990	0.030	–0.02	–0.01	–	0.003	–0.003
1.000	0.040	–0.03	–0.02	0.01	0.003	–0.003
1.010	0.050	–0.04	–0.03	0.02	0.003	–0.003

Maximum profit   = $0.007

Maximum Loss   = $0.003

Break-even points = $0.963 and $0.987
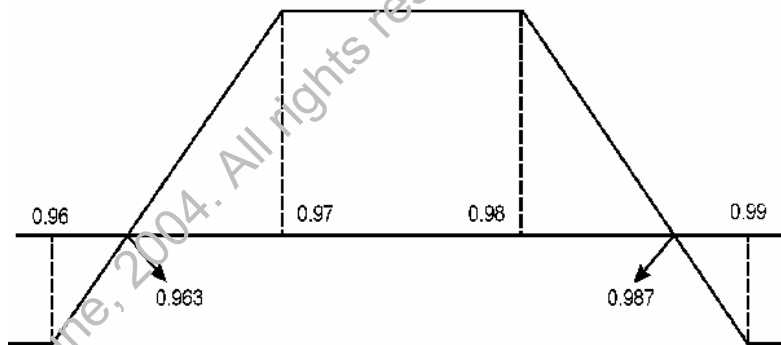
102. Speculator has purchased a put at Rs.48.50 paying premium of Rs.0.05 also entered into a forward contract to purchase $ at Rs.48.60. Initial outflow = Rs.0.05.

Spot	Put exercised	Inflow at Put	Outflow at forward	Gainless on cancellation	Initial outflow	Net gain/ loss
48.30	Yes	48.50	48.60	–	0.05	–0.15
48.35	Yes	48.50	48.60	–	0.05	–0.15
48.40	Yes	48.50	48.60	–	0.05	–0.15
48.45	Yes	48.50	48.60	–	0.05	–0.15
48.50	No	-	-	–0.10	0.05	–0.15
48.55	No	-	-	–0.05	0.05	–0.10
48.60	No	-	-	0	0.05	–0.05
48.65	No	-	-	+ 0.05	0.05	0

Spot	Put exercised	Inflow at Put	Outflow at forward	Gainless on cancellation	Initial outflow	Net gain/ loss
48.70	No	-	-	+ 0.10	0.05	0.05
48.75	No	-	-	+ 0.15	0.05	0.10
48.80	No	-	-	+ 0.20	0.05	0.15
48.85	No	-	-	+ 0.25	0.05	0.20
48.90	No	-	-	+ 0.30	0.05	0.25
48.95	No	-	-	+ 0.35	0.05	0.30
49.00	No	-	-	+ 0.40	0.05	0.35
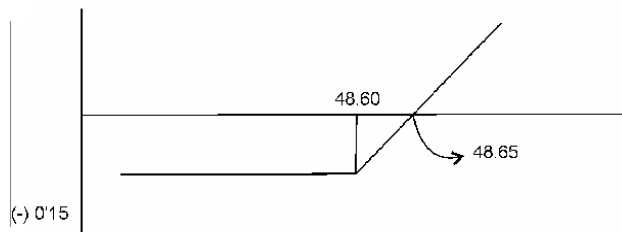
103. Let S_0 = Dividend adjusted current stock price

$$= 195 - e^{-0.06 \times \frac{2}{12}}$$

$$= 195 - 8 \times 0.99005$$

$$= 195 - 7.9204 = Rs. 187.08$$

X = Rs.225

r = 0.06

t = 0.50 year

= 0.15

Value of put, $p = Xe^{-rt}N(-d_2) - S_0N(-d_1)$

Where, $d_1 = \dfrac{\ln\left(\dfrac{S_o}{x}\right) + \left(r + \dfrac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$

$$= \dfrac{\ln\left(\dfrac{187.08}{225}\right) + \left(0.06 + \dfrac{0.15^2}{2}\right)0.50}{0.15\sqrt{0.50}}$$

$$= \dfrac{-0.18456 + 0.03563}{0.10607} = -1.4041$$

d_2 = $d_1 - \sigma\sqrt{t}$

$$= -1.4041 - 0.15\sqrt{0.50}$$

$$= -1.4041 - 0.10607 = -1.5102$$

$N(-d_1)$ = N (1.4041) = 0.9192

$N(-d_2)$ = N(1.5102) = 0.9345

$P = 225 \times e^{-0.06 \times 0.50} \times 0.9345 - 187.08 \times 0.9192$

$= 225 \times 0.9704 \times 0.9345 - 171.964$

$= 204.039 - 171.964 = Rs.32.08.$

104. Appropriate strategy is short butterfly spread. Here, the investor should sell puts at 0.0086 and 0.0080 and buy 2 puts at 0.0083.

Initial inflow

$$= \quad 0.00040 + 0.00008 - 2 \times 0.00015$$

$$= \quad 0.00018$$

Spot	Short $P = 0.0086$	Long $P = 0.0083$	Short $P = 0.0080$	Initial Inflow	Net Inflow/ Outflow
0.0075	–0.0011	+0.0016	–0.0005	0.00018	0.00018
0.0076	–0.0010	+0.0014	–0.0004	0.00018	0.00018
0.0078	–0.0008	+0.0010	–0.0002	0.00018	0.00018
0.0080	–0.0006	+0.0006	–	0.00018	0.00018
0.00818	–0.00042	+0.00024	–	0.00018	0
0.0082	–0.0004	+0.0002	–	0.00018	–0.00002
0.0083	–0.0003	–	–	0.00018	–0.00012
0.0084	–0.0002	–	–	0.00018	–0.00002
0.00842	–0.00018	–	–	0.00018	0
0.0086	–	–	–	0.00018	0.00018
0.0088	–	–	–	0.00018	0.00018
0.0090	–	–	–	0.00018	0.00018

Max. Profit = $0.00018/%

Max. Loss = $0.00012/%

Break even points are $ 0.00818/¥ and $ 0.00842/¥.

105. Face value = $10 million

Premium = 0.02 x 10,000,000

= $2,00,000

$$\text{Amortization of Premium} = \frac{\$2,00,000}{\text{PVIFA}_{(1.50\%,10)}}$$

$$= \quad \frac{\$2,00,000}{9.2222}$$

$$= \quad \$21,687$$

Time (semester)	Interest (%)	Cash flow on deposit ($)	Amortization of premium	cf due to floor	Total
0	–	–10,00,000	–	–	–10,000,000
1	3.50	1,75,000	–21,687	–	1,53,313
2	3.33	1,66,500	–21,687	–	1,44,813
3	3.15	1,57,500	–21,687	5,000	1,40,813
4	3.00	1,50,000	–21,687	12,500	1,40,813
5	2.85	1,42,500	–21,687	20,000	1,40,813
6	2.75	1,37,500	–21,687	25,000	1,40,813
7	2.70	1,35,000	–21,687	27,500	1,40,813
8	3.05	1,52,500	–21,687	10,000	1,40,813
9	3.30	1,65,000	–21,687	–	1,43,313
10	3.40	1,01,70,000	–21,687	–	10,148,313

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Effective return is given by 'r' in the following equation:

$$10,000,000 = 153,313\,PVIF_{(r,1)} + 144,813\,PVIF_{(r,2)} + 140,813\,PVIF_{(r,3)} + 140,813\,PVIF_{(r,4)} + 140,813\,PVIF_{(r,5)} + 140,813\,PVIF_{(r,6)} + 140,813\,PVIF_{(r,7)} + 140,813\,PVIF_{(r,8)} + 143,313\,PVIF_{(r,9)} + 10,148,313\,PVIF_{(r,10)}$$

For r = 2%, RHS = 9,489,119

For r = 1%, RHS = 10,408,867

$$\therefore r = 1\% + (2-1)\% \times \frac{10,408,867 - 10,000,000}{10,408,867 - 9,489,119}$$

$$= 1 + 1 \times \frac{408,867}{9,19,748} = 1.4445\%$$

Annual return = 2 x 1.4445% = 2.89%

Sensitivity of Option Premiums

106. a.   S   =   Rs.120

X   =   Rs.110

T – t   =   30 days = 0.0822 years

r   =   0.08

=   0.25

$$d_1 = \frac{\ln\left(\dfrac{S}{X}\right) + \left(r + \dfrac{1}{2}\sigma^2\right)(T-t)}{\sigma\sqrt{T-t}}$$

$$= \frac{\ln\left(\dfrac{120}{110}\right) + \left(0.08 + \dfrac{1}{2} \times 0.25^2\right) \times 0.0822}{0.25\sqrt{0.0822}}$$

$$= \frac{0.087 + (0.08 + 0.0313) \times 0.0822}{0.0717}$$

$$= \frac{0.087 + 0.009}{0.0717} = 1.3389$$

$$d_2 = d_1 - \sigma\sqrt{T-t} = 1.3389 - 0.25\sqrt{0.0822}$$

$$= 1.2672$$

$N(d_1) = 0.9099$, $N(d_2) = 0.8980$

Value of call option, C

$$= SN(d_1) - X e^{-r(T-t)} \times N(d_2)$$

$$= 120 \times 0.9099 - 110 \times e^{-0.08 \times 0.0822} \times 0.8980$$

$$= 109.19 - 110 \times 0.9934 \times 0.8980$$

$$= 109.19 - 98.13$$

$$= Rs.11.06$$

b.   Gamma $= \dfrac{N'(d_1)}{S\sigma\sqrt{T-t}}$

$$= \frac{0.1628}{120 \times 0.25 \times \sqrt{0.0822}}$$

$$= \frac{0.1628}{8.6012} = 0.0189$$

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$$N'(d_1) = \frac{1}{\sqrt{2\pi}} e^{-d_i^2/2}$$

$$= \frac{1}{\sqrt{2\pi}} e^{-(1.3389)^2/2}$$

$$= \frac{1}{\sqrt{2\pi}} \times 0.4081$$

$$= 0.1628$$

c. Theta $= \dfrac{-SN'(d_1)\sigma}{2\sqrt{T-t}} - r \times X \times e^{-r(T-t)} N(d_2)$

$$= \frac{-120 \times 0.1628 \times 0.25}{2\sqrt{0.0822}} - 0.08 \times 110 \; X \; e^{-0.08 \times 0.0822} \times 0.8980$$

$$= \frac{-4.884}{0.5734} - 0.08 \times 110 \times 0.9934 \times 0.8980$$

$$= -8.5176 - 7.85$$

$$= -16.3678$$

d. Rho $=$ $X(T-t) \times e^{-r(T-t)} N(d_2)$

$\quad\quad\quad = \quad 110 \times 0.0822 \times e^{-0.08 \times 0.0822} \times 0.8980$

$\quad\quad\quad = \quad 9.042 \times 0.9934 \times 0.8980$

$\quad\quad\quad = \quad 8.066.$

107. S $=$ Rs.240

X $=$ Rs.260

C $=$ Rs.10

σ $=$ Rs.25%

r $=$ Rs.6%

i. The theta of the option indicates the rate of change in the value of option with respect to time with all the other factors remaining same.

Theta of call $= \dfrac{-SN'(d_1)\sigma}{2\sqrt{t}} - r\,X\,e^{-rt}\,N(d_2)$

$$N'(d_1) = \frac{1}{\sqrt{2\pi}} e^{-d_i^2/2}$$

$$d_1 = \frac{\ln\left(\dfrac{S}{X}\right) + \left(r + \dfrac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$= \frac{\ln\left(\dfrac{240}{260}\right) + \left(0.06 + \dfrac{0.25^2}{2}\right) \times \dfrac{3}{12}}{0.25\sqrt{3/12}}$$

$$= \frac{-0.080 + 0.02528}{0.125} = 0.4576$$

$d_2 = \quad d_1 - \sigma\sqrt{t}$

$\quad\quad = \quad -0.4576 - 0.25\sqrt{0.25}$

$\quad\quad = \quad -0.5826$

$$N(d_2) = 0.5 - 0.2190 = 0.281$$

$$N'(d_1) = \frac{1}{\sqrt{2\pi}} e^{(-0.4576)^2/2}$$

$$= \frac{1}{2.5066} \times 0.9006 = 0.3593$$

$$\text{Theta} = \frac{-240 \times 0.3593 \times 0.25}{2\sqrt{0.25}} - 0.06 \times 260 \times e^{-0.25 \times 0.06} \times 0.281$$

$$= -21.558 - 4.318$$

$$= -25.876$$

For 1 month decrease in expiration change in call price $= \left(-\frac{1}{12}\right) \times (-25.876)$

$$= \text{Rs.}2.156$$

So, call price will increase by Rs.2.156.

ii.   The rho of an option indicates the change in the value of option with respect to change in interest mode

Rho of call $= X t \, e^{-rt} \, N(d_2)$

$$= 260 \times 0.25 \times e^{0.25 \times 0.06} \times 0.281$$

$$= 17.99$$

So, if interest rate increase by 1%, the option price will increase by (17.94 x 0.01) = Rs.0.17

iii.   The vega of the option indicate the change in the value of option will respect to volatility of stock.

Vega of cell $= S\sqrt{t} \times N'(d_1)$

$$= 240 \times \sqrt{0.25} \times 0.3593$$

$$= 43.116$$

So, if volatility increase by 2%, the value of call will increase by (43.116 x 0.02) = Rs.0.86.

Financial Swaps

108.   Let the notional principal be Rs.1,00,000

$$\text{Present value of floating leg} = \frac{1,00,000 \times \left(1 + \dfrac{0.09}{2}\right)}{\left(1 + \dfrac{0.09}{2}\right)} = \text{Rs.}1,00,000$$

This is the present value of principal and interest to be paid six months hence.

Present value of fixed leg:

6 months	5000
12 months	5000
18 months	5000
24 months	5000
30 months	5000
36 months	105000

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Present value of above cash flows using discount rate of 10.5% is

= 5000 x PVIFA$_{(5.25\%,\, 5)}$ + 1,05,000 x PVIF$_{(5.25\%,\, 6)}$

= 5000 x 4.300 + 1,05,000 x 0.736

= 21,500 + 77280

= Rs.98,780

∴ Value of the swap = 1,00,00 – 98,780

= Rs.1,220.

109. We can see that, X has absolute advantage for borrowing in Fixed Euro market, Y has absolute advantage in Fixed $ market and Z has absolute advantage in floating $ market. So they will borrow in those markets where they have absolute advantage and inter-change the interest payments among them.

Gain due to doing swap

= [5.75 + 6.25 + (LIBOR + 0.75)] – [5.25 + 6.00 + (LIBOR + 0.60)]

= 0.90%

So the total gain of 0.90% will be divided among three parties equally.

Swap arrangement:

X will borrow from the market fixed Euro at 6%, pay Y fixed $ at 5.25% and receive fixed Euro at 5.8% from Z.

Y will borrow from the market fixed $ at 5.25%, receive 5.25% fixed $ from X and pay LIBOR + 0.45%, floating $ to Z.

Z will borrow from the market floating $ at LIBOR + 0.60%, receive floating $ at LIBOR + 0.45% from Y and pay fixed Euro 5.8% to X.
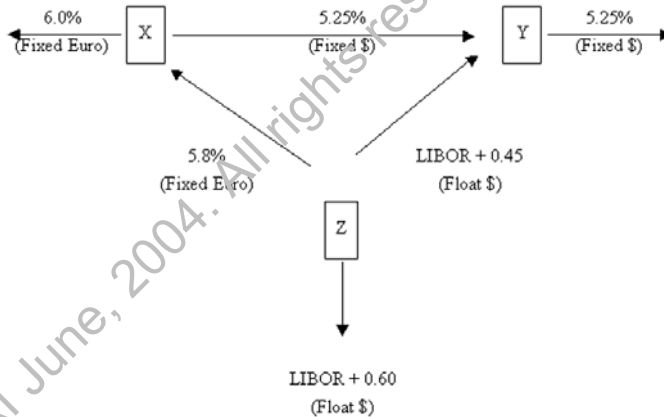
Cost of X = 6 + 5.25 – 5.8 = 5.45

Cost of Y = 5.25 + (LIBOR + 0.45) – 5.25

= LIBOR + 0.45

Cost of Z = LIBOR + 0.6 + 5.8 – (LIBOR + 0.45)

= 5.95

Gain of X = 5.75 – 5.45 = 0.30%

Gain of Y = LIBOR + 0.75 – (LIBOR + 0.45)

= 0.30%

Gain of Z = 6.25 – 5.95 = 0.30%

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110. **a.** In order to cancel the deal on July 1, 2001 (after settling the swap payments), the present value of the future cash-flows would have to be paid. The discount rate applicable should be the current rate of interest in the market i.e. 8% p.a. or 4% for 6 months.

Amount of interest to be paid as per the original contract

$$= \left(\frac{0.1}{2}\right)(10,000,000)$$

$$= 500,000$$

Value of fixed leg

$$= \$500,000 \times \left[\frac{1}{(1.04)^1} + \frac{1}{(1.04)^2} + \frac{1}{(1.04)^3} + \frac{1}{(1.04)^4} + \frac{1}{(1.04)^5} + \frac{1}{(1.04)^6}\right] + \frac{10 \times 10^6}{(1.04)^6}$$

$$= \$500,000 \, [PVIF_{(4\%, \, 1)} + PVIF_{(4\%, \, 2)} + PVIF_{(4\%, \, 3)} + PVIF_{(4\%, \, 4)} + PVIF_{(4\%, \, 5)} + PVIF_{(4\%, \, 6)}] + 10 \times 10^6 \times PVIF_{(4\%, \, 6)}$$

$$= \$500,000[PVIF_{(4\%, \, 6)}] + 10 \times 10^6 \times 0.790$$

$$= \$ 500,000 \, [5.242] + 7,900,000$$

$$= \$ 10,521,068$$

Value of floating leg $= \$ 10$ million [since interest is just paid]

Value of swap $= \$10,521,068 - \$10,000,000$

$$= \$521,068$$

This amount is to be paid by the company to the bank.

b. Company should pay to the bank every six-months $= \$10,000,000 \times \frac{0.08}{2} = \$400,000.$

111. It can be observed from the given interest rates that company Y has absolute advantage in all the markets, however, absolute advantage in Fixed $ market (0.5% – below X) is much higher than 0.25% in LIBOR market and 0.15% T-bill market as compare to X. So, Y will borrow in fixed $ market.

Company X has a comparative advantage in T-bill market as the difference is on 0.15% against Y than 0.5% in Fixed $ market and 0.25% in LIBOR market. So, X will borrow in T-bill market.

Company Z has a comparative advantage also in T-bill market as rate difference is only 0.10% against X, however if allowed Z to borrow in T-bill market, then we have to keep X out of the swap deals. So, Z should borrow in LIBOR market.

Structure of Swap

X   Borrow from the market at T-bill + 0.40%, Lend to Bank at T-bill + 0.40%

      & Borrow from Bank at LIBOR + 0.65%

Y   Borrow from the market Fixed $ at 4.5%, Lend to Bank at 4.5%,

      & Borrow from Bank at T-bill + 0.15%

Z   Borrow from the market at LIBOR + 1.00%, Lend to Bank at LIBOR + 1.00%

      & Borrow from Bank at 5.4%

Gain from swap $= (5.5 + \text{T-bill} + 0.25 + \text{LIBOR} + 0.75) - (4.5 + \text{T-bill} + 0.4 + \text{LIBOR} + 1.0)$

$$= 6.50 - 5.90 = 0.60$$

Margin to Bank $=$ $(\text{LIBOR} + 0.65 + 5.4 + \text{T-bill} + 0.15) - (\text{LIBOR} + 1.00 + 4.5 + \text{T-bill} + 0.4)$

$$= \quad 6.20 - 5.90$$

$$= \quad 0.30.$$

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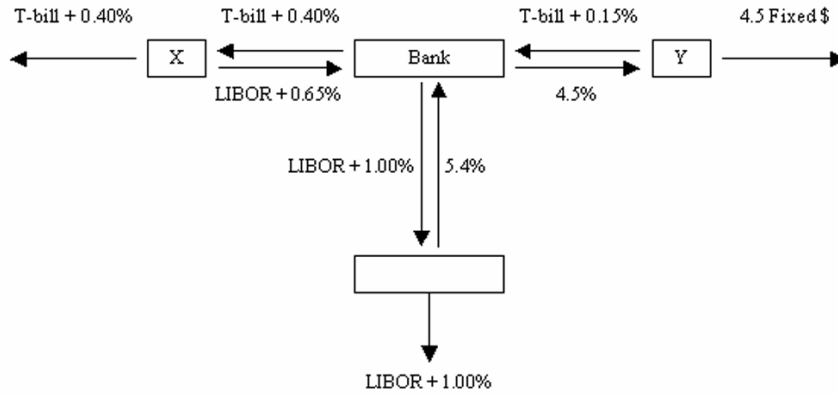
Cost of X $\quad = (\text{T-bill} + 0.40\% + \text{LIBOR} + 0.65\%) - (\text{T-bill} + 0.40\%)$

$\qquad\qquad = \text{LIBOR} + 0.65\%$

$\therefore$ Savings of 0.10%

Cost of Y $\quad = (4.5\% + \text{T-bill} + 0.15\%) - 4.5\%$

$\qquad\qquad = \text{T-bill} + 0.15\%$

$\therefore$ Savings of 0.10%

Cost of Z $\quad = (\text{LIBOR} + 1.00\% + 5.4\%) - (\text{LIBOR} + 1.00\%)$

$\qquad\qquad = 5.4\%$

$\therefore$ Savings of 0.10%.

112. Floating Leg

The value of the floating leg on the reset date is the face value of the principal.

Present value of floating leg $= \dfrac{0.9091 \times \left(1 + \dfrac{0.06}{2}\right)}{\left(1 + \dfrac{0.05}{4}\right)}$

$$= \frac{0.9364}{1.0125} = \$0.9248 \text{ million}$$

Value of floating leg in Yen = 0.9248 x 120 = ¥110.976 million.

Fixed Leg

Months	Cash flow (% in million)
3	1.50
9	1.50
15	1.50
21	1.50
27	1.50
33	1.50
39	1.50
45	1.50
51	1.50
57	1.50 + 100

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Value of fixed leg 3 months from now

= 1.50 + 1.50 x PVIFA$_{(1\%, 9)}$ + 100 x PVIF $_{(1\%, 9)}$

= 1.50 + 1.50 x 8.566 + 100 x 0.914

= ¥104.8490 million

∴ Present value of fixed leg = $\dfrac{104.8490}{\left(1 + \dfrac{0.02}{4}\right)}$

= ¥ 104.327 million

∴ The value of swap to the Japanese firm

  = Value of fixed leg received – Value of floating leg paid

  = ¥104.327 – ¥110.976

  = – ¥ 6.649 million.

113. a. The quote of Prime/Fixed at 40/60 bp over 5 year US-treasury means bank is willing to receive 5.55% for paying floating rate at prime.

  ∴ Bank will pay Prime + 1.25% to the company and it will receive 6.80% (5.55 + 1.25) from the company.

  b. Bank entering swap with Asterix, Bank is facing credit risk if Asterix defaults and also face interest rate risk as it is agreed to receive 6.80% in exchange of paying Prime + 1.25%, if the Prime rises cost to bank will go up, whereas the fixed interest receivable will not change.

  c. Bank of NY is quoting LIBOR/Fixed at 100/125 bs over 5 year treasury, i.e., Bank of NY is willing to receive LIBOR and pay 5.55%.

  Since the cost of fixed borrowing to Bank of London is 5.25% i.e., 0.30% lower than 5.55%, so Bank of NY will pay to Bank of London 5.25% and receive LIBOR - 0.30% from the Bank of London.

  d. Position of the Bank of NY after above two swap:

Inflow	Outflow
6.80%	Prime +1.25%
LIBOR – 0.30%	5.25%

  So we see that Bank of NY's fixed inflow and fixed outflow is matched. But floating inflow of LIBOR + 0.30% and floating outflow of Prime + 1.25% are not matched.

  The Bank of NY is required to match these floating inflows and outflows with similar type of outflows and inflows.

  Bank of Riverside requires LIBOR instead of Prime. So by entering into swap with Bank of Riverside, the Bank of NY is able to remove its mismatch in its assets-liabilities profile.

  e. After all the three swaps, position of Bank of NY:

Inflow	Outflow
6.80%	Prime +1.25%
LIBOR – 0.30%	5.25%
Prime + 0.25%	LIBOR

Total LIBOR + Prime + 6.75% LIBOR + Prime + 6.50%

Net inflow = 0.25%
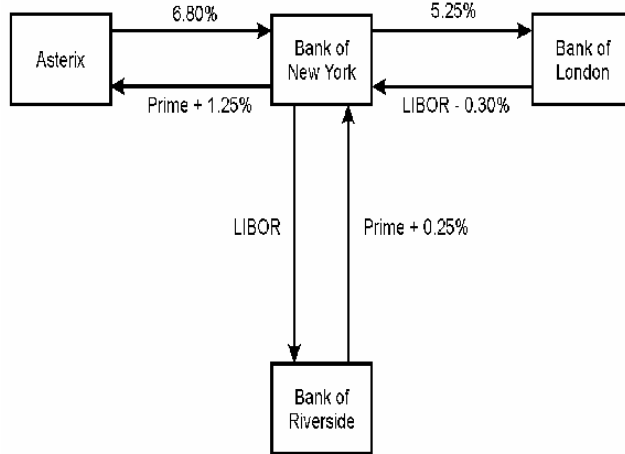
114. Gamma has absolute advantage in LIBOR and fixed $ funds market. In PLR based market both Gamma and Beta have the absolute advantage. Gamma has comparative advantage in the LIBOR market against Beta 0.15% and against Alpha 0.35% which is more than the comparative advantage in Fixed $ funds market. Also, Beta has absolute advantage in PLR market which is more than the comparative advantages in LIBOR and Fixed $ market.

Now Alpha has comparative advantage is in Fixed $ market as difference with Gamma is 0.25% and with Beta is 0.10%, which is less than the difference in interest rates in other markets. Hence, Alpha will borrow in Fixed $ market, Beta in PLR market and Gamma in the LIBOR market.

Total cost of funds for three parties before the swap = (PLR + 0.30) + (LIBOR + 0.30) + 3.10

= PLR + LIBOR + 3.70%

Total cost of funds after the swap = 3.35 + (PLR + 0.5) + (LIBOR + 0.15)

= PLR + LIBOR + 3.55%

Therefore, gain due to swap = (PLR + LIBOR + 3.70%) – (PLR + LIBOR + 3.55%)

= 0.15%

This gain of 0.15% will be distributed among the three parties equally.

The structure of swap:
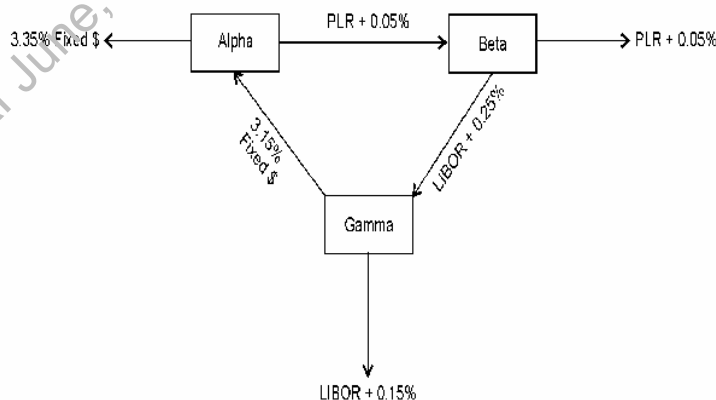
Alpha will borrow Fixed $ 3.35% from the market, pays PLR + 0.05% to Beta and received Fixed $3.20% from Gamma.

Beta will borrow PLR + 0.05% from the market, receives PLR +0.05% from Alpha and pays LIBOR + 0.25% to Gamma.

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Gamma will borrow LIBOR + 0.15% from Beta pays Fixed $ 3.20% to Alpha.

Effective cost of Alpha	= 3.35 + PLR + 0.05 – 3.15%
	= PLR + 0.25%
Effective cost of Beta	= PLR + 0.05 + LIBOR + 0.25 – (PLR + 0.05%)
	= LIBOR + 0.25%
Effective cost of Gamma	= LIBOR + 0.15 + 3.15 – (LIBOR + 0.25)
	= 3.05%

So, cost of each party has be reduced by 0.05%.

115. Valuation of the fixed leg:

Interest payments on fixed leg due as follows:

3 months	$ 10 million
9 months	$ 10 million
15 months	$ 10 million
21 months	$ 10 million
27 months	$ 10 million
33 months	$ 10 million
39 months	$ 10 million
45 months	$ 10 million
51 months	$ 10 million
57 months	$ 10 million

Present value of above cash flows after 3 months

$= 10 + 10 \times PV1FA_{(1.70\%,9)} + 500 \times PV1F_{(1.70\%,9)}$

$= 10 + 10 \times 8.280 + 500 \times 0.859$

$= \$522.30$ million

Present value as on today $= \dfrac{522.30}{1+\dfrac{0.034}{4}} = \$517.898$ million

Value of floating leg $= \dfrac{500 \times \left(1+\dfrac{0.0325}{2}\right)}{\left(1+\dfrac{0.0295}{1.007375}\right)}$

$= \dfrac{500(1.01625)}{1.007375}$

$= \$504.405$

Value of swap for the client = Value of floating leg – Value of fixed leg

$= 504.405 – 517.898$

$= –\$13.493$ million.

116. Let PBT denote profit before tax

PAT denote profit after tax

D → Debt E → Equity S → Interest rate.

Additional debt, that can be raised by the firm is, 2(30) = Rs.60 lakh.

Present PBT	= 18/0.5 = Rs.36 lakh.
PBT after the new loan	= 36 + 18 – 60i = 54 – 60i.

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PAT after the new loan $= (54 - 60i)(0.5)$

Return on Equity (ROE) $= \dfrac{\text{PAT}}{\text{Equity}}$

$$= \dfrac{(54 - 60i)(0.5)}{\text{Equity}}$$

$$\text{Equity} = \dfrac{27 - 30i}{\text{ROE}} = \dfrac{27 - 30i}{0.2}$$

Before the loan:

$$\text{Equity} = \dfrac{\text{PAT}}{\text{ROE}}$$

$$= \dfrac{18}{0.2} = \text{Rs.90 lakh.}$$

Since ROE > 20%,

$$\dfrac{(27 - 30i)}{120} > 0.2$$

$$\Rightarrow 27 - 30i > 24$$

$$30i < 3$$

$$i < 0.1$$

$$\Rightarrow i < 10\%$$

Therefore, the company has to ensure that its cost of borrowing is less than 10%. As it is likely to prefer fixed rate loan which is available only at 10.5%, the company would have to explore the possibility of a swap.

The bank has an absolute advantage of 2.5% in fixed rate and 1% in floating rate markets. Thus, by entering into a swap agreement with the bank, cost of borrowing can be reduced.

The net advantage (if the bank accesses the fixed rate and the corporate the floating rate markets) is 2.5% – 1% = 1.5%. Assuming that the benefit is shared equally between them, the deal can be structured as given below.

Cost of funds for the corporate = Libor + 2 – (Libor + 0.25%) + 8% = 9.75%

Cost of funds for the bank = 8% – 8% + Libor + 0.25%

= Libor + 0.25%.

117. A has an absolute advantage in both the markets. But B has a comparative advantage in sterling market and therefore, would prefer to borrow in sterling. If A borrows in $ and B in £, the net advantage = (2 – 0.4) = 1.6%.

If this benefit is equally shared between A and B, the swap arrangement will be as follows.

A borrows $1.5 million and B borrows £1 million.

At the beginning of the swap, A will give B $ 1.5 million and will receive £1 million from B.

During the tenure of the loan, A will pay B, interest in sterling at the rate of 9.8%. Further, A will pay dollar interest at the rate of 8% to its lender. A will also receive dollar interest from B at the rate of 8%.

B will pay sterling interest at the rate of 11% to its borrower. It will pay dollar interest at the rate of 8% to A. It will receive sterling interest at the rate of 9.8% from A.

Thus, A accesses a loan in $ but its interest liability is converted into sterlings. B accesses a loan in £ and its interest liability is in $.

At the end of the swap, A will give B £1 million to enable it to repay the sterling loan. B will give A $1.5 million so that A can repay its dollar loan.

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The swap is illustrated in the following diagram.
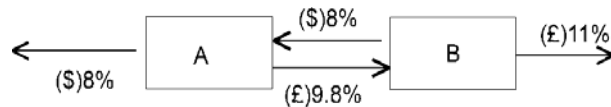
Thus, effective cost of borrowing is reduced for both A and B.

118. Cap cost(amortized) = Upfront premium/PVIFA$_{(10,3\%)}$

$$= \frac{\$(100,000,000 \times 0.02)}{8.5302} = \$0.2345 \text{ million}$$

Semi-annual period	$LIBOR	Loan cash flow (million)	Cap Pay-off (amortized) (million)	Cap cost (million)	Net cash flow on capped loan (million)
0		+100.0000			+100.0000
1	7%	–3.5000	+0.5000	–0.2345	–3.2345
2	7%	–3.5000	+0.5000	–0.2345	–3.2345
3	7%	–3.5000	+0.5000	–0.2345	–3.2345
4	7%	–3.5000	+0.5000	–0.2345	–3.2345
5	7%	–3.5000	+0.5000	–0.2345	–3.2345
6	7%	–3.5000	+0.5000	–0.2345	–3.2345
7	7%	–3.5000	+0.5000	–0.2345	–3.2345
8	7%	–3.5000	+0.5000	–0.2345	–3.2345
9	7%	–3.5000	+0.5000	–0.2345	–3.2345
10	7%	–103.5000	+0.5000	–0.2345	–103.2345

$100.0000 = 3.2345 \times \text{PVIFA}_{(r\%,10)} + 100 \times \text{PVIF}_{(r\%,10)}$

At r = 3.0000%   RHS = 3.2345 × 8.5302 + 100 × 0.7441 = \$102.0009 million

At r = 3.4000%   RHS = 3.2345 × 8.3587 + 100 × 0.7158 = \$98.6162 million

Therefore, $r = 3 + \dfrac{(102.0009 - 100.0000)}{102.0009 - 98.6162} \times (3.4 - 3.0) = 3.2365\%$

Net cost of capped loan = $(1.032365)^2 - 1 = 6.58\%$

119. a.

Company	Amount	Liability	Assets
Liberal Finance Co.	Rs.50 crore	15%	364 T-bill + 4%
Numeans Intermediari	Rs.50 crore	364 T-bill + 2%	17.5%

Here, we arrange an asset swap, so that Liberal Finance company earns a 3% spread.
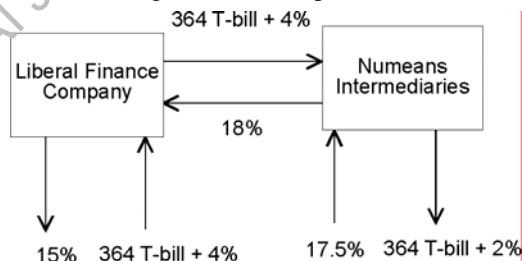
Liberal Finance Company pays Numeans Intermediari a floating rate at 364 T-bill + 4%.

Numeans Intermediari pays Liberal Finance Company fixed at 18%.

So, spread for Liberal Finance Company = Rate on assets – Rate on liabilities

= 364 T-bill + 4% + 18% – (364 T-bill + 4%) – 15%

= 3%

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Spread for Numeans Intermediari

= 364 T-bill + 4% + 17.5% – 18% – (364 T-bill + 2%) = 1.5%

b. If there was no swap, given the following rates, the spread for the two companies would be:

Time	364 T-bill rate	Liberal Finance			Numeans Intermediari		
		Yield	Cost	Spread	Yield	Cost	Spread
6	12.98	16.98	15%	1.98%	17.5%	14.98	2.52
12	13.10	17.10	15%	2.10%	17.5%	15.10	2.40
18	13.20	17.20	15%	2.20%	17.5%	15.20	2.30
24	13.00	17.00	15%	2.00%	17.5%	15.00	2.50
30	12.95	16.95	15%	1.95%	17.5%	14.95	2.55
36	12.75	16.75	15%	1.75%	17.5%	14.75	2.75

Without the swap, Liberal Finance was always earning a spread less than 3%, while with the swap it always earns a spread of 3%. Hence, it has gained from the swap.

Numeans Intermediari was always earning a spread of more than 1.5% without the swap. While with the swap it always earns a spread of 1.5%. So, Numeans Intermediari has not gained from the swap.

120. Market Rates are as under   Euro £ deposit rate   17.75

$/£ 2.2795   Euro £ borrowing rate   18.75

1-m forward 2.2720

$ borrowing Rate 14.50%

Needs are as under:

a. Fund requirement in £

b. Excess funds in Canada $

c. No specific need for Ireland

d. Need for $ but can be met locally by HQ

e. HQ has payable to Canada in 2 days

f. HQ has payable to the UK in 1-month.

The UK subsidiary would meet the requirement by borrowing in £ at 18.75% and repay the borrowing with the receivable from HQ no exchange exposure. Cost of funds is 18.75.

HQ may cover the payable to the UK in the forward market. Since the £ is at a discount, the outflow on a/c of $ will be less. Suppose the UK unit's receivable is £ 1000 after 1-m.

It may borrow £984.62 and repay the borrowing with the receivable from HQ.

Alternatively, HQ may borrow $ 2244.44 at 14.50% and convert to £ at 2.2795 and pay the subsidiary the amount of £ 984.62 and repay the $ borrowing at the end of 1 month by paying $2271.56 which as per present forward rate equals to £ 999.81.

Though $/£ rates are such that interest parity almost holds good, it is better for the HQ to borrow locally and pay the UK subsidiary at the current spot rate. As far as the HQ needs are concerned it may defer the payment to Canadian subsidiary since it does not have liquidity needs. However, it depends on the opportunity cost of the Canadian subsidiary. If it is assumed that the Canadian subsidiary will invest in Euro £ the working will be as under.

Let the $ to borrowed by the Canadian subsidiary be $ 2.2795

The amount of £ inflow after one month $= 1\left(1+\dfrac{0.1775}{12}\right) = 1.01479$

If the same is covered in the forward value the $ inflows will be $ 2.3056

Effective Yield $= \left(\dfrac{2.3056 - 2.2795}{2.2795}\right)12 = 0.1373$ or 13.73% (Annualized)

Since, the yield is less than the borrowing rate in US $ it is better for the HQ to use the funds instead of paying the Canadian subsidiary and borrow at 14.50% locally for its use.

121. Current Rates are as under

Ru/$ Spot	33.5600	33.5825	¥/$ Spot	121.50	122.00
3-m	33.5150	33.5425		119.00	120.00
6-m	33.5000	33.5300		116.70	117.80

			Ru	¥
Interest Rates	Domestic	3-m	6.25	4.50
		6-m	6.50	5.00
	Euro	3-m	6.00	4.25
		6-m	6.25	4.75

a. Receipt in ¥ is due in 6 months time ¥ 250 million.

Inflow After 6-m

i. Cover through Forward Market

Ru inflow after 6-m $= 250 \times \dfrac{1}{117.80} \times 33.5300$

$= $ Ru 71.16 million

ii. Cover through Money Market

Borrow ¥ for 6-m at 4.75 $= $ ¥ 244.20 million

Amount of ¥ to be repaid $= 244.20 (1 + 0.5 \times 0.0475)$

$= 250$ million

Convert into Ru at spot and invest in domestic market

Inflow of Ru $= 244.20 \times \dfrac{1}{122} \times 33.56$

$= $ Ru 67.18 million

Ru 67.18 invested for 6-m at 6.5%

Amount of Ru inflow after 6-m $= 67.18 (1 + 0.065 \times 0.5) = 69.36$ million

The Yen Japanese importer would be ready to pay immediately after delivery if he is offered a discount better than his borrowing cost.

Let's find the implied rate for Euro Yen and Domestic Yen.

Domestic 3-m 4.5

6-m 5.00

Implied 3 months rate, 3-month from now

$$\left(1 + \dfrac{X}{4}\right) = \dfrac{1 + \dfrac{0.05}{2}}{1 + \left(\dfrac{0.045}{4}\right)}$$

$\Rightarrow X = 5.40$

Euro Yen implied rate

$$\Rightarrow \left(1+\frac{Y}{4}\right) = \frac{1+\dfrac{0.0475}{2}}{1+\dfrac{0.0425}{4}} \Rightarrow Y = 5.2\%$$

b. Accept a discount at 5.4% p.a. and receive ¥ 246.30 million immediately on delivery?

Inflow After 3-M

i. Cover in the forward market

Ru inflow after 3-m $= ¥\ 246.30 \times \dfrac{1}{120} \times 33.5150$

$= $ Ru 68.71 million

ii. Cover in the money market

¥ 243.55 million at 4.5% for 3-m

Amount to be repaid after 3-m $= 243.55\ (1 + 0.25 \times .045)$

$= ¥\ 246.29$ million

Inflow of Ru $= 243.55 \times \dfrac{1}{122} \times 33.56$

$= $ Ru 67.00 million

Even if this inflow is invested at 6.50%, the inflow after 3-m will be less than the inflow for the earlier option. Hence, it is better to cover through Forward Market.

122. Current Rate 3-m deposit rate 9%

Issue size at £ 5,000,000

Duration of deposit 3-m

FRA 6/9-m 8.75% – 9%

a. If the 3-m deposit rate is 9.5%

Interest amount receivable on the deposit $= 5,000,000 \times 0.095 \times 90/360$

$= £\ 118750$

Interest payable on FRA $= \dfrac{5,000,000\,(0.095 - 0.0875) \times 90/360}{(1 + 0.095 \times 90/360)}$

$= £9157$

Value of the Interest payable on FRA after 3-m $= 9157\ (1 + 0.095 \times 90/360) = £9375$

Net amount of interest received $= 118750 - 9375 = 109375$

Annualized return $= \dfrac{109375}{5,000,000} \times \dfrac{360}{90} \times 100 = 8.75\%$

b. If the 3-m deposit rate is 8%

Interest amount receivable on the deposit $= 5,000,000 \times 0.08 \times \dfrac{90}{360}$

$= £\ 100,000$

Difference receivable on FRA $= \dfrac{(0.0875 - 0.08) \times 90/360 \times 5,000,000}{(1 + 0.80 \times \dfrac{90}{360})}$

$= £\ 9191$

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Value of differential after 3-m $= 9191 (1 + 0.08 \times 90/360) = £ 9375$

Amount of interest on deposit $= 100,000 + 9375 = 109375$

Annualized return $= \dfrac{109375}{5,000,000} \times \dfrac{360}{90} \times 100$

$= 8.75\%$

123. Cost of funds to the Bank 9.125%

Yield on Funds for the 1st 6-m 9.1875%

Option (a) reinvest after 6-m at the then Libor

Option (b) FRA at 9.22% and reinvest at the then Libor

The return during the 1st 6-m is the same under both the options. Hence, return need to be compared over the remaining 6-m.

a. Return over the six months period for a Unit of Currency

6-m Libor	Return at Libor for 6-m	Difference on a/c of FRA*	Return on a/c of FRA
7.00	0.0350	0.0111	0.0461
7.50	0.0375	0.0086	0.0461
8.00	0.0400	0.0061	0.0461
8.50	0.0425	0.0036	0.0461
9.00	0.0450	0.0110	0.0461
9.50	0.0475	– 0.0014	0.0461
10.00	0.0500	– 0.0039	0.0461
10.50	0.0525	– 0.0064	0.0461
11.00	0.0550	– 0.0089	0.0461

Col.2 $=$ Col.1 $\times \dfrac{180}{360}$

Col.4 $=$ $0.0922 \times \dfrac{180}{360}$

Col.3* $=$ Col.4 – Col.2

* Though the differential needs to be discounted at the actual libor which, can be invested at the bid rate and hence need to be compounded to arrive at the value at the end of the period. It is ignored in the above calculation since, both discounting and compounding is at the same rate.

124. Face value $=$ $ 200 million

Current 6-m Libor $=$ 7.625%

Spread $=$ 0.125%

Cost of funds $=$ 7.750

Strike rate $=$ 10.125%

Premium $=$ 4.5%

Libor rates $=$ 5%, 7%, 9%, 11%, 13%

Amount of Premium $= 200,000,000 \times 0.045 = 9,000,000$

Amortized over 5 dates at 9%

Each installment $= \dfrac{9,000,000}{\text{PVIFA}_{(4.5\%, 5\text{yrs})}}$

$= \dfrac{9,000,000}{4,389976}$

$= $ 2,050,125$

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Libor rate	Time	Cash flow from loan	Amortization of premium	Cash flow from cap	Total
	0	200.000			+200.000000
7.62%	1	–7.750	– 2.050125	–	–9.800125
5.000%	2	–5.125	– 2.050125	–	–7.175125
7.000%	3	–7.125	– 2.050125	–	–9.175125
9.000%	4	–9.125	– 2.050125	–	–11.175125
11.000%	5	–11.125	– 2.050125	0.875	–12.3001250
13.000%	6	– 213.125		2.875	–210.250000

Hence, the effective cash flows are as follows:

Time	Cash Flow	Discount Factor at 5%	P.V.
0	200.00	0	200.000000
1	– 9.80	0.9524	–9.335200
2	– 7.18	0.9070	–6.512260
3	– 9.18	0.8638	–8.326260
4	– 11.18	0.8227	–9.197786
5	– 12.30	0.7835	–9.637050
6	– 210.25	0.7462	–156.888550
			–199.900000

The cost of borrowing is found by calculating the IRR of the effective cash flows which is 5%.

Hence, the cost of loan will be 5 x 2 = 10% (approximately).

125. Transaction = Borrowing after 6-m

Face value = $25 million

Maturity = 6-m

Current 6-m libor = 8%

a. Remain unhedged

b. Buy a 6/12 FRA at 8.5%

c. Buy a call on 6-m libor

– Strike rate 8.5% – Premium 75,00

– Strike rate 9.5% – Premium 30,000

d. Write a put option on 6-m libor

– Strike rate 8.5% – Premium 75,000

– Strike rate 9.5% – Premium 40,000

e. Buy a put with maturity on Euro $ Future

– Strike price 91.5 – Premium 0.75

f. Write a 6-m call on Euro $ Future

– Strike price 91.75 – Premium 0.75

We will assume a range of Libor rates from 8% to 10%

a.

Libor rate	Cost of borrowing
8.00	1.0000
8.50	1.0625
9.00	1.1250
9.50	1.1875
10.00	1.2500

b. Under FRA of 6/12 at 8.5%

Libor	Cost of borrowing	Cash flow on a/c of FRA*	Total cash
8.00	1.0000	– 0.0625	1.0625
8.50	1.0625	–	1.0625
9.00	1.1250	+ 0.0625	1.0625
9.50	1.1875	+ 0.1250	1.0625
10.00	1.2500	+ 0.1875	1.0625

* The discounting of the cash flow and compounding the same is ignored as both are to be done at the same Libor.

c. Buy a call 6-m Libor

	Strike Price 8.50%			Strike Price 9.50%		
Libor	Cost of borrowing	Premium	Total	Cost	Premium	Total
8.00	1.0000	0.075	1.0750	1.0000	0.030	1.0300
8.50	1.0625	0.075	1.1375	1.0625	0.030	1.0925
9.00	1.0625	0.075	1.1375	1.1250	0.030	1.1550
9.50	1.0625	0.075	1.1375	1.1875	0.030	1.2175
10.00	1.0625	0.075	1.1375	1.1875	0.030	1.2175

d.

	Strike Price 8.50 Premium 75,000			Strike Price 9.50 Premium 40,000		
Libor	Cost	Premium	Net Cost	Cost	Premium	Net Cost
8.00	1.0625	0.075	0.9875	1.1875	0.040	1.1475
8.50	1.0625	0.075	0.9875	1.1875	0.040	1.1475
9.00	1.1250	0.075	1.0500	1.1875	0.040	1.1475
9.50	1.1875	0.075	1.1125	1.1875	0.040	1.1475
10.00	1.2500	0.075	1.1750	1.2500	0.040	1.2100

e. Buy a put with maturity 6-m on Eurodollar Future – Strike Price 91.5 Premium 0.75

Libor	Price	Premium	Pay-Off	Cost at libor	Net cost
8.00	92.00	–0.0075	0	1.0000	1.0075
8.50	91.50	–0.0075	0	1.0625	1.0700
9.00	91.00	–0.0075	+ 0.0025	1.1250	1.1300
9.50	90.50	–0.0075	+ 0.0050	1.1875	1.1900
10.00	90.00	–0.0075	+ 0.0075	1.2500	1.2500

If F > 91.50 Option Expires

If F < 91.50 Pay-off = (91.50 – F) (1/100) (180/360) = 0.005 (91.50 – F)

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f. Write a 6-m call

Libor	Price	Premium	Outflow	Cost at libor	Cost
8.00	92.00	+ 0.0075	0.0025	1.0000	0.9950
8.50	91.50	+ 0.0075	0.0	1.0625	1.0550
9.00	91.00	+ 0.0075	–	1.1250	1.1175
9.50	90.50	+ 0.0075	–	1.1875	1.1800
10.00	90.00	+ 0.0075	–	1.2500	1.2425

If F < 91.50 option expires

If F > 91.50 pay-off = (F – 91.50) x 180/360

Summary of Costs Under Various Options

Libor	a	b	c @ 9.50	c @ 8.5	d @ 8.5	d @ 9.5	e	f
8.00	1.0000	1.0625	1.0300	1.0750	0.9875	1.1475	1.0075	0.9950
8.50	1.0625	1.0625	1.0925	1.1375	0.9875	1.1475	1.0700	1.0550
9.00	1.1250	1.0625	1.1550	1.1375	1.0500	1.1475	1.1300	1.1175
9.50	1.1875	1.0625	1.2175	1.1375	1.1125	1.1475	1.1900	1.1800
10.00	1.2500	1.0625	1.2175	1.1375	1.1750	1.2100	1.2500	1.2425

The data if plotted on a graph looks as under

The Libor rate at which the cost is lowest under a given option is said to be dominating others.

126.

Face value FFr 6 million	US $1 million
Rate FFr/$	5.00
Fixed vs. 6-m Libor Swap Rate	13%
Current Rate FFr/$	4.50
Time to maturity	5 year 3m
6-m Libor Rate 3 months ago	11%
3-m Libor Rate now	9.5%

Valuation of the floating leg

The Floating Rate contract will be valued at par. However, the inflow after 6-m will be interest for 6-m at Libor, 11% discounted at 3-m current rate.

$$\text{Present Value} = \frac{1,000,000 \times (1+0.5 \times 0.110)}{(1+0.25 \times 0.095)}$$

$$= \$ 1030525.$$

Valuation of Fixed Leg

Time	Coupon Flows
3-m	3,90,000
9-m	3,90,000
15-m	3,90,000
21-m	3,90,000
27-m	3,90,000
33-m	3,90,000
39-m	3,90,000
45-m	3,90,000
51-m	3,90,000
57-m	3,90,000
63-m	63,90,000

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Discounted value of the cash flows 3-m hence;

= 3,90,000 + 3,90,000 PVIFA$_{(10,5\%)}$ + 60,00,000 PVIF$_{(10,5\%)}$

= 3,90,000 + 3,90,000 x 7.7217 + 60,00,000 x 0.6139

= 70,84,863

This discounted at 10% for 3-m = $\dfrac{70,84,863}{1.025}$ = 69,12,061 at current exchange rate of FFr/$

= 4.50

Fixed leg = $\dfrac{69,12,061}{4.5}$ = 15,36,014

Profit   = 15,36,014 – 10,30,525 = 5,05,489

127. Contracted Fixed vs. Libor Swap Rate 13%

Requiring Term	5.25 Years
Current 5 Year Swap Rate	10%
3-m Libor	7%
1 year Libor	11%

(Set 9 months ago)

     Let the face value $10,00,000

     Valuation of Floating Leg

Present value of Floating Rate Leg = $\dfrac{10,00,000 \times (1+0.11)}{(1+0.07 \times 0.25)}$ = \$ 10,90,909

Valuation of Fixed Leg

Time	Cash flows
3-m	1,30,000
15-m	1,30,000
27-m	1,30,000
39-m	1,30,000
51-m	1,30,000
63-m	11,30,000

Present value of cash flows 3-m hence;

= 1,30,000 + PVIFA$_{(5,5\%)}$ 1,30,000 + PVIF$_{(5,5\%)}$ 10,00,000

= 1,30,000 + 4.3295 x 1,30,000 + 0.7835 x 10,00,000

= \$ 14,76,335

PV as on date = $\dfrac{14,76,335}{(1+0.025)}$ = \$ 14,40,327

Value of the swap = 14,40,327 – 10,90,909 = \$ 3,49,418.

128. 'A' has an apparent comparative advantage in fixed rate markets but wants to borrow floating; 'B' has an apparent comparative advantage in floating rate markets but wants to borrow fixed; This forms the basis for the swap. There is a 1.2% per annum differential between the fixed rates offered to the 2 companies and a 0.4% differential between the floating rates offered; the total gain is, therefore, 0.8% per annum. This means that both the companies will be better off by 0.4% per annum each. That is A's borrowing will be at LIBOR – 0.2 percent and B's borrowing will be at 10.8% per annum.

Company A will pay LIBOR to Company B; while Company B will pay 10.2% to Company A.

129. White Ltd., has an apparent comparative advantage in fixed rate markets but wants to borrow floating; Black Ltd., has an apparent comparative advantage in floating rate markets but wants to borrow fixed. The differential in fixed rate markets is 1.6% while it is 0.6% in floating rate markets. The gain, thus will be 1 percent to all parties involved in the swap. Because the bank gets 0.1% per annum, the swap should make White Ltd., and Black Ltd., better off by 0.45% per annum each. This means that it should lead to White Ltd., borrowing at LIBOR – 0.05% while Black Ltd., to 12.15% p.a.

Value at Risk

130. Call option position delta = £100 million x 0.5 = £50 million. This position has the same risk as $50 million in spot.

Daily volatility = $\dfrac{15}{\sqrt{250}}$ = $\dfrac{15}{15.81}$ = 0.9487%

Potential gain/loss on the position (with 68% confidence)

Call option on $100 million

Position value $\qquad$ = US $2.9132 million

Position gain/loss $\quad$ = 50 x 1.4566 x $\dfrac{0.9487}{100}$

$\qquad\qquad\qquad\qquad$ = $0.6909 million

Potential gain/loss on the position (with 95% confidence)

Position gain/loss $\quad$ = 50 x 1.4566 x $\dfrac{2 \times 0.9487}{100}$

$\qquad\qquad\qquad\qquad$ = $1.3819 million.

131. Call option position delta = $1 million x 100 x 0.5 = $50 million. This call option position has the same risk as $50 million.

Position in common shares

$\Rightarrow$ Potential gain/loss with 68% confidence

Position value = $5 x 1 million = $5 million

VaR = $50 million x 1% = $0.5 million

$\Rightarrow$ Potential gain/loss with 95% confidence.

VaR = $50 million x 2 x 1% = $1 million

132. Quarterly Standard Deviation of 2-year Treasury Yield = $\dfrac{1.25}{\sqrt{4}}$ = 0.625%

$\quad$ i. $\quad$ With 68%, confidence in one quarter 2 year treasury yields will be

$\qquad$ 5.8 + 0.625 = 6.425%

$\qquad$ 5.8 – 0.625 = 5.175%

$\qquad$ The corresponding bond prices can be calculated by using HP 12 Calculator.

$\qquad$ $\Rightarrow$ Bond prices are $98.8443 and $101.1731.

$\qquad$ With 95% confidence in one quarter 2 year treasury yields will be

$\qquad$ 5.8 + 1.25 = 7.05%

$\qquad$ 5.8 – 1.25 = 4.55%

$\qquad$ The corresponding prices are $99.69 and $100.31

133. You know that $F = \dfrac{S(1+i_{Rs.})}{(1+i_{\$})} = 47.20 \times \dfrac{1.085}{1.05} = 48.77$

The Bank can decompose its long forex position in the following manner.

i.   **Forex Position:** Bank ABC is exposed to potential declines in the value of Rupee vs. US$. If the $ strengthens, the Bank experiences a loss.

ii. **Rupee Interest Rates:** A long position of one year zero-coupon bond with a face value of Rs.4,877 million and a present value of Rs.144,739,290. Bank ABC is exposed to a potential increase in the long position of Rupee bond. Such an increase results in a loss in the long position in Rupee bond.

iii. **US$ Interest Rates:** A short position of one year zero-coupon bond with a face value of US $100 million and a present value of $94,170,000. Bank ABC is exposed to a potential decrease in the US$ interest rates. Such a decrease results in a loss in the short position of US$ bond.

Price Volatility of Bonds

The price volatility of rupee one year zero-coupon bond is obtained as follows:

Yield volatility   = 1.38%

Yield   = 8.5%

Duration   = 1

Modified Duration (MD) = $\dfrac{1}{\text{yield}}$ = $\dfrac{1}{1.085}$ = 0.922

Δyield   = 8.5 x 1.38% = 0.1173%

Price volatility   = MD x Δyield

                  = 0.922 x 0.1173 = 0.1082%

The price volatility of US$ one-year zero-coupon bond is obtained as follows:

Yield volatility   = 1.98% Yield = 5%

Duration   = 1

Modified Duration (MD)   = $\dfrac{1}{1.05}$ = 0.952

 yield = 5.0 x 1.98%   = 0.099%

Price volatility   = MD x yield

                  = 0.952 x 0.099 = 0.0942%

Value at risk calculations:

1.   Forex Position on Rs./$ short position in US$

   = $94,170,000 x 0.963% = $906,857.

2. $i_{Rs.}$ Position: Long one year zero-coupon bond.

   144,739,290 x 0.1082 = Rs.1,56,630

   $\Rightarrow \dfrac{156,630}{48.77}$ = $3211.6

3. $i_{\$}$ Position : Short one year coupon bond

   = 94,170,000 x 0.0942% = $88708.

Summary:

	Position	VaR in US$
A.	Rs./$	–906,857
B.	$i_{Rs.}$	+ 3212
C.	$i_{\$}$	– 88708

134. Standard deviation of 'A' $= \sqrt{64} = 8$

Standard deviation of 'B' $= \sqrt{25} = 5$.

$$
\begin{aligned}
\text{Covariance}_{(A,B)} \quad &= (\rho_{A,B})\sqrt{\text{Var}_{(A)}\,\text{Var}_{(B)}} \\
&= 0.25\,\sqrt{64}\,\sqrt{25} = \pm 40 \\
&= 0.25 \times 8 \times 5 = 10
\end{aligned}
$$

$$
\begin{aligned}
\text{Variance of }_{A+B} \quad &= \text{Var}_A + \text{Var}_B + 2\,\text{Covariance}_{(A,B)} \\
&= 64 + 25 + 2(10) \\
&= 109
\end{aligned}
$$

Standard deviation of $A + B = \sqrt{109} = 10.44$

Therefore, S D of Asset 'A' + SD of Asset 'B' + Benefits of diversification = 10.44

$8 + 5 + x = 10.44$

$\therefore$ Benefits of diversification $= -2.56$

When $\rho_{AB} \qquad = 1$

$$
\begin{aligned}
\text{Cov}_{(A,B)} \quad &= \rho_{AB}\,\sqrt{\text{Var}_A}\,\sqrt{\text{Var}_B} \\
&= +1\,\sqrt{64}\,\sqrt{25} = \pm 40
\end{aligned}
$$

$$
\begin{aligned}
\text{Var}_{(A+B)} \quad &= \text{Var}_A + \text{Var}_B + 2\,\text{Cov}_{(A,B)} \\
&= 64 + 25 + 2(40) = 169
\end{aligned}
$$

$$\text{SD} \qquad = \sqrt{169} = 13$$

When $\rho_{AB} \qquad = -1$

$$
\begin{aligned}
\text{Cov}_{(A1\,B)} \quad &= \rho_{AB}\,\sqrt{\text{Var}_A}\,\sqrt{\text{Var}_B} \\
&= -1\,\sqrt{64}\,\sqrt{40} = 40
\end{aligned}
$$

$$
\begin{aligned}
\text{Var}_{(A+B)} \quad &= \text{Var}_A + \text{Var}_B + 2.\text{Cov}_{(A,B)} \\
&= 64 + 25 - 2(40) = 9
\end{aligned}
$$

$$\text{SD} \qquad = \sqrt{9} = 3$$

When $\rho_{AB} \qquad = 0$

$$
\begin{aligned}
\text{Cov}_{(A,B)} \quad &= \rho_{AB}\,\sqrt{\text{Var}_A}\,\sqrt{\text{Var}_B} \\
&= 0\,\sqrt{64}\,\sqrt{25} = 0
\end{aligned}
$$

$$
\begin{aligned}
\text{Var}_{(A+B)} \quad &= \text{Var}_A + \text{Var}_B + 2.\text{Cov}_{(A,B)} \\
&= 64 + 25 + 0 = 89 \\
&= \text{SD} \Rightarrow \sqrt{89} = 9.434
\end{aligned}
$$

Summary:

	$\rho_{AB} = 1$	$\rho_{AB} = 0.25$	$\rho_{AB} = 0$	$\rho_{AB} = -1$
SD of Asset 'A'	8	8.00	8.00	8
SD of Asset 'B'	5	5.00	5.00	5
Benefits of div	0	-2.56	-3.57	-10
SD of portfolio	13	10.44	9.43	3

Value at Risk

Position	1 SD	2 SD
Asset A: $100	8	16
Asset B: $100	5	10
Portfolio		
$\rho_{AB} = -1$	3	6
$\rho_{AB} = 0$	9.43	18.86
$\rho_{AB} = 0.25$	10.44	20.88
$\rho_{AB} = 1$	13	26

135. Yield $= 6.21$

Annual SD(σ_m) $= 0.85$

1-month

SD for 1-month $= \sigma_m = \dfrac{\sigma_A}{\sqrt{12}} = \dfrac{0.85}{3.464} = 0.24538$

1 SD	[6.21 + 0.24538]	=	6.455
	[6.21 – 0.24538]	=	5.965
1.65 SD	[6.21 + [1.65 x 0.24538]	=	6.615
	[6.21 – (1.65 x 0.24538)]	=	5.805
2 SD	[6.21 + (2 x 0.24538)]	=	6.701
	[6.21 – (2 x 0.24538)]	=	5.719

1-Week

SD for 1-week $= \sigma_w = \dfrac{\sigma_A}{\sqrt{52}} = \dfrac{0.85}{7.2111} = 0.11787$

1 SD	[6.21 + 0.11787]	=	6.328
	[6.21 – 0.11787]	=	6.092
1.65 SD	[6.21 + (1.65 x 0.11787)]	=	6.404
	[6.21 + (1.65 x 0.11787)]	=	6.016
2 SD	[6.21 + (2 x 0.11787)]	=	6.446
	[6.21 – (2 x 0.11787)]	=	5.974

1-Day

SD for 1-day $= \sigma_D = \dfrac{\sigma_A}{\sqrt{250}} = \dfrac{0.85}{15.81} = 0.005376$

1 SD	[6.21 + 0.05376]	=	6.264
	[6.21 – 0.005376]	=	6.156
1.65 SD	[6.21 + (1.65 x 0.005376)]	=	6.299
	[6.21 – (1.65 x 0.005376)]	=	6.121
2 SD	[6.21 + (2 x 0.005376)	=	6.318
	[6.21 – (2 x 0.005376)]	=	6.102

136. Holding Period 1 day

68% Confidence

47.25 [1 + 0.00716] = 47.5883

47.25 [1 – 0.00716] = 46.9117

90% Confidence

47.25 x [1 + 1.65 x 0.00716] = 47.808

47.25 x [1 – 1.65 x 0.00716] = 46.6918

95% Confidence

47.25 x [1 + 2 x 0.00716] = 47.926

47.25 x [1 – 2 x 0.00716] = 46.573

98% Confidence

47.25 x [1 + 3 x 0.00716] = 48.265

47.25 x [1 – 3 x 0.00716] = 46.235

137. a. Share price = Rs.300

Annualized volatility = 15%

Daily volatility $= \dfrac{15}{\sqrt{250}} = 0.9487\%$

Possible gains and losses at 90% confidence level can be measured as:

VaR = 100 x 300 (1 + 1.65 x 0.009487)

= Rs.30,469.61

or

VaR = 100 x 300 (1 – 1.65 x 0.009487)

= Rs.29,530.39

So for total investment of Rs.30,000, Mr. Pranoy faces a potential gain or loss of Rs.469.61 each day.

∴ Potential loss/gain over holding period

$= 469.61 \text{ x } \sqrt{\dfrac{250}{2}}$

= Rs.5,250.40

b. Delta of call option position = 100 x 300 x 0.35 = Rs.10,500

Value of long call position = 100 x 28 = Rs.2800

Possible gain/loss at 90% confidence level:

$\text{VaR} = 10{,}500 \text{ x } 1.65 \text{ x } 0.009487 \text{ x } \sqrt{\dfrac{250}{2}}$

= Rs.1,837.63

∴ Potential gain/loss from long call position = Rs.1,837.63.

138. a. SD of Alpha's stock $= \sqrt{18}$ = 4.24%

SD of Beta's stock $= \sqrt{30}$ = 5.48%

Covariance $= \rho\sqrt{\text{Var (Alpha) x Var(Beta)}}$

$= 0.40 \sqrt{18 \text{ x } 30} = 9.30(\%)^2$

Variance of (Alpha + Beta) = Var (Alpha)+ Var (Beta) + 2 x Covariance (Alpha, Beta)

= 18 + 30 + 2 x 9.30

$= 66.60(\%)^2$

b. SD of (Alpha + Beta) = $\sqrt{66.60}$ = 8.16%

Now, SD of Alpha + SD of Beta + Benefits of diversification = SD of (Alpha + Beta)

or, 4.24 + 5.48 + Benefits of diversification = 8.16

or, Benefits of diversification = –1.56%

c. If = ρ = –1,

Covariance = –1 x $\sqrt{18 \times 30}$ = –23.24(%)^2

Variance (Alpha + Beta) = 18 + 30 + 2 x (–23.24)

= 1.52(%)^2

SD of (Alpha + Beta) = 1.23%

Benefit of diversification = 1.23 – 4.24 – 5.48 = –8.49%

d. Total investment = Rs.1,00,000

SD or volatility = 8.16% p.a.

Daily volatility = $\dfrac{8.16}{\sqrt{250}}$ = 0.5161%

Possible gains or losses at 95% confidence level:

VaR = 1,00,000 (1 + 2 x 0.005161) = Rs.101,032

Or,

VaR = 1,00,000 (1 – 2 x 0.005161) = Rs.98,968

This implies that for a total investment of Rs.1,00,000 a potential gain or loss of Rs.1,032 can be made each day.

139. Position value in Euros = $\dfrac{1}{41.30}$ = 0.024213

Daily volatility = $\dfrac{\text{Annual Volatility}}{\sqrt{300}}$ = $\dfrac{20}{\sqrt{300}}$ = 1.15%

Now, the potential fluctuation at 95.5% level of confidence will be:

0.024 (1 + 2 x 0.0115) = 0.024552 Euros

OR

0.024 (1 – 2 x 0.0115) = 0.023448 Euros

The potential gains or losses on the position at 95.5% level of confidence (95% percentile) will be:

50 million Euro = Rs.2,065 million

VaR = 2,065 x 0.023 = Rs.47.495 million.

140. i. Size of investment in shares = Rs.160 x 300 = Rs.48,000

Volatility = 25% p.a.

Daily volatility = $\dfrac{25}{\sqrt{250}}$ = 1.5811

Volatility of 30 days period = 1.5811 x $\sqrt{30}$

= 8.66%

Value at risk at 90% confidence level for 30 days = 48,000 x 0.0866 x 1.65

= Rs.6,858.72

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ii.   Delta of put option = –0.30

Delta of put option position = Rs.160 x 300 x (–0.30) = –Rs.14,400

So, the long put option has the same risk of going short on the stock of size Rs.14,400.

Value at risk 90% confidence level for 30 days

= 14,400 x 0.0866 x 1.65

= Rs.2,057.62

iii.   As the buying put option on 300 shares of ACC is equivalent to going short on the shares of size Rs.14,400.

∴ The combined position of long stock and long put

= Rs.48,000 – Rs.14,400 = Rs.33,600

So, the combined VaR at 90% confidence level for 30 days

= 33,600 x 0.0866 x 1.65 = Rs.4,801.10

141. a.   The trader has taken following positions:

i.   Long position in a £-bond at £1 million

i.e., $ 1.537 million

ii.   Short position in a $-bond at

$ 1.5225 million

The value of £-bond $= \dfrac{1.537}{1+\dfrac{0.04}{2}} = \$1.507$ million

The value of $-bond $= \dfrac{1.5225}{1+\dfrac{0.025}{2}} = \$1.504$ million

The standard deviation of change in the combined position in one day

= $[1.507^2 \text{ x } 0.005^2 + 1.504^2 \text{ x } 0.002^2 - 2 \text{ x } 0.75 \text{ x } 1.507 \text{ x } 0.005 \text{ x } 1.504 \text{ x } 0.002]^{1/2}$

= $[0.0000318]^{1/2}$

= $ 0.00564 million

b.   Standard deviation for 15-days $= 0.00564 \text{ x } \sqrt{15}$

= $0.02184 million

∴ VaR at 99.7% confidence level = 0.02184 x 3

= $ 0.06553 million.

142. For Zero-coupon bond:

Yield volatility   = 5% p.a

Duration   = 1 Year

Yield $= \dfrac{1,000}{935} - 1 = 6.95\%$

Modified Duration $= \dfrac{1}{1.0695} = 0.935\%$

Delta yield = 6.95% x 0.05 = 0.3475%

Price volatility   = Mod. Duration x Delta yield

= 0.935 x 0.3475% = 0.3249%

For 8% coupon bond:

Yield volatility = 6% p.a

Yield 'k' is given in following equation:

$98.2 = 8 \times \text{PVIFA}_{(k,3)} + 100 \times \text{PVIF}_{(k,3)}$

for k = 8%, RHS = 100.02

for k = 9%, RHS = 97.45

$$k = 8\% + (9 - 8)\% \times \frac{100.02 - 98.20}{100.02 - 97.45} = 8.71\%$$

Year (I)	Cf(II)	PV of CF (III)	(I) x (III)
1	8	7.359	7.359
2	8	6.769	13.538
3	108	84.065	252.195
			273.092

Duration $= \dfrac{273.092}{98.2} = 2.781$ years

Modified duration $= \dfrac{2.781}{1.0871} = 2.558$ years

Delta yield $= 8.71\% \times 0.06 = 0.5226\%$

Price volatility $= 2.558 \times 0.5226\%$

$= 1.3368\%$

Value of Zero-coupon bond = Rs.93,500

Value of 8% bond = Rs.49,100

The standard deviation of change in the combined position for 1 year

$$= \left[\begin{array}{l} (93,500 \times 0.003249)^2 + (49,100 \times 0.013368)^2 \\ + 2 \times 0.90 \times 93,500 \times 0.003249 \times 49,100 \times 0.013368 \end{array} \right]^{\frac{1}{2}}$$

$= [882010]^{1/2} = \text{Rs.}939.15$

Standard deviation for 1-month $= 939.15 \times \dfrac{1}{\sqrt{12}} = \text{Rs.}271.11$

∴ VaR at 95% confidence level = Rs.271.11 x 2 = Rs.542.22.

Introduction to Insurance: Life and Non-Life

143. Amount Paid $= \dfrac{\text{Amount declared}}{\text{Actual amount of stocks}} \times \text{Damage}$

$= \dfrac{24.50}{24.75} \times 0.75 = \text{Rs.}0.7424 \text{ lakh.}$

144. Amount payable under the policy $= \dfrac{\text{Sum insured}}{\text{Value of insured asset}} \times \text{Actual loss}$

$= \dfrac{75,000}{1,50,000} \times 45,000 = \text{Rs.}22,500.$

145. a Loss amount = Rs.60,000

Percentage to the total sum insured = 10 percent

Liability of individual insurers = Sum insured with each insurer x 0.1

Liability of A = 1,00,000 x 0.1 = Rs.10,000

Liability of B = 2,00,000 x 0.1 = Rs.20,000

Liability of C = 3,00,000 x 0.1 = Rs.30,000

b. Liability of individual insurers

$$= \frac{\text{Sum insured with each insurer x Amount of loss}}{\text{Total value at risk}}$$

Liability of A $= \dfrac{1,00,000 \text{ x } 60,000}{8,00,000} = $ Rs.7,500

Liability of B $= \dfrac{2,00,000 \text{ x } 60,000}{8,00,000} = $ Rs.15,000

Liability of C $= \dfrac{3,00,000 \text{ x } 60,000}{8,00,000} = $ Rs.22,500

146. The amount of guarantee = Rs.10 lakh

Number of persons covered in the policy = 10

Rate of premium = 1 percent

Per capita charge = Rs.50

Total premium = (Amount of guarantee x Premium rate) + Per capita

= (10,00,000 x 0.01) + (1 x 50)

= Rs.10,050.

147. As the declaraion prior to the loss is under- declared, the loss payable is

$= $ Rs.$\dfrac{49,00,000}{49,60,000}$ x 32,000 = Rs.31,613

148. Average declaration $= \dfrac{27.40 + 26.90 + 25.00}{3} = $ Rs.26.43 lakh

Premium that can be refunded is the lower of:

i. Premium earned at short period rates:

26.43 x $\dfrac{0.14}{28}$ x 0.50 = Rs.0.0661 lakh

ii. 35% of Rs.14,000 = 0.35 x 0.14 = Rs.049 lakh.

The amount refunded is Rs.0.049 lakh.

149. Since there is no underdeclaration, the actual loss of Rs.24,80,000 may be paid.

The average declaration is Rs.48,00,000 and, therefore, the premium earned up to the date of loss is *pro rata* Rs.24,000.

That is, $\dfrac{146}{365}$ x 24,000 = Rs.9,600.

Also, the extra premium to be charged for reinstating the sum insured following the loss is the pro rata premium from the date of loss to the date of expiry on the amount of loss.

That is, $\dfrac{12,400 \text{ x } 219}{365}$ = Rs.7,440

Total premium on policy account is Rs.17,040.

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The difference between the amount earned and the provisional premium is refunded.

The insured gets refund premium of Rs.7,960 and the insurance company pays him the amount of Rs.24,80,000 claim amount.

150. Since there is no underdeclaration, the actual loss of Rs.19,84,000 may be paid.

The average declaration is Rs.38,00,000 and, therefore, the premium earned up to the date of loss is to be calculated *pro rata* on Rs.19,000.

i.e. $\dfrac{144}{365}$ x 19,000 = Rs.7,495.89

Also, the extra premium to be charged is the *pro rata* premium from the date of loss to the date of expiry on the amount of loss. That is,

= 9,920 x $\dfrac{221}{365}$ = Rs.6,006

Total premium on policy is = Rs.13,502

The difference between the amount earned and the provisional premium is refunded.

The insured gets refund of premium of Rs.6,498 in addition to the claim amount of Rs.19.84 lakh.

Part III: Applied Theory (Questions)

1. "Prices of options will always be within the upper and lower boundaries.'' What are the upper and lower bounds for European call options on non-dividend paying stock?

2. A speculator who is specialized in forecasting the movement of US$, and his friend hold the same view about the US$ over the next three months. While the speculator suggested to buy a "Butterfly call option", his friend suggested to go in for a straddle. What do you think is the view of the speculator?

3. The General manager – Finance of a broking company, while disclosing his lack of interest for borrowing at a floating rate of interest holds the view that, "Cost of funds for a borrower is supposed to depend on how creditworthy he is. If so, it should remain the same irrespective of how and where he is borrowing from." Explain how swaps still help in reducing the cost of funds. What are the factors that give rise to a swap transaction?

4. "Futures rely on a great deal on expected spot prices. The theoretical framework suggests that forward rates reflect the expected spot rates.'' How futures differ from forwards? Explain.

5. ICICI has recently advertised the details of three financial swaps undertaken by them. It is found that all the three swaps involved Indian companies who have transferred their US borrowing to ICICI and took over rupee denominated borrowing. Explain the motives underlying a swap transaction. What do you think is the motive of the corporates in the example?

6. "Derivatives are widely known instruments for risk management. There are many instruments available for managing credit risk by using derivatives.'' Describe them.

7. "Risk management needs to be looked as an organizational approach, as management of risks independently cannot have the desired effect over the long-term.'' What are the steps involved in the risk management function?

8. "The critical issue that an insurance marketer has to tackle is to increase the awareness of the necessity of insurance services.'' How is the set-up of sales force in a life insurance company?

9. "Insurance is a Uberrimae fides contract.'' What is Uberrimae fides and what is its significance to an insurance company? List the elements on which an insurance contract is built upon.

10. "In the near future, stock index futures are likely to become one of the most liquid contracts with very large volumes.'' Explain how the use of stock index futures can benefit the stock markets.

11. "Options, while very attractive and profitable, are risky to both the call writer and put writer.'' Explain.

12. "Weather derivatives should be taken not only as a local phenomenon, but also as an industrial phenomenon.'' What are the factors that affect the profitability as far as whether uncertainties are concerned?

13. "Stock index futures may be used to facilitate a dynamic portfolio insurance program in order to alter the return profile of a stock portfolio.'' Describe portfolio insurance in detail.

14. "In the context of the present business environment, financial risk management has become a critical activity for most of the firms.'' In the light of the above discuss the different approaches to manage risks.

15. "Corporate financial models are formal representations of a company's operations and processes in financial terms.'' What are the major steps in the process of using a model to arrive at the optimal decision?

16. "There are a variety of option combinations, which traders adopt to suit their risk-return profile." Discuss the following option combinations: (i) straddle and (ii) strangle.

17. "Of late, option-pricing theory is being applied to value real investment opportunities such as an option to postpone investment or an option to make a follow-on investment.'' Are there any other applications for the theory apart from these two? Explain.

18. "VaR is a technique that allows the managers to know about the losses before they occur.'' What are the other uses of VaR?

19. "The derivative markets and instruments have created an efficient system for transfer of risk throughout the global financial system.''   Explain.

20. "The list of pure risks suffices to say that doing anything in life involves risk.'' Describe the main pure risks.

21. "Clearing House is the 'de facto' guarantor for all the transactions in futures.'' Describe briefly, the functions of a Clearing House.

22. "Option value, is influenced by the option prices, which in turn depend on a number of factors.'' What are the assumptions made by the Black-Scholes option pricing model?

23. The interest rate swaps market in India is still at a nascent stage. But, in course of time, it is expected to pick up strongly. What are the motivations that lead to undertake financial swaps? Explain.

24. "Even though volatility is an input model that cannot be observed directly, an option trader needs to determine whether his/her expectations about volatility are realized in the market price or not.'' What are the different types of volatilities and what are their causes?

25. "Swaps can be valued on the same lines as bonds as they essentially involve a series of cash flows at different points of time.'' Explain how interest rate swaps and currency swaps are valued?

26. "A swap bank has to entail certain risks, which are inherent to the swap business and are interrelated.'' Explain the risks involved in the swap business.

27. Call options are said to be "At the money'', "In the money'' and "Out of the money'' depending on whether the exercise price is equal to or less than or greater than the current market price of the stock. In case of put options, the opposite is true. Explain when a trader realizes profits in case of call as well as put options with the help of simple examples.

28. "There are various costs involved in measuring the total risk.'' Identify them.

29. "Management of risk forms the main issue for any company.'' How do the companies manage the currency and interest rate risk?

30. "An asset or a liability must satisfy certain criteria if it is to be designated as a hedging item.'' What are the criteria on which an asset or liability is designated as a hedge item?

31. "Financial Engineering is a product with increasing sophistication of techniques and rigorous application of the scientific methods to finance." Justify it by discussing the meaning, nature and scope etc.

32. What are the Environmental/External Factors that contribute to the Growth of "Financial Engineering"?

33. The job of a Financial Engineer starts where the job of a Financial Analyst ends. Compare and contrast the jobs of a Financial Engineer and a Financial Analyst.

Part III: Applied Theory (Answers)

1. Upper Bounds

An American or European call option gives the holder the right to buy one share of a stock for a certain price. No matter what happens, the option can never be worth more than the stock. Hence, the stock price is an upper bound to the option price:

$$c \leq S \text{ and } C \leq S$$

If these relationships are not true, an arbitrager can easily make a riskless profit by buying the stock and selling the call option.

An American or European put option gives the holder the right to sell one share of a stock for X. No matter how low the stock price becomes, the option can never be worth more than X. Hence,

$$p \leq X \text{ and } P \leq X$$

For European options, we know that at time T, the option will not be worth more than X. It follows that it must now not be worth more than the present value of X:

$$p \leq Xe^{-r(T-t)}$$

If this were not true, an arbitrager could make a riskless profit by writing the option and investing the proceeds of the sale at the risk-free interest rate.

Lower Bound for Calls on Non-dividend-Paying Stocks

A lower bound for the price of a European call option on a non-dividend-paying stock is

$$S - Xe^{-r(T-t)}$$

We first illustrate this with a numerical example and then present a more formal argument.

Suppose that $S = \$20$, $X = \$18$, $r = 10\%$ per annum, and $T - t = 1$ year. In this case,

$$S - Xe^{-r(T-t)} = 20 - 18^{e-0.1} = 3.71$$

or $3.71. Consider the situation where the European call price is $3.00, which is less than the theoretical minimum of $3.71. An arbitrager can buy the call and short the stock. This provides a cash inflow of $20.00 – $3.00 = $17.00. If invested for 1 year at 10 percent per annum, the $17.00 grows to $17e^{0.1} = \$18.79$. At the end of the year, the option expires. If the stock price is greater than $18, the arbitrager exercises the option for $18, closes out the short position and makes a profit of

$$\$18.79 – \$18.00 = \$0.79$$

If the stock price is less than $18, the stock is bought in the market and the short position is closed out. The arbitrager then makes an even greater profit. For example, if the stock price is $17, the arbitrager's profit is

$$\$18.79 – \$17.00 = \$1.79$$

For a more formal argument, we consider the following two portfolios:

Portfolio A: One European call option plus an amount of cash equal to $Xe^{-r(T-t)}$

Portfolio B: One share

In portfolio A, the cash, if it is invested at the risk-free interest rate, will grow to X at time T. If $S_T > X$, the call option is exercised at time T and portfolio A is worth $S_T - X$, the call option expires worthless and the portfolio is worth X. Hence, at time T, portfolio A is worth max (S_T, X).

Portfolio B is worth S_T at time T. Hence, portfolio A is always worth as much as, and is sometimes worth more than, portfolio B at time T. It follows that, in the absence of arbitrage opportunities this must also be true today. Hence,

$$c + Xe^{-r(T-t)} > S$$
$$\text{or}$$
$$c > S - Xe^{-r(T-t)}$$

Since the worst that can happen to a call option is that it expires worthless, its value must be positive. This means that $c > 0$ and, therefore,

$$c > \max(S - Xe^{-r(T-t)}, 0)$$

2. A butterfly spread involves positions in options with three different strike prices. It can be created by buying a call option with a relatively low strike price, X_1; buying a call option with a relatively high strike price, X_3; and selling two call options with a strike price, X_2, halfway between X_1 and X_3. Generally, X_2 is close to the current stock price. The pattern of profits from the strategy is shown in the above figure. A butterfly spread leads to a profit if the stock price stays close to X_2 but gives rise to a small loss if there is a significant stock price move in either direction. It is, therefore, an appropriate strategy for an investor who feels that large stock price moves are unlikely.

Butterfly Spread Using Call Options
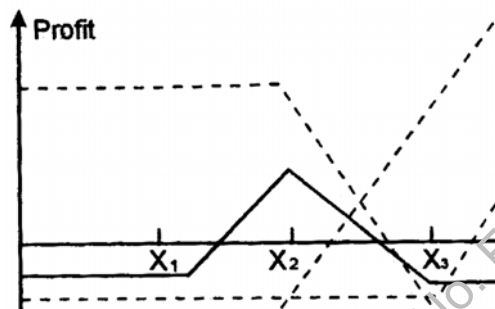
Straddles

A straddle involves buying/selling a call and a put with the same strike price and maturity. This strategy is often used in situations where an investor is expecting a large movement in the stock price but does not know in which direction the move will be.

A long straddle is formed by buying an equal number of calls and puts with the same strike price and maturity. If there is a drastic depreciation, the put gives a profit while in the case of drastic appreciation, the call gives a profit. There will be a profit to the extent that the gain on the profitable option exceeds the total premium cost of establishing the straddle. If the investor expects the prices to be stable, he will sell a straddle. A speculator with a short position profits from stable prices. He gains to the extent of the premium from writing the options.

The profit pattern and pay-off from a straddle is shown below:

Pay-off from a Straddle
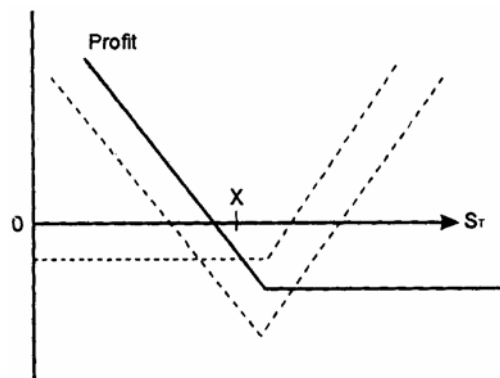
Range of Stock Price	Pay-off from Call	Pay-off from Put	Total Pay-off
$S \leq X$	0	$X - S$	$X - S$
$S > X$	$S - X$	0	$S - X$

3. The reduction in borrowing cost is achieved as follows:

i. Each party borrows in the market in which he can get funds cheapest.

ii. They swap the liabilities in such a way that the advantage is shared among all the parties in negotiated proportions.

The following illustration makes it clear:

Consider XYZ Inc., a manufacturing firm which wants to raise 5 year fixed rate dollar funding to finance an expansion project. Its credit rating is not very high, say BBB. It finds that it will have to pay 2% over 5 year treasury notes which are currently yielding 9%. In the floating rate market it can issue 5 year FRNs at a margin of 0.75% over the prime rate. On the other hand, ABC Inc. a large bank looking for floating rate funding, finds that it will have to pay prime rate. While in the fixed rate market it can raise 5 year funds at 50 bp (0.50%) above T-notes due to its AAA rating. Thus, the spread demanded by the market between AAA and a BBB credit is 150 bp in the fixed rate segment while it is only 75 bp in the floating rate segment. This differential is known as Quality Spread Differential (QSD). The requirements and access of the two parties are summarized below:

	XYZ	ABC
Requirement	Fixed Rate $	Floating Rate $
Cost fixed $	11%	9.5%
Cost floating $	Prime + 0.75%	Prime

The bank ABC has an absolute advantage over the corporation XYZ in both the markets but the corporation has a comparative advantage in the floating rate market. Both can achieve cost saving by each borrowing in the market where it has a comparative advantage and then doing a fixed-to-floating interest rate swap. Suppose the notional principal is $100 million. The terms of the swap arranged by a swap bank can be as follows:

ABC borrows $100 million at 9.5% s.a. fixed. XYZ borrows $100 million floating at prime + 0.75 payable semi-annually.

ABC pays the swap bank (prime – 0.25%) on $100 million every six months. The swap bank passes this on to XYZ. XYZ pays the swap bank 9.75% s.a. on $100 million. The swap bank pays ABC 9.5% s.a.

The key result is that both the parties have achieved their objectives with some cost saving:

XYZ Corp.:

9.75% + [prime + 0.75% – (prime – 0.25%)] = 10.75% fixed rate

ABC Bank:

9.5% – 9.5% + prime – 0.25% = prime – 0.25%

The swap bank earns a margin of 25 bp.

The cost savings could be achieved by exploiting the comparative advantage. By ABC borrowing in the fixed rate market there was a saving of 1.5% (= 11 – 9.5) and by XYZ borrowing in the floating market there was a loss of 0.75% (= prime + 0.75 – prime) for a net gain of 0.75%. Notice that the gains of all three parties together equal this total gain. The division of the total gain between these parties is subject to negotiation depending upon supply and demand factors. The equal division assumed in the example is purely illustrative.

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4. The differences between forwards and futures can be summarized as follows:

Feature	Forward Contract	Future
Maturity	Any date	Only dates fixed by the exchange
Maximum life	Many years	Nine months
Contracted amount	Any amount	Contract amounts fixed by the exchange
Secondary market	Can be offset only by an offsetting transaction	Can be sold off on the exchange
Guarantor for performance	None	Clearing corporation
Major users	Basically hedgers	Basically speculators

5. The motivations for swaps arise either from capital market imperfections or from other factors such as differences in financial norms, differences in investor attitudes, peculiarities in regulatory structures, etc. The commonly seen motivations are:

i. **Quality Spread Differential:** Consider the following information.

		Interest Rate Payable	
Company	Requirement	Fixed $	Floating $
ABC	Fixed $	11%	LIBOR + 2%
XYZ	Floating $	10%	LIBOR + 1.5%

If both the above companies borrow in the markets in which they need funds, the total interest payable by them will be 11% + LIBOR + 1.5%, that is, LIBOR + 12.5%. But, if ABC borrows at floating rate and XYZ borrows at fixed rate, the total interest cost will be LIBOR + 2% + 10%, that is, LIBOR + 12%. There is, thus, a saving in cost to the extent of 0.5%, which can be shared by the two companies through a swap. This is possible due to the differences in quality spreads in fixed rate market and floating rate market. In other words, in the fixed rate market ABC has to pay 1% more than XYZ, whereas in the floating rate market it has to pay only 0.5% more and difference between the additional interest payable in the two markets is called quality spread differential.

ii. **Market Saturation:** A company may have already issued so many securities in a particular market (say, its home country) that people in the market are no longer interested in investing in that company, or are demanding higher returns than warranted by the quality of the company. In such a situation, the company may borrow in a foreign market and do a swap for home currency denominated funds.

iii. **Differing Financial Norms:** Investors use a variety of financial ratios such as the debt-equity ratio, interest coverage ratio, etc. to assess financial health of a firm. Norms regarding "acceptable" values of these ratios differ across countries. For instance, Japanese companies tend to have much higher debt-equity ratios than what would be considered acceptable in the US. A Japanese firm wanting to raise dollar funding might find a direct approach to the US market unattractive because its rating may be affected by its high debt-equity ratio. It might be cheaper to borrow at home in Yen and then execute a swap.

iv. **Hedging Price Risks:** The factors considered so far made swaps an attractive funding tool from the point of view of lowering financing costs. An equally important objective underlying swaps is hedging of interest rate and exchange rate risks. Swapping out of a floating rate debt (or asset) into a fixed rate debt (or asset) could be motivated purely by the desire to eliminate interest rate risk rather than saving on borrowing costs (or improving return on investment). Similarly swapping out of say a DM denominated liability into a dollar denominated liability is a way of eliminating exchange rate exposure if the firm has certain future inflows in dollars.

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v. **Other Considerations:** A few other possibilities have been pointed out where swaps provide an efficient way of achieving the firm's objectives. In some capital markets e.g. Japan, the authorities regulate the timings of foreign issues by means of a queue system. Suppose an American firm is way back in the queue and needs yen funding urgently. It can "jump the queue" by entering into a currency swap with a firm which is at the head of the queue and is willing to accept dollar funding. A firm may be able to access markets via swaps which it otherwise cannot enter profitably. Occasionally, differences in tax law across countries create profitable swap opportunities.

The motive behind the swaps mentioned in the question appears to be to transfer currency risk.

6. There are a number of ways in which a financial institution can reduce the default risk viz.

i. The FI can set credit limits for every counterparty.

ii. The FI can ask the counterparty to post collateral and agree that the amount of collateral posted will be adjusted periodically to reflect the value of the derivatives contract to the counterparty.

iii. The pay-offs on contracts can be designed to reduce the credit risk.

iv. Default risk can be reduced by introducing downgrade triggers in the contract. These state that if the credit rating of the counterparty falls below a certain level, the contract is closed out using a predetermined formula. Downgrade triggers lead to significant reduction in credit risk.

7. Risk management needs to be looked at as an organizational approach, as management of risks independently cannot have the desired effect over the long-term. This is especially necessary as risks result from various activities in the firm, and the personnel responsible for the activities do not always understand the risk attached to them. The risk management function involves a logical sequence of steps. These steps are

a. *Determining objectives:* Determination of objectives is the first step in the risk management function. The objective may be to protect profits, or to develop competitive advantage. The objective of risk management needs to be decided upon by the management, so that the risk manager may fulfill his responsibilities in accordance with the set objectives.

b. *Identifying risks:* Every organization faces different risks, based on its business, the economic, social and political factors, the features of the industry it operates in – like the degree of competition, the strengths and weaknesses of its competitors, availability of raw material, factors internal to the company like the competence and outlook of the management, state of industry relations, dependence on foreign markets for inputs, sales, or finances, capabilities of its staff, and other innumerable factors. Each corporate needs to identify the possible sources of risks and the kinds of risks faced by it. For this, the risk manager needs to develop a fundamental understanding of all the firm's activities and the external factors that contribute to risk. The risk manager especially needs to identify the sources of risks that are not so obvious.

c. *Risk evaluation:* Once the risks are identified, they need to be evaluated for ascertaining their significance. The significance of a particular risk depends upon the size of the loss that it may result in, and the probability of the occurrence of such loss. On the basis of these factors, the various risks faced by the corporate need to be classified as critical risks, important risks and not-so-important risks.

d. *Development of policy:* Based on the risk tolerance level of the firm, the risk management policy needs to be developed. The time-frame of the policy should be comparatively long, so that the policy is relatively stable. A policy generally takes the form of a declaration as to how much risk should be covered, or in other words, how much risk the firm is ready to bear.

e. *Development of strategy:* Based on the policy, the firm then needs to develop the strategy to be followed for managing risk. The tenure of a strategy is shorter than a policy, as it needs to factor-in various variables that keep changing. A strategy is essentially an action plan, which specifies the nature of risk to be managed and the timing. It also specifies the tools, techniques and instruments that can be used to manage these risks. A strategy also deals with tax and legal problems. It may specify whether it would be more beneficial for a subsidiary to manage its own risk, or to shift it to the parent company. It may also specify as to how it will be most beneficial to shift the losses to a branch located at a particular location.

While the strategy is to be designed within the guidelines laid down by the top management, and in a manner that best satisfies the objectives of risk management, the actual leeway available to the manager for making the decision changes from company to company. In some corporates, the guidelines may only specify the broad framework to be followed while making the risk management decision, giving him a lot of scope for deciding about the specific technique and instrument to be used for managing a specific risk. On the other hand, some corporates lay down rigid and detailed guidelines that need to be followed while making risk management decisions, leaving the manager very little scope for exercising his judgment. Finally, the devices used for risk management will depend on the management's willingness to take risks, to shift production centers, to change the product mix, to use derivative products, etc.

f. *Implementation:* Once the policy and strategy are in place, they are to be implemented for actually managing the risks. This is the operational part of risk management. It includes finding the best deal in case of risk transfer, providing for contingencies in case of risk retention, designing and implementing risk control programs, etc. It also includes taking care of the details in the operational part, like the back office work, ensuring that the controls are complied with, etc.

g. *Review:* The function of risk management needs to be reviewed periodically, depending on the costs involved. The factors that affect the risk management decisions keep changing, thus necessitating the need to monitor the effectiveness of the decisions taken previously. Sometimes, the decisions taken earlier may not prove to be correct, or the changing circumstances may make some other option more effective. A periodic review ensures that the risk management function remains flexible, and the tools, techniques and instruments used to manage risk change according to the changing circumstances.

The process of risk management has to be flexible because a company's risk profile keeps changing. Hence, it needs to be remembered that the emphasis of the risk management process is not on identification of any specific risk, but on developing a method of assessment of risk and of arriving at the best possible way of dealing with them, as and when they arise.

8. Effective sales force is essential for any product, moreso for life insurance products where the awareness is low and the necessity for such products is not felt much. The sales force of a life insurance organization is generally a three-layered structure consisting of agents, supervisors and managers.

Agents: The agents are the first line or grass-root workers of a life insurance company. Their duties include:

- Identifying prospective clients

- Meeting prospective clients, to explain and discuss different products of insurance

- Finalizing the sales

- Forwarding the proposals to the insurance company

- Attending to the requirements, if any, for the acceptance of those proposals

- Rendering post-sales services.

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Consumers are identified either by direct contact or through reference. In most cases, one consumer who has insured in the initial years always goes back to the same agent insuring through the same insurance company for various kinds of assets classes. Even in the case of life insurance in India, many people take multiple policies through the same agent even years after taking the first policy. Also, since the agent will be in constant touch with the consumers towards periodic payment of premiums, many new policies are taken by repeat consumers.

Supervisors: At the intermediary level of marketing insurance services are the supervisors. Functioning at this level are the development officers who are also known as development supervisors/organizers. They act as the link between the agent and the branch/sales team. Their duties include:

- Identifying and meeting prospective new agents for recruitment.

- Recommending the prospective agents to the Management for the purpose of appointment.

- Supervising and guiding the activities of the agents by providing initial training.

- Fixing targets and objectives for the agents under their supervision.

- Monitoring the activities of the agents and motivating them to realize the objectives.

- Enabling the agents in extending post-sales service.

In India, development officers form a link between the agents and the branch in selling of insurance products. These development officers supervise a group of agents by assigning targets and overseeing the payment mechanisms. Development officers themselves are supervised by the sales team of the branch, usually a branch manager, with new business targets assigned.

Managers: In the next higher step of this marketing chain after the agents and the supervisors are the Managers who form a part of the company's core management team. Apart from being entrusted with the full responsibility of developing the sales organization, the managers are also responsible to strengthen the credibility of the organization. Managers will be entrusted with the sales in a particular area and this will include arranging for training of the sales force. Their duties include:

- Setting overall targets for the sales force under their charge.

- Assigning the targets for the various levels, i.e. at the intermediate level and at the agent level.

- Guiding, monitoring and controlling the sales activities.

- Reviewing the sales plans and the targets set.

- Motivating the sales force and enabling them realize the targets.

- Administrating the office to ensure proper and full customer service by the sales force.

The effectiveness of the sales force will in turn depend on many factors viz., the quality of recruitment, training, guidance, supervision, monitoring and above all the compensation offered for the services rendered. One drawback that will exist while using this sales force is that the reach will be limited.

9. Legally, insurance is a *uberrimae fides* contract where one party agrees to compensate the other in consideration of a certain smaller sum. Such compensation is contingent upon happening or non-happening of a certain event.

Uberrimae fides relates to one of the 8 elements of insurance – Utmost Good Faith. *Uberrimae fides* contracts require utmost good faith on both the parties of an insurance contract that ask for voluntary disclosure of all material facts relevant to the subject matter of the contract. Thus, in an insurance contract, both the person who is buying insurance and the insurance company should disclose all material facts at the time of entering into the contract. Any material facts that are not disclosed to the other party having a direct or indirect relationship to the contract will make it null and void.

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The assured must disclose material facts which he knows or ought to know, at the time when he is making or is under the duty to make disclosure. The assured is under such duty until there is a binding contract of insurance made. The question as to whether certain facts are material or not will not be decided by the assured but is to be determined by the views of reasonable and prudent insurer. Thus materiality is a question of fact, to be decided in the circumstances of each case and may be generally taken to embrace every circumstance which would influence the judgment of a prudent insurer in fixing the premium or determining whether he will take the risk and if so, at what premium and on what conditions.

It also means that the person who is buying insurance should disclose all material facts to the insurance company, and it is for the insurance company to determine relevance of each material facts. But in practice, the prospective assured is given a proposal form upon which certain questions relating the risk to be insured are asked. This has considerable bearing upon the question of materiality involved in the non-disclosure and misrepresentation. The express terms that are contained in the proposal form as a rule are called warranties, by which the truth of the answers to proposal form is made the basis to the liability of insurers under the contract. Apart from this, the insurance company is obligated to explain the implication of the clauses in the agreement and further to explain each of the questions of which the answers are sought in the personal statement.

Apart from utmost good faith, there are seven other elements of insurance contract which are listed below:

- Insurable Interest
- Indemnity
- Subrogation
- Warranties
- Proximate cause
- Assignment
- Nomination.

10. In years to come the stock index futures are expected to be extremely liquid given the speculative nature of our markets and the overwhelming retail participation that is expected to be fairly high. The stock index futures will definitely see enhanced volumes in India. It is likely to become one of the most liquid contracts in the world in terms of number of contracts if not in terms of notional value. The advantage to the equity or cash market is the fact that they would become less volatile as most of the speculative activity would shift to stock index futures. The stock index futures market should ideally have more depth, volumes and act as a stabilizing factor for the cash market. Initially the market is witnessing low volumes as it is in its nascent stage. Retail participation will improve with better understanding and comfort with the product whereas the market is yet to witness institutional participation. FIIs have not been able to participate as they are still awaiting certain clarifications pertaining to margins from the RBI. With greater participation, the volumes are expected to improve tremendously with increasing knowledge and acceptability of the instrument. It has been noticed that derivative markets volume is roughly five times the volume of the cash market in the developed markets.

11. The risks of writing options can be summarized as follows:

The writer of an option faces the risk of being assigned an exercise. The implications of this risk for call writers and put writers are as follows:

i. The call writer who has written a call on a stock which he does not own (naked call writer) will end up incurring losses proportional to the increase in the price of the asset above the exercise price because he has to buy the asset from the market at the higher price and deliver it at the lower (exercise) price.

ii. The put writer must have adequate financial capacity and liquidity to buy the stock at the exercise price. This risk of being assigned an exercise is more significant for the writer of an American option because he can be assigned an exercise at any time during the life of the option.

iii. The writer of the covered call foregoes the opportunity to benefit from an increase in the value of the underlying asset above the option premium, but continues to bear the risk of a decline in the value of the underlying interest.

iv. Transactions involving buying or writing of multiple options (like straddles and strangles) and transactions involving buying/writing options in combination with Short/Long positions in the underlying stocks presents additional risks to the investor. The investor attempting such transactions must understand that there is a possibility of incurring losses on both sides of the combination transaction and an increased risk exposure can result when one side of the trade is exercised or liquidated while the other side remains outstanding.

12. Weather changes should be taken not only as a local phenomenon but as an industrial concern. A company must take a proper study of its business to analyze the impact of weather risks on its profitability.

The profitability can be affected by the following factors, as far as weather uncertainties are concerned:

i. Lower production or productivity resulting in lower revenues.

ii. Variation in the price of the final product, as a result of changes in the demand and supply situation.

iii. Increased costs of production.

iv. Increased or decreased prices of inputs.

v. Increased demand for substitute products.

vi. Changed income of the public of the region.

13. Portfolio insurance is essentially a name given to a dynamic hedging strategy using stock index futures. Dynamic hedging strategy is a hedging strategy which requires continuous adjustment of the hedge ratio in response to the market movements. This continuous rebalancing requires periodic buying and selling of stock index futures to achieve the desired short future position. The main goal of the short future positions is to protect a stock portfolio from incurring a loss greater than some predetermined amount, or to put a floor to the portfolio's value. Pension funds, for example, having a fiduciary obligation to pay future retirement benefits, may not want their portfolio to incur more than a certain loss. The objective of portfolio insurance is similar to that associated with purchasing an index put option.

In fact, portfolio insurance seeks to achieve exactly the downside protection that would be obtained by purchasing an index put option. First, we have to calculate an initial hedge ratio by taking account of the several factors: the risk to be hedged, the level of protection desired, the hedging horizon, etc. Whenever the value of the portfolio falls (due to falling stock price), the hedge ratio is increased. If the value of the portfolio rises instead, the hedge ratio should be reduced, possibly to zero. In a falling market, therefore, portfolio insurers sell increasing amounts of stock index futures to generate increasing amount of profits to make-up for depreciation in the value of the original portfolio. In rising markets, portfolio insurers will be buyers of futures. Sometimes this dynamic buying and selling are alleged to be the cause of the excess market volatility. Portfolio insurance can be executed with the help of selling and buying stocks directly. However, use of stock index future is preferred because of the superior liquidity of futures market which is apparent from the fact that a position of more than 100 million can be accomplished in a few minutes with a minimal effect on the market. Again use of the index future lowers the transaction costs and it does not interfere with individual portfolio manager, who is often a party to larger institutional investment strategy.

Portfolio insurance program can be executed with the help of listed index options, but most of the portfolio managers are not in favor of the options because of the disadvantages of option premiums being expensive. If the portfolio being insured contains a mixture of stock and bonds, use of the stock index futures will be more appropriate.

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14. The following are some of the generic approaches for managing risks:

- Risk avoidance
- Loss control
- Combination
- Separation
- Risk transfer
- Risk retention
- Risk sharing.

Risk Avoidance: An extreme way of managing risk is to avoid it altogether. This can be done by not undertaking the activity that entails risk. For example, a corporate may decide not to invest in a particular industry because the risk involved exceeds its risk bearing capacity. Though this approach is relevant under certain circumstances, it is more of an exception rather than a rule. It is neither prudent, nor possible to use it for managing all kinds of risks. The use of risk avoidance for managing all risks would result in no activity taking place, as all activities involve risk, while the level may vary.

Loss Control: Loss control refers to the attempt to reduce either the possibility of a loss or the quantum of loss. This is done by making adjustments in the day-to-day business activities. For example, a firm having floating rate liabilities may decide to invest in floating rate assets to limit its exposure to interest rate risk. Or a firm may decide to keep a certain percentage of its funds in readily marketable assets. Another example would be a firm invoicing its raw material purchases in the same currency in it which invoices the sales of its finished goods, in order to reduce its exchange risk.

Combination: Combination refers to the technique of combining more than one business activities in order to reduce the overall risk of the firm. It is also referred to as aggregation or diversification. It entails entering into more than one business, with the different businesses having the least possible correlation with each other. The absence of a positive correlation results in at least some of the businesses generating profits at any given time. Thus, it reduces the possibility of the firm facing losses.

Separation: Separation is the technique of reducing risk through separating parts of businesses or assets or liabilities. For example, a firm having two highly risky businesses with a positive correlation may spin-off one of them as a separate entity in order to reduce its exposure to risk. Or, a company may locate its inventory at a number of places instead of storing all of it at one place, in order to reduce the risk of destruction by fire. Another example may be a firm sourcing its raw materials from a number of suppliers instead of from a single supplier, so as to avoid the risk of loss arising from the single supplier going out of business.

Risk Transfer: Risk is transferred when the firm originally exposed to a risk transfers it to another party which is willing to bear the risk. This may be done in three ways. The first is to transfer the asset itself. For example, a firm into a number of businesses may sell-off one of them to another party, and thereby transfer the risk involved in it. There is a subtle difference between risk avoidance and risk transfer through transfer of the title of the asset. The former is about not making the investment in the first place, while the latter is about disinvesting an existing investment.

The second way is to transfer the risk without transferring the title of the asset or liability. This may be done by hedging through various derivative instruments like forwards, futures, swaps and options.

The third way is through arranging for a third party to pay for losses if they occur, without transferring the risk itself. This is referred to as risk financing. This may be achieved by buying insurance. A firm may insure itself against certain risks like risk of loss due to fire or earthquake, risk of loss due to theft, etc. Alternatively, it may be done by entering into hold-harmless agreements. A hold-harmless agreement is one where one party agrees to bear another party's loss, should it occur. For example, a manufacturer may enter into a hold-harmless agreement with the vendor, under which it may agree to bear any loss to the vendor arising out of stocking the goods.

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Risk Retention: Risk is retained when nothing is done to avoid, reduce, or transfer it. Risk may be retained consciously because the other techniques of managing risk are too costly or because it is not possible to employ other techniques. Risk may even be retained unconsciously when the presence of risk is not recognized. It is very important to distinguish between the risks that a firm is ready to retain and the ones it wants to offload using risk management techniques. This decision is essentially dependent upon the firm's capacity to bear the loss.

Risk Sharing: This technique is a combination of risk retention and risk transfer. Under this technique, a particular risk is managed by retaining a part of it and transferring the rest to a party willing to bear it. For example, a firm and its supplier may enter into an agreement, whereby if the market price of the commodity exceeds a certain price in the future, the seller foregoes a part of the benefit in favor of the firm, and if the future market price is lower than a predetermined price, the firm passes on a part of the benefit to the seller. Another example, is a range forward, an instrument used for sharing currency risk. Under this contract, two parties agree to buy/sell a currency at a future date. While the buyer is assured a maximum price, the seller is assured a minimum price. The actual rate for executing the transaction is based on the spot rate on the date of maturity and these two prices. The buyer takes the loss if the spot rate falls below the minimum price. The seller takes the loss if the spot rate rises above the maximum price. If the spot rate lies between these two rates, the transaction is executed at the spot rate.

15. **The Modelling Process:** The following are the major steps in the process of using a model to arrive at the optimal decision:

- Feasibility study
- Model construction
- Compatibility of the model with the tools used
- Model validation
- Implementation
- Model revision
- Documentation.

Feasibility Study: The foremost step in developing a model is to ascertain the feasibility of a model assisting the decision-making process. The various points that are required to be considered are

- Whether the decision under consideration is a one-time process, or is required to be taken as a routine measure.
- The suitability of the area in which the decision is required to be made, to be supported by a model.
- The possibility of all the relevant variables being unambiguously identified.
- The possibility of all the variables being built-in into a single model.
- The expected effectiveness of the model.
- The acceptability of a model replacing human judgment to the management.
- The possibility of obtaining the required data on an ongoing basis.
- The possibility of integrating the model with the normal decision-making process.
- The costs involved with setting up and running the model, and its comparison with the expected benefits.

If it is feasible to construct an efficient and effective model for the decision process under consideration, and if the model can be easily integrated with the process, the firm can proceed to the next step of constructing the model.

Model Construction: The construction of the model depends on a number of factors. Some of these are

- The decision to be made using the model
- The issues that are relevant for making the decision
- The way in which these issues and factors affect the decision
- The external factors that restrict the decision-making process.

Depending on these factors, the input requirement for the model is identified and the numerical and theoretical relationships between variables are specified. This is followed by development of the structure of the model.

Model Compatibility: Once the model is in place, it needs to be made compatible to the tools to be used to implement it. For example, if a particular model is to be solved using computers, the model needs to be programmed and converted to a language that the computer understands.

Model Validation: A number of test runs are conducted on the model to check whether it produces reasonably accurate results. The test runs may use actual past data of the input variables, and the results generated by the model compared to the actual results. Alternatively, the model may be tested by using probability distributions. Test running a model checks the effectiveness of the structure of the model, as well as its predictive ability.

Implementation: The implementation of a model includes integrating it with the normal decision-making process. Further, it needs to be ensured that the results generated by the model are relevant enough for the decision-maker to take them into consideration while making a decision.

Model Revision: No model remains useful for an indefinite period. The relationships between variables that form a basis for the model may change over a period of time. External factors affecting a model may also change. Use of the model over a period may provide an insight into its drawbacks. It is necessary that such changes are noted and the model periodically revised to accommodate them. Unless a model is continuously updated, it may lose its relevance.

Documentation: Documentation is a way of institutionalization of the knowledge created during the process of developing and installing a model. It involves making detailed, systematic notes at all the stages of the process. The records should be maintained right from the stage when the need for the model was felt, detailing the factors that gave rise to the need. The various ideas considered at different stages need to be documented along with the reasons for their acceptance or rejection. The various problems faced during the development and implementation of the model, together with their solutions should also form a part of the records. Documentation also helps in proper communication between the members of the team working on the development of the model. In addition, it makes the process of revising the model less tedious.

While developing and implementing models, certain issues need to be kept in mind. It is not just necessary to specify the objectives of the model, it is also necessary to build the relative importance of the different objectives into the model. For example, the objective may be to maximize the profits of the firm, while restricting the debt taken by it to a certain percentage of the total assets. The model should specify the objective (maximum profits or limited debt) that would be held supreme, if there were a clash between the two. Another important point to be remembered is that the model should preferably focus on some key aspects, rather than be a collection of all relevant and irrelevant data. A focused model is more likely to generate effective decisions.

16. **Option Combinations:** There are a variety of option combinations which traders can adopt to suit their risk-return profile. These option strategies would help the trader to profit from the unexpected movement of prices of the underlying asset in either directions.

Straddle: A straddle involves a call and a put option with the same exercise price and the same expiration date. A straddle buyer buys a call and a put option and the seller sells a call and a put option at the same exercise price and the same expiration date. The maximum loss associated with the long straddle position is the cost of the two options (the premium paid for buying the options). Profit potential is unlimited when the prices of the underlying

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asset rise significantly and limited when it falls significantly. The pay-off of a straddle buyer is given below:

Pay-off of Straddle
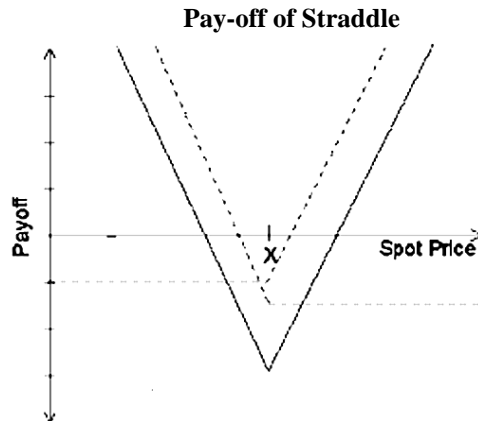
Strangle: It is a combination of a call and a put with the same expiration date and different strike prices. If the strike prices of the call and the put options are X_1 and X_2, then a strangle is chosen in such a way that $X_1 > X_2$.

Assume that you buy a call and a put option on a particular stock with strike prices $35 and $30 respectively. Let the cost of the call and the put be $3 and $5 respectively. Then your initial outflow is $8. If you have to benefit from your strategy, the total pay-off should exceed $8. You will exercise your call option only when the price of the stock at expiration goes above $38. Similarly, you will exercise your put option only when the price of the stock at expiration goes below $25. To break even, (to reach a position of no loss and no profit) the stock's price at expiration should be below $22 or above $43. If the price at expiration falls some where between $22 and $43 then you do not benefit from your strategy. In fact within this range you are exposed to loss. Outside this range you have a profit potential. You would have guessed by now that the profits and loss on a short position in a strangle would be the reverse of that of the long position. The pay-off of a strangle buyer and seller are given below.

Pay-off of Strangle
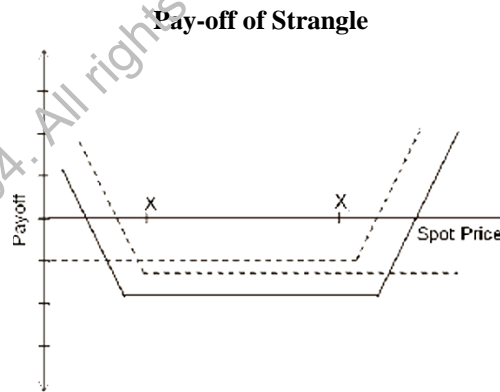
17. **Abandonment Analysis:** Sometimes, it may be better economically to abandon a project well before the useful life. The value of the project as on the date of abandonment can be compared to the exercise price, the value that can be realized either by sale or alternative use will be the stock price and the option to abandon can be valued as a put option.

Timing Decisions: Consider a project which requires an investment of Rs.180 crore. If set-up immediately, it gives inflows with a present value of Rs.200 crore. If postponed by a year, the present value of cash flows may change to Rs.270 crore or Rs.180 crore. The probability of changing to Rs.270 crore is 35 percent and for Rs.180 crore it is 65 percent.

The project can be viewed as a call option with an exercise price of Rs.180 crore. If exercised immediately, its pay-off is Rs.200 crore, and a year latter, it is Rs.(270 x 0.35 + 180 x 0.65 = 211.50) crore. It is, therefore, beneficial not to exercise the option immediately.

It should be remembered that the analysis is based on the assumption that the present value of cash flows is comparable in its movements to the stock prices and that the company will have the necessary funds to invest after three years. Another serious conceptual defect arises from the method of arriving at the value of the option. The derivation was based on the fact that holding the stock (or the underlying asset) and borrowing a suitable amount can provide the same pay-off as a call option. In such a situation, if the pay-offs from the two are not equal, possibilities of arbitrage arise. There should exist as good a market for real assets as for stocks, to avoid arbitrage opportunities which does not. In fact, many assets are difficult to trade in.

The application can, however, be justified from a different angle. Assume that for each capital investment project, there exists a traded option with the same risk characteristics, that is, the same volatility and exercise period. If we know how the traded option is valued by the market, we can value the capital investment option as well. It is not necessary that such an option should exist. If we can value a hypothetical option with the same characteristics, our job is done.

18. **Uses of Value at Risk**

   i. Initially, Value at Risk was used as an information tool to communicate to the management a feeling of the exposure to changes in the market prices or rates. After market risk started being implemented in the actual risk control structure, VaR is being used to calculate and measure the risk adjusted performance and compensation, in addition to remaining a very powerful management information system as far as the risks of investment are concerned.

   ii. Value at Risk is also important in identifying the effects caused by substantial future movements to the value of the portfolio. Based on the measurement made by VaR, the portfolio manager can compare it with the maximum acceptable risk and take appropriate measures either by using derivatives to hedge the position or by changing the portfolio components to reduce the risk in Trading Risk Management.

   iii. Position limits can also be established as a function of risk and a comparison of the positions and risk in different markets can be made on a common scale in Investment Management.

   iv. Firms with market risk measurement systems which apply portfolio diversification theory can lower their project risks.

   v. In 1995, 10 major central banks realized the use of VaR in order to assess the capital adequacy ratio for market risk and started their own in-house VaR modeling. Of course, now this has become a regular practice with most central banks in developed countries.

   vi. As discussed above, VaR can be used in ALM to estimate the changes in the net interest income and economic value of portfolio equity.

   vii. In addition, VaR can be used in Corporate Applications to measure the risk of foreign exchange exposures, interest rate changes, effectiveness of hedging and derivatives portfolio, management of credit risks of each counterparty, evaluation of complex transactions to be undertaken and investment management in overall.

19. The process of development in the derivatives market is a continuing one. New contracts come into existence on an ongoing basis in the market every month. New exchanges are opened for business. Over 50 exchanges throughout the world now trade in some form of derivatives or the other. At the same time, the OTC market has developed a vast array of products that can be customized to suit any risk/reward profile in almost every market. All the derivatives products like Swaps, FRAs, Options can now be purchased from a large number of professional market makers and brokers on different underlying assets. There are also derivatives whose underlying assets themselves are derivatives.

The development of these markets has enabled institutional investors, bank treasurers and corporate CFOs to manage risks more efficiently and to speculate on them if they wish. Treasurers now have no excuse for unexpected surges in interest expense, translational loss or real exchange losses. Instruments now exist that allow them to fix a budgeted rate, insure

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against catastrophic rate changes and participate in beneficial movements. Portfolio managers can now execute investment decisions without going to the asset market, which may be illiquid or expensive for an individual market participant. With derivative instruments, corporates can alter or synthesize assets and liabilities, quickly and efficiently without much cost. Now they can express their views on interest rate or exchange rates by entering directly into the market.

Derivative markets are able to bring the dividend and disparate markets together. These markets and instruments have created an efficient system for transfer of risk throughout the global financial system. Market makers became very sophisticated and they are ready to take any type of risk which a customer wants to hedge. Far from being a destabilizing force, derivative instruments can claim to be having moderating influence on world financial markets, enabling all users of those markets to position themselves according to their views. The derivatives market is now mature. There are now liquid exchange-traded contracts on all the major commodities, currencies and most of the key stock indices. The OTC market offers two-way prices for swap and option products on wider range of underlying assets. A large number of banks, financial institutions and brokers can now offer these services while their structures and uses are well-understood by many corporate treasurers and institutional investors. With this level of maturity, the transaction costs in derivatives markets has come down drastically and arbitrage profit for the traders became negligible. Exchange-traded futures and options for some traders became a 'true' commodity product. The markets are so efficient and transparent that there is little scope for large spreads.

All these derivative products have been used effectively by treasury managers for hedging risk. Considering the potential profits in these products the corporates and treasurers, began looking at these products for enhancing their profits. Thus speculation on derivatives slowly became an integral part of the treasury function. The most significant feature (most dangerous too) of the derivatives is that the cash outlay required for taking position is insignificant when compared to the cash outlay required for taking a similar position on the underlying assets.

In the last decade, several major cases of corporate losses were reported in international media due to trading in the derivative markets. Major losers are Barrings Bank, Procter & Gamble and Orange County. These incidents brought in their wake a school of thought which concluded that derivatives are adding to the risk rather than helping in hedging the risk. While there may be temptation to agree, an attempt to have a deeper insight will only highlight the need for strong risk management framework including treasury control and the need for scrupulous adherence to the guidelines. The important thing is to understand the products well and have appropriate controls in place. All the mishaps have taken place only because basic controls were not observed. These mishaps have only emphasized the need for adequate infrastructure, controls and reporting system.

20. The main pure risks can be described as under:

   i.   Property Exposure
   ii.   Liability Exposure
   iii.   Life and Health Exposure
   iv.   Financial Exposure.

Property Exposure: Any business or individual that uses any kind of property whether owned, leased, rented or otherwise is exposed to the risk of loss, theft and damage that may be caused by man-made reasons or natural reasons. Depending on the extent of exposure and damage, the business may be affected.

Liability Exposure: Around the world, liability to any business due to litigation, damages, claims, etc. has become a major issue of concern. Millions of dollars are lost by companies over legal suits and settlements. Such risks are there to an individual also.

Life and Health Exposure: Human beings have a certain death, although the extent of life and its quality cannot be determined. An individual may die while still young or may be

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bed-ridden for most of his life. Some people are healthy while others have to spend a major part of their earnings on health related matters. This exposure leads to loss of earnings for the individual, as well as loss of man-hours to the business to which he is associated.

Financial Exposure: The three exposures mentioned above involve pure risks. Financial exposure can be because of speculative nature also, and should not always be considered as a pure risk, but it still has same problems associated with pure risks. Although the techniques associated with these risks may be different from those used to manage the other risks mentioned above, it remains critical that these risks be identified and assessed in order for the firm to achieve its business goals.

21. **Clearing House Mechanism:** As the futures are exchange traded instruments, the contract obligation is not between the buyer and the seller of the contract even though the contract at the time of initiation is between two parties. Each contract is substituted by two contracts in such a way that clearing house becomes the buyer to every seller and seller to every buyer.

Transaction with Clearing House
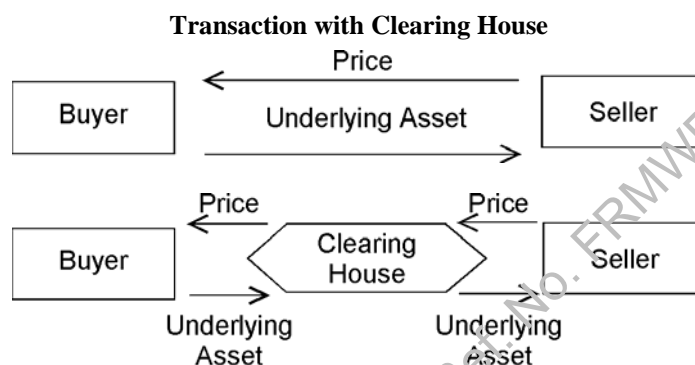
This mechanism effectively removes counterparty risk from the futures transaction. In a transaction where A sells futures to B and B is replaced by the clearing house the credit risk taken by A becomes insignificant. Same is the case for B as well. This means that the credit risk is now assumed by the clearing house instead of the individual. When this happens for all the transactions the credit risk assumed by the clearing house becomes disproportionately high. It becomes necessary for the clearing house to minimize the credit risk. The credit risk of the clearing house is minimized by the imposition of margins. Margins are the amounts which buyers and sellers of futures contracts have to deposit as collateral for their positions. Margins levied on each contract reflect the volatility of the underlying instrument and these margins are adjusted everyday depending on the changes in the prices. If the price of a contract increases, then the buyer of the contract experiences a gain because the value of an asset increases. The gain will be credited to the buyer's account.

In case of a loss, the amount will be debited to the account. This type of adjustment of gains and losses on each day is called marking-to-market.

Clearing House and its Importance: Normally, clearing house is an entity different from the exchange, but it works closely with the exchange for smooth functioning of the day-to-day operations. As the clearing house is the 'de facto' guarantor for all the transactions, it will never have open positions in the market. This situation increases the confidence of the trader which in turn increases volumes of trade and liquidity in the market. Clearing houses undertake many important functions which include maintenance of delivery schedules, delivery of underlying assets, delivery points, etc. If a trader does not close his position till the expiration period, the trader would have to deliver or take delivery of the underlying asset. In this type of situation, the exchange will prescribe a set of rules for delivering the underlying asset. At the same time, if the underlying asset is a commodity then the exchange will specify the grade of commodity that should be delivered and also delivery points where the goods have to be delivered. These points will usually be the warehouses authorized by the exchange. These steps are taken to ensure delivery of an underlying asset with uniform quality as prescribed by the exchange. However, such problem is not seen in case of currencies by virtue of their nature.

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Important Functions of a Clearing House

i.   Ensuring adherence to system and procedures for smooth trading.

ii.   Minimizing credit risk by being a counterparty to all trades.

iii.   Accounting for all the gains/losses on daily basis.

iv.   Monitoring the speculation margins.

v.   Ensuring delivery of payment for the assets on the maturity date for all the outstanding contracts.

It was mentioned earlier that the clearing house will be the guarantor for all the transactions that take place in the exchange and hence stipulates margins to manage the increased default risk. These margins are of two types:

i.   Initial margin

ii.   Maintenance margin.

When a trader experiences a loss on account of the outstanding contracts, the loss is set-off on the same day with the margin maintained. Simultaneously, a demand is made on the trader for restoring the level of margins. Thus, the risk involved in each contract is limited to one day's loss.

22. **Assumptions of Black and Scholes Model:** It is necessary to understand the implication of the assumptions made by the Black and Scholes model. Some of the assumptions of the model are:

   i.   **The stock pays no dividends during the option's life:** Most companies pay dividends to their shareholders, so this might seem a serious limitation to the model considering the observation that higher dividend yield elicit lower call premiums. A common way of adjusting the model for this situation is to subtract the discounted value of a future dividend from the stock price.

   ii.   **Markets are efficient:** This assumption suggest that people cannot consistently predict the direction of the market or of an individual stock. The market operates continuously with share prices following a continuous process. To understand what a continuous process is, you must first know that a Markov process is one where the observations in time period t depend only on the preceding observations. An process is simply a Markov process in continuous time. If you were to draw a continuous process, you would do so without picking the pen up from the piece of the paper.

   iii. **There are no transaction costs or taxes:** Usually market participants do have to pay a commission to buy or sell options. Even floor traders pay some kind of fee, but it is usually very small. The fees that individual investors pay is more substantial and can often distort the output of the model.

   iv.   **Interest rates remain constant and known:** The Black and Scholes model uses the risk-free rate to be constant and known rate. In reality there is no such thing as the risk-free rate, but the discount rate on the US Government Treasury Bills with 30 days left until maturity is used to present it. During period of rapidly changing interest rates these 30 days rates are often subject to change, thereby violating one of the assumptions of the model.

   v.   **Returns are lognormally distributed:** The assumption underlying the Black and Scholes model is that stock prices follow random walk which means that proportional changes in the stock price in a short period of time are normally distributed. This in turn implies that the stock price at any future has what is known as a lognormal distribution, whereas a variable on a normal distribution curve can be either positive or negative, with the lognormal distribution it can only be positive. A variable with a lognormal distribution has the property that its natural logarithm is normally distributed.

Lognormal Distribution
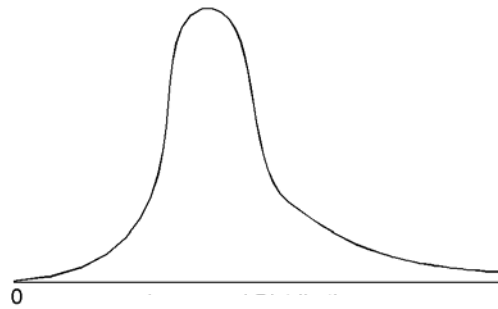
Normal Distribution
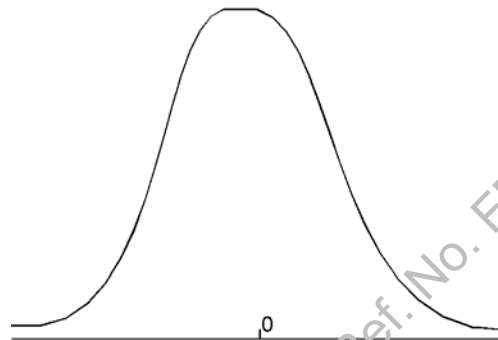
vi **European exercise terms are used:** European exercise terms say that the option can only be exercised on the expiration date. American exercise terms allow the option to be exercised at any time during the life of the option, making American options more valuable due to their greater flexibility. This limitation is not a major concern because very few calls are ever exercised before the last few days of their life. This is true because when you exercise a call early, you forfeit the remaining time value on the call and collects the intrinsic value. Towards the end of the call, the remaining time value is very small, but the intrinsic value is the same.

23. The motivations that lead companies to undertake financial swap are:

Quality Spreads: One of the important reasons for entering into a swap transaction is to reduce the interest cost, the reduction in the interest cost can be achieved because of the quality spreads prevailing in the market. Quality spread is the difference between borrowing power of two parties in the market. For example, Firm X can borrow at a fixed rate of 10%, while Firm Y can borrow at a fixed rate of 12%. This difference between the interest rates of X and Y is called the quality spread. This difference in the interest rates arises because of the difference in the credit ratings of the two firms. In the above case, firm X could have been rated better by the market in comparison to the firm Y.

The quality spreads exist in the market due to following reasons:

Credit Rating: As stated earlier, the firm with a higher credit rating attracts a lower rate of interest. However, when the firm faces a floating rate market the risk premium demanded will be low relative to fixed rate market since the interest rate in case of floating rate market moves in line with the market. Hence the spread in floating rate market and fixed rate market are likely to differ.

Market Saturation: Market saturation is one of the important reasons, which results in differential spreads to prevail. For example, IDBI and ICICI raised money through debt issues in the domestic market in the recent past. If this continues the market is likely to reach a stage where the acceptability of the paper may be low not necessarily because the quality of the paper is low, but because the market has seen too much of the same paper. This can result in the market demanding a return higher than what would be otherwise considered as normal. In such a situation, they can raise the funds abroad and swap them

for the domestic currency. By this mechanism the firm can achieve the same objective of the borrowing funds in the domestic market.

Financial Norms: The financial leverage of a firm adds to the financial risk thereby influencing the risk premium demanded. However, what is considered as an acceptable level of leverage varies from market-to-market. It is often said that high leverage is an acceptable proposition in the Japanese markets though it might have undergone some change after the real estate bubble. In such a situation, a firm with a particular level of leverage may be able to get a better rate in overseas market when compared to the domestic market thus resulting in the prevalence of quality spreads.

Currency Risk Management: Managing the currency risk is vital for modern corporates as they have cash inflows and outflows in different currencies. A corporate can use different methods to manage its currency risk. One of the methods for corporates to manage the currency risk is by entering into currency swaps. Let us take an example: A firm whose exports are denominated in GBP has borrowed funds in dollars in view of the low interest rates in the Euro dollar market. However, since its cash inflows are in GBP the firm is exposed to exchange risk. At this point the firm can change its loan portfolio into GBP by entering into currency swap so that both receivables and payables will be in the same currency.

Interest Rate Risk: Swap will give an opportunity for the corporates to manage the interest rate risks by entering into interest rate swaps. If a corporate borrowed in floating rate and it expects that interest rates will increase, then the corporate can enter into an interest rate swap as a fixed rate payer. Due to this it will be able to manage the increase in interest rates more efficiently. Example: Firm X borrowed floating rate funds at LIBOR + 1%. After sometime if the firm feels that the interest rate may increase it may prefer borrowing in fixed rate. The firm can achieve this by undertaking either of the following activities.

i.   Repay the existing loan and borrow at fixed rate.

ii.   Enter into interest rate swap.

The first choice will be more cumbersome because the firm has to go to the market again to borrow at fixed rate, which may not be cost effective to firm. In the second choice, the firm has more flexibility in managing its existing interest rate risk. Also, there will not be any significant costs involved in entering into the swap.

24.   Volatility is the one input in a theoretical option pricing model which cannot be directly observed. But many option strategies require an accurate prediction of volatility. Therefore, an option trader needs some method of determining whether his/her expectations about volatility are actually realized in market price.

Future Volatility: Future volatility is that which every trader wants to know, the volatility that best describes the future distribution of prices of an underlying contract. When future values can be accurately predicted then future volatility can be calculated and used in the theoretical pricing model to arrive at an accurate theoretical value. But the uncertainty factor proves impractical to use future volatility.

Historical Volatility: Though future is unpredictable with certainty, you can make a wise guess about the future volatility from the historical data. The latter will serve as an attracting point to make an estimate of future volatility. Additional information will further help in arriving at a more realistic figure for future volatility. The two important parameters to be considered for calculation of historical volatility are historical period over which the volatility is to be calculated and the time interval between successive price changes. The longer the historical period the better the volatility estimate. To become completely familiar with volatility characteristics of a contract a trader may have to examine a whole variety of historical time periods.

Implied Volatility: In a theoretical option pricing model, the parameter values from historical data are substituted to arrive at a price. But this is not the most common way of computing the option price because it is difficult to measure the volatility of the underlying asset. Historical volatility may not be an accurate estimate and it changes over time. A direct measurement of volatility is, therefore, difficult in practice. Nevertheless, the option

prices are quoted in the market. This implies that even if you do not know the volatility, the market knows it. For instance, consider the Black-Scholes formula. The inputs are interest rate, the price of the underlying asset, exercise price, time to expiry and the volatility of the price of the underlying. Except volatility all the other parameters can be easily measured and are either quoted constantly or specified in the contract itself. Consider a call option. Since a call option price increases with volatility there is a direct relationship between the two. We can take the option price quoted in the market and working backwards deduce the market's opinion about the volatility of the option over the remaining life of the option. This volatility arrived from the quoted price of the option is called the implied volatility.

The calculation of implied volatility is not direct and it should be arrived by trial and error. On an initial assumption of a particular value of volatility, the option price is calculated using Black-Scholes formula. If the calculated price is the same as the quoted price, then assumed volatility is the implied volatility; if not, the same procedure is repeated with another volatility data until we arrive at a value for which the calculated price equals the quoted price. One unusual feature of implied volatility is that it does not appear to be constant across exercise prices. That is, if the value of the underlying asset, the interest rate and the time to expiry are fixed the prices of options across exercise prices should reflect a uniform value for the volatility. But in practice, this is not the case, even puts and calls give slightly different implied volatilities. The following figure shows the implied volatility as a function of exercise price. It can be observed how the volatility of the options deeply in the money is greater than for those at-the-money. This is called the smile effect.

Smile Effect
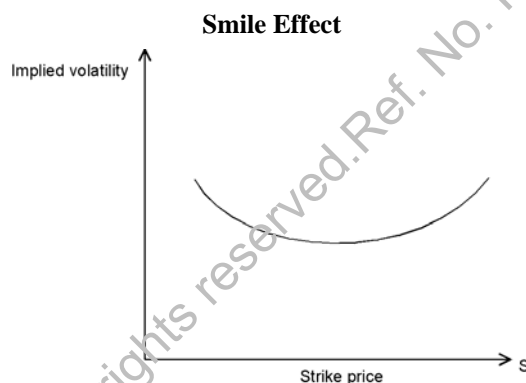
In practice, volatility is neither constant nor predictable for time scales of more than a few months. This limits the validity of any model that assumes the contrary. This problem may overcome by pricing options with implied volatility. Thus, one trading strategy is to calculate implied volatilities of all options on the same underlying asset and the same expiry date and then buy one with the lowest volatility and sell one with the highest with the belief that prices move in such a way that implied volatilities become more or less comparable and the trader makes a profit on his/her portfolio.

Causes of Volatility

There are two main reasons for volatility on a stock price in the market:

i.   Trading of the stock in the stock markets which implies that volatility will be more when the markets are operational as compared to the time when markets are closed.

ii.   Information obtained by the investors about the expected future performance of the company or the stock, which affects the stock prices.

While these are two different assumptions about the reasons for volatility, various studies conducted on the subject implied that the volatility was mainly as a result of trading rather than information about future expected returns.

25.   There are two ways of valuing a swap:

i.   Considering the swap as a package of long-term forward contracts.

ii.   Considering the swap as a portfolio of two bonds.

Valuation of Interest Rate Swaps: In the case of the plain vanilla interest rate swap, the fixed leg should be considered as a fixed coupon bond while the floating rate should be considered as a floating rate note.

Assuming thus that at maturity the fixed and floating parties give each other equal amount of money, the pricing of the swap becomes simply the value of the fixed coupon bond minus the value of the floating rate note.

$V = F_B - F_F$

Where,

V = Value of the swap

F_B = Value of fixed coupon bond

F_F = Value of floating rate note

As market rates change after the initial pricing of the swap, the values of both the fixed leg and the floating leg will be different. One should be aware that the cash flows on the fixed leg do not change but the discount factor changes and hence the value. On the floating side, both the cash flows and the discounting factor change and hence the value changes. Such a swap in which the present values of the fixed leg and the floating leg are not equal is called an off-market swap. This implies that the value of an off-market swap can be positive or negative and not zero.

Valuation of Currency Swaps: In the case of currency swaps, the valuation can be done considering the swap as a portfolio of two bonds. So, the swap value will be the difference between the current values of both the bonds, as per the following formula

$V = P_F - P_L$

Where,

V = Value of the swap

P_F = Value of foreign currency bond

P_L = Value of local currency bond

The practical difficulty encountered in this problem is the determination of interest rates used on both legs of the swap. For each cash flow on the fixed rate leg, we should use a zero coupon term structure.

26. **Swap Risks:** While the earnings of the swap bank are from the bid-ask spread of swaps and the fees charged (upfront fees), it has to entail the following risks, which are inherent to the swap business and are mostly inter-related:

i. **Interest Rate Risks:** Interest rate risks arise mostly on fixed rate legs of swaps. While the floating rate interest can be periodically adjusted to the prevailing interest rates, the fixed rate remains constant, a change in the level of interest rates in the market not accompanied by a change in the yield of debt instruments of the same time period as the interest rates will entail interest rate losses to the bank. Unless the swap bank is fully hedged, losses will be incurred.

ii. **Currency Exchange Risks:** Currency exchange risks happen when there is an exchange rate commitment given to one party and there is a steep change in the exchange rate between the currencies in the swap. If the swap bank is not able to match the counterparty well in time, it will incur losses due to the exchange rate difference.

iii. **Market Risks:** Market risks occur when there is difficulty in finding a counterparty to a swap. Usually, longer maturity swaps have less takers and vice versa. Lower the number of takers, higher the risks of losses.

iv. **Credit Risks:** Credit risks are those risks which the swap bank has to bear in case the counterparty to a swap defaults on payment due to bankruptcy or any other defaults, legal or otherwise. The bank continues to be obliged to pay the other party of the swap, irrespective of the fact whether the former party defaulted or not. Market risks and credit risks together amount to default risks of the bank.

v. **Mismatch Risks:** Mismatch risks take place when the swap bank comes across mismatches in the requirements of both counterparties to the swap. Usually, banks have a pool of swaps and have no difficulty in finding matches, but if no party is found, the risk of mismatch losses is there. This risk is further aggravated in case one of the parties defaults.

vi. **Basis Risks:** Basis risks take place mostly in floating-to-floating rate swaps, when both the sides are pegged to two different indices and both the indices are fluctuating and there is no proper correlation between both.

vii. **Spread Risks:** Spread risks happen when the spread changes over the time period the parties are matched. The spread risk is not the same as interest rate risk, as spreads may change as a result of change in basis points, while the interest rate may still remain constant.

viii. **Settlement Risks:** Settlement risks take place when the payments of currency swaps are made at different times of the day mainly because of different settlement hours in capital markets of two countries involved in the currency swap. If a limit on the size of the settlement is placed for each day, this risk is minimized.

ix. **Sovereign Risks:** Sovereign risks are those risks that can take place if a country changes its rules regarding currency deals. It mostly happens in the underdeveloped or developing countries which tend to have more political instability than the developed world.

27. In a call option, if the investor decides to exercise his right, then he will buy the shares of the company at the exercise price. Should he do so irrespective of the current market price of the stock? No, he should not. The explanation for different market prices of the stock is given below.

For a contract, assume that the option premium was Rs.3, the exercise price Rs.25 and the current market price of the stock is Rs.23. This data remains the same for all the following three cases. Each contract stands for 100 shares.

Case 1: After three months, assume that the market price of the stock rose to Rs.30. At this point, should the investor exercise the option? Yes, he should. The pay-offs are shown below:

Premium	Exercise price	Total outgo	Worth of stock at current price	Profit/(Loss)
300	2500	2800	3000	200

In this case, the trader made a profit of Rs.200. The explanation is as follows: The trader by exercising the option has received stock worth Rs.3,000 by paying only Rs.2,500. That is, a profit of Rs.500. This, lowered by the premium will be Rs.200. Therefore, the trader will make a profit whenever the stock price exceeds the sum of option premium and the exercise price. It is beneficial for him to exercise the option as long as the stock price is greater than the exercise price.

Case 2: In this case, assume that the stock price has increased to Rs.28. Should he exercise the option? He should. The pay-offs are shown in the following table:

Premium	Exercise price	Total outgo	Worth of stock at current price	Profit/(Loss)
300	2500	2800	2800	0

In this case, the trader by exercising the option has made a profit of Rs.300. However, this profit is negated by the option premium. Looking at it from another angle, if the investor buys the stock in the market, he will have to pay Rs.28, whereas he can get it for Rs.25 on exercising the option.

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Case 3: Now, assume that the current stock price is Rs.21. Should the investor now exercise his option and what would be the profit/loss if he exercises his option and if he does not? The pay-offs are shown in the following table:

Premium	Exercise price	Total outgo	Worth of stock at current price	Profit/ (Loss)
300	2500	2800	2100	(700)
300	–	300	–	(300)

We observe that if the tender exercises his option, he will incur a total loss of Rs.700 and even if he does not exercise the option, the loss will be equivalent to premium. That is, if the stock price falls below the exercise price, the investor loses and his maximum loss is equal to the premium he pays.

Put Options: In case of put options, a buyer will make a profit if he exercises his option when the stock's current price is lower than the exercise price. In this situation, the writer will take delivery of the stock whose worth is lower. We consider three cases as above. The option price (Rs.3) and the exercise price (Rs.25) remains the same for all the three cases.

Case 1: Assume that the current market price is Rs.21. Should the buyer of the option exercise it? Yes, he should. The pay-offs are shown in the table.

Premium	Exercise price	Total inflow	Worth of stock at current price	Profit/(Loss)
300	2500	2200	2100	100

The explanation is as follows: On buying the option, the trader pays Rs.300. On exercising the option, the trader could manage to make a profit of Rs.400 as the price of the stock in the market is Rs.21. Therefore, Rs.400 reduced by Rs.300, he has a total profit of Rs.100. Thus, when the current price of the stock is lower than the exercise price less the premium, the trader makes a profit.

Case 2: Assume that the stock's current market price is Rs.22. Should the buyer exercise the option? Yes, he should. Pay-offs are shown in the table that follows:

Premium	Exercise price	Total inflow	Worth of stock at current price	Profit/(Loss)
300	2500	2200	2200	0

In this case, the buyer paid Rs.300 as option premium. On exercising the option, he made a profit of Rs.300 as the market price of the stock is Rs.22. Therefore, whatever profit was made on exercising the option was negated by the option premium paid. As a result, there was no profit for the trader. Therefore, we conclude that when the exercise price of the contract equals the sum of premium paid and the current price of the stock, the trader just manages to recover his investment.

Case 3: Assume that the stock's current market price is Rs.27. The pay-offs are shown in the table.

Premium	Exercise price	Total inflow	Worth of stock at current price	Profit/(Loss)
300	2500	2200	2700	(500)
300	–	(300)	2700	(300)

In this case, the trader incurred loss. This is because the buyer already paid the premium of Rs.300. As the price of the stock increased, it will be a wise decision not to exercise the option. At least by selling the stock in the exchange, the trader can recover the premium and make profits as a part of capital appreciation. Therefore, the trader makes a loss when the current market price of the stock is greater than the exercise price. His maximum loss is, again, limited to the premium paid as the option is allowed to lapse.

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28. There are various costs involved in risk. These can be segregated as risk identifying costs, risk handling costs, actual losses, social costs, loss financing costs, loss control costs and cost of residual uncertainty. Let us discuss the same briefly.

    i. **Risk Identifying Costs:** Risk Identifying Costs are those costs which an enterprise incurs to identify and analyze the risk like fees for consultants. Given the fact that most preventive measures are estimated on *ex ante* basis, risk identifying costs are estimates of the cost of the losses.

    ii. **Risk Handling Costs:** After the risks are identified, certain expenses of handling them are to be incurred like insurance premiums, alarm installation and loss prevention devices, etc. in addition to the man hours spent on risk handling.

    iii. **Actual Losses:** Actual losses imply direct as well as indirect losses. Damages caused by fire, death of personnel, injuries, loss of production and finished stocks are direct losses while indirect losses imply productivity reduction, stoppages etc. which will happen if the fire takes place.

    iv. **Social Costs:** These are the costs that the company may have to undertake to compensate the society for whatever damages may be caused by its actions or by pure risks. For example, Union Carbide had to pay millions of dollars as compensation to the society because of the poisonous gas leak at Bhopal in 1984.

    v. **Loss Financing Costs:** These costs also include insurance policies, hedging arrangements and other contractual risk transfers. The same have been discussed in more detail in the next chapters.

    vi. **Loss Control Costs:** Loss control costs are the increased precautions and limits on the risk activities in order to reduce the chances of occurrence of risks. For example, proper timely maintenance of machinery can reduce the breakdowns and chances of accidents.

    vii. **Residual Uncertainty Cost:** After the magnitude of losses are eliminated through various measures like insurance policies, loss control, internal risk reduction, etc. there are certain risks that still remain uncovered. These are usually small in nature and are known as residual uncertainty risks. The costs involved with residual uncertainty risks are called residual uncertainty costs. For example residual uncertainty about certain risk may make the staff uncomfortable about the future and they may demand higher wages to continue with the company. Generally shareholders, employees and other stakeholders are affected by residual uncertainty costs.

29. **Management of Currency and Interest Rate Risk**

    Currency and interest rate risk can be managed using both external and internal techniques. The external techniques are mostly dependent on the use of derivatives. A company may use products like forwards, futures, options and swaps for managing these risks. For example, an exporter who is expecting to receive $1 million at the end of 6 months is exposed to currency risk. He may hedge this risk by selling the foreign currency in the forward market. Alternatively, he may sell futures contracts for the relevant amount. Further still, the exporter may buy a put option for the foreign currency. Under the last alternative, while he limits his downside risk, he retains the upside potential. Similarly, a financial institution that is exposed to interest rate movements because it has fixed rate investments financed through floating rate borrowings, may enter into a swap transaction whereby it pays interest on a fixed rate basis and receives interest on a floating rate basis.

    In addition to these external hedging techniques, there are a few internal hedging techniques that are available for managing currency risk. These are exposure netting, leading and lagging, and choosing the currency of invoice. Exposure netting refers to creation of exposures in the normal course of business which offset the existing exposures. Leading refers to advancing a payment and lagging refers to postponing a payment. This is done in anticipation of exchange rate movement. A company may lead a payment that is due in a currency which is expected to appreciate. Similarly, it may lag a payment that is due in a currency which is expected to depreciate. Thus, while the company does not have to pay a higher amount due to the subsequent appreciation of the foreign currency, it ends up paying a lesser amount due to the depreciation of the foreign currency. A firm can also

manage exchange risk by invoicing all its exports and imports in the domestic currency. Alternatively, it may invoice its exports in a currency that is expected to appreciate, and its imports in a currency that is expected to depreciate. However, it needs to be remembered that the other party is likely to factor in these considerations while arriving at the acceptable price.

The internal techniques of managing interest rate risk form a part of asset-liability management.

Marshall and Bansal describe asset-liability management as "an effort to minimize exposure to price risk by holding the appropriate combination of assets and liabilities so as to meet the firm's objectives and simultaneously minimizing the firm's risk". Asset-liability management can be used to manage both interest rate risk and exchange risk. It can be used in addition to, or in the place of the risk management tools described above. However, generally asset-liability management is used to manage interest rate risk as a complementary tool to the other tools.

30. An asset or liability must satisfy the following criteria if it is to be designated as a hedging item:

1. The single item (or portfolio of similar items) must be specifically identified as hedging all or a specific portion.

   a. If similar items are aggregated and hedged, each item has to share the risk exposure that is being hedged (i.e. each individual item must respond in a generally proportionate manner to the change in fair value).

   b. A specific portion must be one of the following:

      i. A percentage of the total asset, liability or portfolio.

      ii. One or more selected contractual cash flows: For instance, the present value of the interest payments due in the first two years of a 4-year debt instrument;

      iii. An embedded put, call, cap or floor that does not qualify as an embedded derivative in an existing asset or liability;

      iv. Residual value in a lessor's net investment in a sales-type or direct financing lease.

2. The item has an exposure to fair value changes that could affect earnings.

3. The item is not:

   a. Re-measured with changes reported currently in earnings, for example, a foreign currency denominated item;

   b. A minority interest;

   c. A firm commitment to enter into a business combination or to acquire or dispose of a subsidiary; a minority interest; an equity method investee; or

   d. An equity method interest classified in stockholder's equity.

4. The item is not a held-to-maturity debt security unless the hedged risk is for something other than for fair value changes in market interest rates or foreign exchange rates; examples include hedges of fair value due to changes in the obligor's creditworthiness, and hedges of fair value due to changes in a prepayment option component.

5. If the item is a non-financial asset or liability (other than a recognized loan servicing right or a non-financial firm commitment with financial components), the designated hedged risk is the fair value change of the total hedged item (at its actual location, if applicable); FASB-133 stipulates that the price of a different location cannot be used without adjustment.

6. If the item is a financial asset or a liability; a recognized loan servicing right or a non-financial firm commitment with financial components, the designated hedge risk arises out of changes in fair value in:

   a. The total hedged item;

   b. Market interest rates;

c. Related foreign currency rates;

d. The obligor's creditworthiness; or

e. Two or more of the above other than a.

Prepayment risk for a financial asset cannot be hedged but an option component of a pre-payable instrument can be designated as the hedged item in a fair value hedge. Embedded derivatives have to be considered also in designating hedges. For instance, in a hedge of interest rates, the effect of an embedded prepayment option must be considered in the designation of the hedge.

31. In the present Global scenario, financial innovation is a central force that drives the financial systems towards greater economic efficiency and several innovations are being witnessed in the financial markets around the world. Many a time, when an innovation is effected, the market participants face a lot of difficulty in adapting themselves to these changing situations. Therefore, a process was necessary to aid the market participants to react effectively to the changing scenarios. Thus came the concept of Financial Engineering. The word 'Financial Engineering' was first coined in the mid-80s, among London investment banks to build risk management departments consisting of teams of experts who would advocate structured solutions to corporate risk exposures. Today what we are seeing is a product of several parallel developments.

"Financial engineering is a sophisticated management technique aimed to manage the risk and return of financial transactions. It involves the design, the development and the implementation of innovative financial instruments and processes, and the formulation of creative solutions to problems in finance."

From this definition, it can be inferred that financial engineering is wound around the two words – innovative and creative. It is a product with sophisticated techniques. It is a rigorous application of the scientific methods to finance. It is mostly used to exploit anomalies in the tax, accounting, and regulatory frameworks within which markets operate. It is conducted by 'teams,' which bring together traders, financial analysts, syndication staff, corporate finance officers, lawyers, tax specialists, accountants, mathematicians, statisticians, compliance officers, programmers and other specialists.

The objective of financial engineering is to decompose standard financial transactions into small elements and then synthesize these elements into innovative cross-market structures, or new combinations customized to the requirements of the parties involved. Financial engineering makes use of derivatives to effectively decompose the transactions and synthesize them into new combinations.

Financial engineering is directed at the corporate and institutional level as well as the retail and customer level. Apart from this, financial engineering can be applied in a number of important areas. The following paragraphs highlight the importance of financial engineering in the above mentioned areas.

- **Corporate Finance:** Financial engineering is desirable in the field of corporate finance in raising the necessary funds for the operation of large scale businesses and in mergers and acquisitions. Sometimes the nature of the financing required or cost considerations in large firms may demand certain new instruments or a combination of instruments to accomplish the desired result. The instruments must be tailor-made with an appropriate solution. It is here the financial engineer plays a vital role. In mergers and acquisitions, the role of financial engineers assumes more importance. During the last two decades, many junk bonds and bridge financing were introduced to raise funds for takeovers and leveraged buyouts (LBOs).

- **Trading:** Financial engineering is widely adopted by the securities and derivatives traders. It comes to their rescue particularly in developing trading strategies involving those that are arbitrage or quasi-arbitrage in nature. These strategies span across space, time, instruments, risk, legal jurisdictions, or tax rates. Innovations interlinking futures markets across the world to help traders offset losses made in

one market with gains in another market is an example involving arbitrage across space. Program trading, which seeks to exploit price discrepancies between the cash market and futures market, is a classic example of innovations involving arbitrage across time. Innovations involving arbitrage across instruments resulted in many 'synthetic' instruments like synthetic options, zero coupon bonds, and Collateralized Mortgage Obligation bonds (CMOs). Innovations to confront asymmetries in risk, market access, and tax exposure resulted in the introduction of swaps, preferred stocks, and special purpose partnerships.

- **Investment and Money Management:** Financial engineering is playing a constructive role in investment and money management. Many novel instruments like "high yield" mutual funds, money market funds, sweep systems, repo market etc., were possible only because of financial engineering. Processes like repackaging and over collateralization are helping in transforming high-risk investment instruments into low-risk investment instruments.

- **Risk Management:** Though financial engineering finds a place extensively in the above mentioned areas, it was involved more immensely in risk management. It would be interesting to know that the concept of financial engineering was designed by the London-based investment banks to carefully examine all the financial risks to which a firm is exposed. Most of the finance professionals equate financial engineering with risk management. A basket of instruments like futures, options, swaps, rate caps, rate floors, forward rate agreements, and so on were introduced for the purpose of risk management.

Therefore, a financial engineer has three roles to play – that of a marketer, innovator, and outlaw. As a dealmaker, he is supposed to structure a deal to meet the client's needs and then sell the client on the idea. As an innovator, he is supposed to create new products. In the outlaw role, he is supposed to exploit the loopholes.

32. Owing to the increasing complexities in the financial systems around the world and a number of innovations, financial engineering is gaining enormous importance lately. This has led to its enormous growth in the last two decades, and it can be attributed to various factors. These factors, which contributed to a heavy growth in financial engineering, can be divided into Environmental factors and Intra-firm factors.

Environmental Factors: The environmental factors are those factors, which are external to the firm but still have an impact on the firm's performance. The firm has virtually no control over these factors. These factors include price volatility, globalization of markets, tax asymmetries, technological advances, advances in financial theory, regulatory change and increased competition, and transaction costs.

Price Volatility: In literal sense, a price is the amount to be paid to acquire some object for its value. Such object may either be a commodity, domestic financing, or a foreign currency. Therefore interest rates, exchange rates, and equity capitalization rates are all different forms of prices. Prices are determined by the demand for and supply of the respective object. If demands and supplies for different objects are stable over time, the prices are also stable. But in reality, as the demands and supplies are not stable, the prices are also not stable and this instability in prices leads to price volatility. Various factors like changes in the cost of production, changes in the prices of other goods, expectations about future demand and supply conditions, and size of the market are responsible for the instability in prices. According to some economists, the global price volatility is a product of (i) inflationary forces, which disrupted the financial markets during 1970s, (ii) the breakdown of traditional institutions and international agreements, (iii) the globalization of markets, (iv) the rapid industrialization of many underdeveloped countries, and (v) greater speed in acquiring, processing, and acting upon information.

Price volatility has three dimensions – The speed of price change, the frequency of price change, and the magnitude of price change. Though the price changes are very much warranted for a smooth functioning of the economy, the financial engineers have a role to play because of the increased activity in above mentioned three dimensions. Changes in interest rates, exchange rates and equity capitalization rates have become the order of the

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day. Various techniques to combat these changes were possible only because of financial engineering. For instance, the concept of diversification stemmed out to counter the equity capitalization risk. Similarly, various hedging techniques using various derivative instruments like currency futures, currency options and currency swaps were developed in an attempt to reduce the exchange rate risk. Instruments like interest rate derivatives were developed to reduce the interest rate risk. Thus, volatility in prices prompted the financial engineers to come out with novel techniques.

Globalization of Markets: Today the corporates as well as the governments have realized that nothing can be achieved in isolation. Knowledge about the happenings around the world and their impact on them is very much vital to the corporates as well as the governments. This has led to the movement of goods and services to all parts of the world no matter where the producer is located. Now the markets are not restricted to a particular place. Added to this, the advent of technology, speed in communication systems, good transport systems, etc., have made the world one market place. All these have globalized the world markets. Every country is adapting itself to the changing global scenario.

Globalization has increased the size of the markets and greatly enhanced competition. Owing to this the customers are benefiting with the availability of increased varieties and quality. However, the globalization has augmented the risks faced by the corporates. The corporates' responsibility towards their shareholders, creditors, suppliers, and society has tremendously increased. All these developments necessitated the corporates to differentiate themselves from the lot and take the benefit of globalization. This forced them to depend on financial engineers to give them novel ideas regarding reduction of their risks, adopting new dividend and capital structure policies, raising the capital domestically vs. overseas, expanding their branches to foreign countries, tax aspects, etc. A parallel growth in the investment banks, risk management firms, and insurance companies was also witnessed. Thus, we can see that globalization of world markets has immensely contributed to the growth in financial engineering.

Be it to satisfy the needs of a corporate or an investment bank, financial engineers have given the world the new instruments like ADRs, GDRs, many variants in derivative instruments, variants in mutual funds, debt market instruments, and equity market instruments. A revolution is made in the field of financial services around the world.

Tax Asymmetries: Tax asymmetries exist if two firms are subject to different tax rates. Tax asymmetries exist because of the following reasons: (i) some industries are granted special tax exemptions and preferences in order to encourage their growth, (ii) different countries impose different tax burdens on domestic firms and the foreign firms, (iii) the nature of some firms' past performance may attract certain tax credits or write-offs in the coming years reducing the tax burden on them. Again corporates are taxed separately for the inflows from equity, preference and debt capital. There are different norms for recipient and payer companies. The fact that different firms have different capital structures puts the firms in different tax brackets. Financial engineers often exploit these tax asymmetries, and provide innovative ideas to facilitate the firms to attract lower tax burdens. The role of financial engineers is only to help their clients to reduce the tax burden but not to help them to escape from taxes.

Technological Advances: As mentioned above, financial engineering is largely motivated by advances made in technology and telecommunication sectors. Advances in these two areas have encouraged the development of powerful trading systems, network systems, data transmission systems, and many compatible software programs. Introduction of all these amplified the effectiveness in the spot and futures markets, forex markets, commodity markets, and debt markets. Flow of information and its processing is very fast.

Financial engineers took advantage of these tools and provided elaborate mathematical relationships necessary to exploit discrepancies between the different markets. Further, these relationships were transformed into computer programs enlisting the necessary hardware and data linkages to obtain a continuous feed of data and instantaneous order execution. Program Trading was one such innovation interlinking the futures market and the spot market.

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However, all these technological innovations increased the price volatility to a large extent. Again the role of a financial engineer becomes imperative in helping the firms to manage the price risks inherent in the market economy. It can be said that to the extent that the technological developments increase volatility, the risk management role of the financial engineer gains prominence.

Advances in Financial Theory: For a financial engineer to perform effectively, sound knowledge about the finance theory is imperative. Also, since finance is closely interlinked with economics and accounting, the financial engineer should be capable to integrate all the related subjects while arriving at a solution. He should be competent enough to model all the available data by making certain assumptions, through derivations, etc., and interpret it to provide a conclusion to the model. These are the important skills that a financial engineer should possess because even a small error in an assumption, or a faulty derivation, or an erroneous interpretation of a conclusion can lead to a financial disaster.

It should be borne in mind that all the conceptual tools in the modern financial engineer's toolkit are developed by either academicians or by practitioners working closely with academicians. Hence keeping abreast of the advances made in finance theory are all the more important for a financial engineer.

Regulatory Change and Increased Competition: Lately, most of the financial engineering activity has been fostered by the deregulation of the industry and the entrepreneurial experimentation. Deregulation has enhanced competition and compelled the once protected industries to become more efficient or simply to close down thereby releasing their resources to more productive ends. The increased competitive pressures coupled with deregulation encouraged the growth of financial engineering.

For instance, the reintroduction of commercial banks into investment banking activities had made difficult for the investment banking firms to retain their business. The tough competition from the commercial banks had bound them to go for innovations in order to keep their existing clientele intact. The markets are so competitive corporations are changing their investment bankers even for a small benefit in fees. All these are efforts and fruits of financial engineers.

Transaction Costs: The recent innovations in the financial sector have reduced the transaction costs considerably for both the issuers and the investors. Still the arbitrage opportunities do exist and the financial engineers are working out to develop appropriate trading strategies in the coming days.

33. A financial analyst's job is to analyze the financial statements and draw conclusions. In general, financial analysis is a process or a method of studying the nature of something in order to determine its essential features and their relationships. On the other hand, financial engineering is the process of formulating and implementing a new instrument, a new process, or a creative solution to a problem. Many a time, knowingly or unknowingly, a financial analyst ends up performing the task of a financial engineer. We will continue the discussion with the help of an example.

Let us consider a situation where a corporate house is facing an increase in its expenditure without any substantial increase in sales. Here in this situation if an analyst is engaged, he would conclude that the expenditure follows a secular trend, market wide fluctuations, etc. Thus he would end up explaining the components of the change and the sources of risk. It is to be noted that the bottom line is to reduce the expenditure to a desirable level. Now, comes the financial engineer. The ending point of an analyst marks the beginning of an engineer. The financial engineer is likely to configure a solution to the above problem; he is expected to suggest an approach that will help the firm to control its increasing expenditures or to increase its sales to match those expenditures.

Here we are neither intending to criticize financial analysts nor to highlight financial engineers. We had just made an attempt to make our readers understand the key difference between the two.

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Part IV: Case Studies (Problems)

Case Study 1

Read the case carefully and answer the following questions.

1. Explain the term 'extendible swap'?

2. Discuss the alternatives available to the company and evaluate each of them. What action will you suggest and why?

3. Evaluate the result of using the various options, if the actual spot rate after 6 months turn out to be Rs.45.80/$.

4. If the firm order does not materialize after three months and it has already taken positions as in the question 2, then how will it cover its exposures and show the cash flows for each of the alternative if the following rates are materialized after 3 months?

Spot Rs./$	44.60
3-m forward	45.70
3-m futures	45.80

   3-m put option on $ vs. Rupee (European option):

Strike price (Rs./$)	Premium (Paise per $)
46.50	90
46.00	70
45.50	50
45.00	35

5. What are the possible internal hedging techniques available to Sugandha Industries?

Sugandha Industries Ltd. is a medium scale company engaged in the production of electric switches. Till date, its major market has been the domestic market, with a small occasional international order coming its way. These occasional orders have not been big enough to make the company feel the need to hedge the resultant currency risks.

Recently, the company engaged some agents to look for business opportunities in the international markets. One of the agent's efforts paid off and the company got an order worth $2 million from an American firm. However, the American company is not ready to give a firm order till it has satisfied itself about the quality of Sugandha Industries Ltd.'s products. For this, the Indian firm is required to send a sample to the American firm. If the sample is approved, the Indian company will receive a firm order. The initial process of getting its sample approved is expected to take about 3 months. The firm is confident that its sample will be approved and get the firm order, so it is decided to take a position now. The payment for the firm order will be realized by the end of the 6th month from now.

The forex markets have been witnessing extreme volatility during the past few months. The company wants to hedge its exposure right away. It can choose between a forward sale, using a futures and buying a put option or keep an open position.

The company has made a detailed study of the various factors affecting the expected exchange rate between the dollar and the rupee six months from now and has come out with the following probability schedule:

Expected exchange rate (Rs./$)	Probability
44.50	10%
45.00	20%
45.50	30%
46.00	40%

The other rates are:

	Rs./$
Spot rate	44.00
6-m forward	45.50
6-m futures	45.70 (Standard size = $1m)

6-m put option on $ vs. Rupee (European option):

Strike price (Rs./$)	Premium (Paise per $)
46.50	150
46.00	120
45.50	95
45.00	75
44.50	50

Events

i.   In the current fiscal we witnessed huge volatility in the forex market, along with the weakening of the rupee. According to RBI, the reserve portion is comfortable, except the depleting of reserve in the last two months. The recent data shows that the export growth in the current fiscal is above the expected level.

ii.   RBI has imposed a surcharge of 50 percent of the lending rate on import finance.

iii.   RBI has advised banks not to speculate in the forex market.

iv.   RBI has issued a circular restricting banks to structure rupee-dollar swaps the way they like. Now onwards, RBI dictated that every swap transaction has to be structured on a matched basis.

v.   Federal Reserve has increased the interest rate by 50 basis points.

vi.   In recent past FIIs are net sellers in the Indian stock markets, thus showing net negative balance of FII investments.

vii.   Inflation level in India is rising at a constant pace. From the last year's level of around 3% it has been risen to above 6% in current fiscal.

viii.   Market players are very apprehensive that interest rates may rise in next few months because of the weak rupee.

Case Study 2

Read the case carefully and answer the following questions.

1.   Explain the concept 'Forward Swaps'.

2.   Evaluate the following alternatives for hedging the Chemco's exposure.

    a.   Forward contract

    b.   Call option (Use three options for working)

    c.   Futures.

3.   What will be the outflow if a cross-currency option is used for hedging along with a forward contract for US$.

4.   M/s Dravid Denim agreed to pay US$ 8 million to Chemco at the end of four months. Compare the alternative of a forward contract with that of a call option at Rs.42.80 from the view of Chemco.

5.   What are the steps in a currency swap?

Chemco is a medium-sized company manufacturing speciality chemicals which are used in textile and leather industries. Though it faces competition from some large companies, it has managed to establish its reputation as a reliable supplier of high quality products. It has a strong marketing and distribution network and devotes a considerable effort to servicing the needs of small textile and leather goods exporters whom its larger competitors tend to ignore.

Chemco has been recently negotiating a long-term supply contract with a major textile mill M/s. Dravid Denim which has made a foray into the Denim market. M/s Dravid Denim is confident of being able to get very large export orders. It wants Chemco to supply a particular process chemical which hitherto was not among Chemco's products. M/s Dravid Denim has agreed to place a trial order with Chemco and finalize a long-term contract if the product supplied meets with their quality specifications.

The process of manufacturing of this chemical will not call for a substantial investment in plant and equipment to begin with. However, some raw materials will have to be imported. Preliminary enquiries have revealed that the most reputed supplier of these basic chemicals is the German firm BASF.

Chemco has contacted the German firm and indicated that it wishes to place an order worth Euro 4 million. BASF has indicated that delivery will be made sometime after three months from the date of the firm order but certainly before four months. It has demanded payment in DM on delivery.

Till date, Chemco has had no experience in coping with currency exposure since all its requirements were sourced from domestic suppliers and it had not entered the export market. Chemco's Chief Financial Officer (CFO), a Chartered Financial Analyst, decided that she should approach their bank for advice.

She came back from the bank having heard the forex chief of the bank on the pros and cons of several hedging products. Among the possibilities mentioned were a forward purchase, a cross-currency forward contract, an option forward, options against the rupee and cross-currency options.

The bank presented the following scenario for exchange rates.

Rs./US$	Probability	Rs./Euro	Probability
42.70	0.5	45.80	0.4
42.80	0.3	45.90	0.3
42.90	0.2	46.00	0.3

	Rs./Euro	Rs./US$	Futures on Euro	
Spot	45.90	42.50	3-m futures	Rs.45.80
3-m forward	46.25	42.80	Standard size	Euro 100000
4-m forward	46.40	42.90		

4 months Call options on Euro vs Rupee: American option		4 months Call options on Euro vs US Dollar: American option		4 months Call options on US Dollar vs Rupee: American option	
Strike (Rs./Euro)	Premium (paise per Euro)	Strike (US$/Euro)	Premium ($/Euro)	Strike (Rs./$)	Premium (paise per $)
45.70	125	1.0900	0.005	42.70	120
45.80	105	1.0890	0.008	42.80	95
45.90	65	1.0880	0.010	42.90	75
46.00	40	**Note:** Premium for a cross-currency option is paid in US$.		43.00	55
46.10	30				
46.20	15				

The actual rates at the time of payment for imports and receipt of exports are as under

Rs./US$	42.85
Rs./Euro	46.05
Futures on Euro	Rs.46.02

Commentary

i.   The rupee has held very steady against the dollar for past several months. Against the mark there are noticeable short-term swings. The reserve position is very comfortable. However, the exports have shown a negative growth while imports continued to remain stagnant. However, very recent data showed that export growth has actually picked up.

ii.   The market witnessed unprecedented capital inflows in the form of GDRs, FCCBs and direct investment by FIIs in the Indian stock market. The recent trends indicate a net outflow. Many corporates who borrowed in foreign currencies are now swapping them for Rupee borrowings.

iii.   The Euro is launched on 1.1.99 and the rate is announced as US$/Euro 1.16. In the last two months Euro has depreciated to US$/Euro 1.08 as against the market expectation of appreciation.

iv.   The Governing council of European union which meets every alternate Thursday, met last Thursday but decided not to cut the interest rates which is against the market expectations.

v.   Inflation in the US economy also remains moderate. However, the FED has cut the discount rate by 75 bp in three steps over the last six weeks.

vi.   The Japanese economy is showing very weak sign of recovery and the US$ is continuously appreciating against Yen.

vii.   The sanctions imposed by US on India have not been lifted as yet. But the market seemed to have forgotten all about the sanctions.

viii.   The market is bad though not bad enough to designate it as 'recession'. Low margins, discounts and installment credit seem to be the order of the day. Corporates are looking for export market where the situation seems to be more difficult.

Case Study 3

Read the case carefully and answer the following questions.

1.   Explain what are the major bottlenecks in valuing a swap.

2.   Suppose the UK subsidiary has to pay £50,000 to the Swiss subsidiary on 1/3/20x1 while the Swiss subsidiary has to pay £30,000 to the UK subsidiary. Explain with necessary calculations, how netting can benefit the M.N.C.

3.   What would have been the benefit from netting in the earlier problem if the following had been the spot rates prevailing on 1/3/20x1:

$$\$/£ : 1.605 \quad SF/\$: 1.485$$

4.   Explain briefly the difference between covering exposure in the money market and in the forward market for both receivables and payables.

5.   Using detailed calculations, explain to the Japanese subsidiary how it can manage its transactions for the month of March without incurring any forex exposure. Consider two alternatives.

    a.   Forward market with money market cover only to the extent required.

    b.   Pure money market cover.

6.   What are zero coupon swaps?

You are the treasurer of a multinational corporation based in USA. Your company has subsidiaries in many countries. International operations have traditionally been an important source of revenues. The percentage of earnings contributed by overseas businesses is given in Exhibit I.

Even though international businesses have been an important part of the company's activities, the company has not applied a systematic approach to the management of both cash flows and foreign exchange risk. Traditionally, the subsidiaries have operated with considerable autonomy. As a result, management of foreign exchange risk has been largely left to the country treasurers. Subsidiaries have also been managing cash more or less independently except during emergencies when they receive support from the parent. Excess cash balances have also tended to remain within the subsidiary which typically deploy them in short-term investments in the local markets. However, at the end of the year, the subsidiaries remit their earnings in the form of dollars to the parent.

Since the subsidiaries are located in developed eastern countries, little political risk is involved. There are also few restrictions on the repatriation of dividends.

As the treasurer, who has joined the company recently, you instinctively feel that there is considerable scope for improvement. Your training as a finance professional makes you feel that adequate controls are not being exercised and such a decentralized style of management can lead to unwanted consequences. Having worked in a reputed bank earlier, you are also aware of various sophisticated hedging instruments such as futures and options.

Since the company is involved in the Fast Moving Consumer Goods (FMCG) business, the traditional emphasis has been on brand building and selling. Preliminary and informed discussions with colleagues have also indicated that it is indeed the marketing personnel who are calling the shorts at most subsidiaries.

An additional complicating factor is that each of the subsidiaries on its own has significant volumes of overseas transactions. You have confirmed that the commonly used method of settling payments for both exports and imports has been the irrevocable letter of credit. However, the general practice has been to wait and buy in the spot market to settle payments against imports and sell spot on the date of maturity of the receivables in the case of exports. You feel this is a dangerous strategy and would like to inform the top management accordingly.

Before going into the specifics, you have identified a few basic issues which need to be considered.

- Is decentralized cash management as it exists today really advisable?

- Does it make sense to cover foreign exchange exposure?

- What are the hedging instruments which ideally suit the risk profile of the company?

To make your arguments more effective, you have collected the following information on the transactions of the Japanese subsidiary for the month of March, 20x1. You would like to explain to the treasurer in Japan how foreign exchange risk can be managed.

March 1, 20x1

- Exports to UK worth £2,000,000 are made. Payment will be realized in one month.

- Payment of Yen 130 million has to be made towards local taxes immediately.

- A payment of AUD 1,000,000 will be realized from a Australian customer.

- An equipment worth SF 100,000 will be imported from Switzerland. The payment will be made in a month from now.

April 1, 20x1

- Payment of SF 100,000 will have to be made to a supplier against earlier imports: received two months before.

- A customer will remit US 50,000 towards earlier purchases.

- The company has to settle a major payable in DKK and is exploring opportunities of mobilizing the required funds. Exhibit II gives exchange rates and interest rates prevailing on 1st March.

Exhibit I

Year	% of earnings from overseas operations (on dollar basis)	Year	% of earnings from overseas operations (on dollar basis)
19x1	25	19x3	21
19x2	24	19x4	22
19x3	23	19x5	23
19x4	24	19x6	24
19x5	22	19x7	25
19x6	23	19x8	25

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Year	% of earnings from overseas operations (on dollar basis)	Year	% of earnings from overseas operations (on dollar basis)
19 x 7	24	19x9	25
19 x 8	24	20x0	26
19 x 9	21	20x1	28
19 x 0	20	20x2	25
19 x 1	20	20x3	22
19 x 2	20		

Exhibit II

```
    1/3/20x1
Spot rates :   $/£     :  1.60/1.61
               Yen/$   :  130.5/131.0
               AUD/$   :  1.80/1.81
               SF/$    :  1.48/1.49
               DK/$    :  6.16/6.18
Interest rates:
               $ – 6%  £ – 7%   Yen – 2%
               AUD – 4%  SF – 4%   DKK – 4%
One month forward rates:
               $/£     :  1.59/1.60
               Yen/$   :  131.5/132.0
               AUD     :  1.81/1.82
               SF/$    :  1.47/1.48
               DKK/$:  6.20/6.30
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Case Study 4

Read the case carefully and answer the following questions.

1. Calculate the arbitrage opportunity available with the strike price of 125.

2. Explain the concept of butterfly spread, with a simple graph.

3. Give an advise on the pricing of the calls and puts of the option with strike price Rs.105 with the help of option price convexity principle.

4. Can any arbitrage profit be made by the premium positions in Q3 above?

5. What are the main causes of volatility in the stock market?

Reliable Spinners Ltd., a company traded in the BSE stock exchange has options traded in the BSE Options exchange (assumed). The face value of the bond is Rs.100 and it pays interest every three months. The rate of interest is 10% p.a. The interest has just been paid for the quarter and the next coupon payment is due after three months.

The following are the strike prices and the premiums on calls and puts:

Strike Price	Calls	Puts
95	16	4
105	13	6
115	4	11
125	2	16

Case Study 5

Read the case carefully and answer the following questions.

1. Calculate the profit or loss on the unhedged position, taking two alternative scenarios: no selling price change and cost price reduction to Rs.400 per tin.

2. Suggest an hedging position using a short futures position @ Rs.400/tin.

3. Suggest an hedging position using a long put options.

4. Suggest an hedging position using a long bear put spread.

5. Define bear vertical spreads using puts and calls.

The prices of groundnut oil keep variating throughout the year depending on the demand-supply situation, the crop season, the festival season, etc. It is a highly risky business to store large quantities of oil tins for a variety of reasons: blockage of funds, storage space, price volatility, leakage, etc.

Konark Oils Ltd. is a wholesale dealer of groundnut oil. It has a stock of 1,00,000 tins of oil which have been purchased in the month of April 20x1 at a price of Rs.2,400 per tin and the selling price is Rs.410 per tin. Subsequently, Konark enters into an agreement with Bhagwati group of hotels to deliver 1,00,000 tins on 15th of July 20x1 at the prevailing rate then. Given the fact that the price of groundnut is bound to reduce by June/July 20x1 as this is the harvest season time, Konark must carry this stock in its inventory and incur the risk that the prices may be reduced. The groundnut oil futures (assumed to exist) are Rs.410.50 being Rs.0.50 above the selling price per tin. This basis of 50 points is assumed to remain constant till 15th of July 20x1. The carrying and storage costs are assumed to be Re.1 per month. (we can safely assume 3 months between the date of the order and the delivery date). The selling price by 15th of July 20x1 is expected to be Rs.400.00 per tin. A put option on a strike price of Rs.400/tin of July 20x1 is available at a premium of Rs.0.25, while a put option with a strike price of Rs.400/tin of September 20x1 is available at a premium of Rs.0.15.

Case Study 6

Read the case carefully and answer the following questions.

1. East-West spends almost 35-40 percent of its operating budget on fuel, which is considerably more than the industry average. Any increase in oil price is difficult to be passed on to the customers as that would erode the competitive edge East-West has. Explain how the risk due to changes in oil price can be managed by East-West.

2. Calculate the effective cost of long-term funds if on reset dates the LIBOR rates turned out to be: 3.10%, 2.80%, 2.60%, 2.50%, 2.75%, 3.00%, 3.40%, 3.60%, 3.90%. Amortize the net premium on collar over the period of the loan using a discount rate of 3% per annum.

3. a. If Eurodollar interest rates in December turn out to be 2.90% or 3.25%, calculate the effective cost of short-term loan when hedged through Eurodollar futures.

   b. Calculate the effective cost of short-term loan when hedged through T-bill futures if

   i. December T-bill futures closes at 96.80 and 3 month LIBOR in December is 3.40%.

   iii. December T-bill futures closes at 97.25 and 3 month LIBOR in December is 3.00%.

4. As on October 01, 2002, calculate the 3 month VaR of Eurodollar futures and T-bill futures at 95.5% confidence level. The annual yield volatility for Eurodollar futures is 1.05% and T-bill futures is 0.92%. (Assume that the duration is 2.5 months).

5. VaR is not a panacea for all risk-management and management ills. Many financial losses and management issues were caused by failures that a VaR measurement system would not have prevented. According to you what are the limitation of using VaR?

East-West Airlines was launched by a small group of pilots and investors in 1990. In that year, the group bought several planes from a failed carrier and carved a niche for itself by servicing out-of-the-way locations that were neglected by large carriers. From the beginning, management concentrated on keeping fares low, operating costs down and low debt. Pilots, baggage handlers,

flight attendants, and other employees received a significant part of their compensation in the form of profit sharing, in lieu of salary. Average salaries at East-West have long been 30% below of industry average, but total compensation, after profit sharing is about the same.

Initial start-up stage was difficult for East-West, but its below market salaries and further, although temporary, concessions from worker, got the airline through the crunch. By the middle of 1997, East-West was in good stead and positioned nicely in the market. The remainder of 1990's were a phenomenal growth period for the airline, as a new city was added to airline's service base on an average once in every two months. The airline continued its strategy of purchasing older planes of other airlines to service these cities. By 1996, East-West's annual revenues had reached $1.50 billion, placing it in the ranks of mid-size carriers. At this point, East-West's management decided it was time to enter international arena. By 2000, its operating revenue reached $2.4 billion of which 20% was from transatlantic routes. The airline provided regular service to London, Paris and other major cities in Europe.

Despite a bumpy start, the 1990's were good to East-West's owners, managers and employees. As the decade closed, however, problems were looming for the industry. For a time, East-West's management, consisting largely of former pilots and other 'hearts in the sky' personnel, failed to see the dangers. The airline's method of aircraft acquisition had resulted in one of the oldest, most fuel inefficient fleets in the industry. Also, its low-budget operating had led to a reputation for cheap no-frills flights-making is difficult to sell upscale service. On the other hand, the airline had stayed relatively debt-free – much of its aircraft acquisitions had been made out of profits and additional issue of equity. Indeed, at the close of 2000, East-West's capital structure had almost 90% equity-of which almost half was owned by employees. The remaining portion of capital was debt, of this, 90% was fixed rate debt and 10% was floating rate.

In 2001, East-West's business flew straight into an economic recession, which only now seems to be coming to an end. As with the industry as a whole, both domestic and international ticket sales declined significantly during the recession; however, East-West suffered a smaller loss on its domestic routes than most of its competitors. The dramatic rise in oil prices due to OPEC production cut, cut deeply into profits that shocked management and cast a shadow over the future of the airline. As the financial situation grew bleaker, management began plotting asset sales and route sales to generate cash to buy time. Layoffs were scheduled for the first time in the firm's history and management salaries were slashed. It had become very clear just how serious East-West's strategic risk exposures really were.

While revenues were still off significantly from their peak, the first two quarters of 2002 showed considerable improvement. Nevertheless, the firm still suffered a loss for both quarters. The third quarter, however, looks quite promising. East-West's dismal performance over the past year has focused management's attention on the long neglected need for strategic risk management, the age of its fleet, and its long-term growth strategy. In June 2002, East-West's Board of directors decided to revamp its strategic plan. To assist in the process, management hired John Fairberg, an experienced financial analyst.

John, who was thoroughly versed in financial risk management, joined the airline in June. He spent his first three months analyzing the nature of the airline's business, its historic cash flows, its future funding requirements, its strategic risk exposures, and various economic forecasts. Not surprisingly, he determined that the airline had a significant exposure to oil prices, interest rate, several different exchange rates and general market softness.

Presently in October 01, 2002, East-West requires $500 million for 5 years for acquiring new fleet and $25 million for 3 months in December 2002 for improving its quality of service. John prefers to borrow both the funds in floating rate market. A French bank, Bank de Cale, has offered Eurodollar loan $500 million at 6 month LIBOR + 1.00% for 5 years. The bank has also agreed to offer the short-term loan at 3 month LIBOR + 0.25% at the 3m LIBOR rate prevailing in December 2002. John is concerned that due to the economic recovery in US the interest rate may increase and in turn that will also raise the Eurodollar interest rates, so he wants to hedge the borrowings against rise in interest rates. For the 5 year loan buying a 5 year cap close to the prevailing interest rate is the most appropriate strategy. However, John finds out such a cap is

quite costly. So John prefers an interest rate collar where cap cost to some extent reduced by the premium inflow from the floor. For short-term loan, it is considering to hedge either through US T-bill futures or Eurodollar futures.

The following quotations are obtained by John in October:

Interest Rates:

Current 6 month LIBOR	3.25%
Current 3 month LIBOR	3.00%

Interest Rate Collar:

Cap strike rate	3.50%
Floor strike rate	2.75%
Net premium	0.50%
Face value	$500 million
Underlying interest rate	6 month LIBOR
Maturity	5 years

Futures:

December Eurodollar futures	96.88
90-day US T-bill futures	97.05

Case Study 7

Read the case carefully and answer the following questions.

1. What is a Forward Rate Agreement (FRA)? How do you compare the hedge with eurodollar futures and a FRA?

2. Assume the month-end closing of different eurodollar futures contracts are as follows:

Month-end	March Futures	June Futures	September Futures
March	98.12	98.04	97.92
June	–	97.98	97.86
September	–	–	97.78

   a. Explain how the company can hedge interest rate risk through the eurodollar futures. Also calculate the effective return from the deposit if 6-month LIBOR in April turns out to be 1.98%.

   b. If the company wishes to capitalize on the rising interest rate scenario during the period between April 2003 to September 2003, what different strategies using eurodollar futures the company may adopt? Explain.

3. Calculate the effective return from the deposit when covered through the FRA if 6-month LIBOR turns out to be 1.98% or 2.25% in April.

4. If Mr. Miller decides to convert $20 million into euro, at spot rate in April, then calculate the daily value-at-risk (VaR) at 99% confidence level for the euro spot position in April, if expected spot price in April is $/Euro 1.0090 and volatility of $/Euro exchange rate is 5% p.a. (Assume 250 trading days in a year)

5. Describe in brief the risk management process in an organization.

Phoenix Energy Corporation (PEC), headquartered in Phoenix, is engaged in petroleum production, supply of energy related equipment, furnishing services and transportation services, including construction, to integrated energy and petroleum companies in the United States and abroad. In 2002, PEC's sales reached about $3 billion, of which energy, including oil and coal production, accounted for 60 percent of worldwide sales, equipment and supplies accounted for 15 percent, and energy related services such as construction and transportation accounted for 25 percent of sales. PEC's performance ratios show that rate of return on shareholder's investment

averaged 10 percent in 1990's, the rate of return on sales was approximately 4 percent, and the total debt to shareholders' equity ratio was 16.4%.

In recent years, the company is engaged in several large port construction and transportation projects in Southern Europe and Southeast Asia. These projects were promoted and finanaced primarily by multilateral and regional economic and financial institutions, including the World Bank, in conjunction with leading international construction, transportation and energy corporations.

The CEO of PEC, Mr. Gunther Horn, was approached at a recent international energy conference in London by the energy minister of Portugal, a rapidly developing country in southwest Europe, offering PEC the opportunity to participate in an international consortium to construct a Coal Handling Port (CHP) in Portugal. PEC was expected to put up around $50 million for construction costs over 2 years, but would be given the option of converting its credit in to equity after the third year of operation by acquiring CHP's common shares at a discount of 40 percent from the prevailing market price.

During the preliminary discussions between the CFO of PEC Mr. Miller and Portugese government officials, and according to the investment prospectus that was issued by a British investment bank, it was estimated that the construction of the coal project could cost $450-500 million equivalent, of which $350-400 million was expected to be in local currency euro.

PEC's Board of Directors was briefed on several preliminary details of the coal facility and the request to participate in the project. A board member – an energy expert and a former chief economist for a Fortune 500 company – recently visited Portugal and was impressed by their development programs. Subsequently, the board recommended a thorough review of the proposed project, with the objectives of (i) determining under which terms and conditions should PEC join the international construction consortium and (ii) whether an investment in the proposed project is viable considering different alternative opportunities available at present.

The CFO Mr. Miller and his team was instructed to travel to Portugal and obtain all relevant information concerning the proposed investment. After returning from Lisbon, Mr. Miller presented the details of commitment required for the project, and the Board of Directors accepted the project and decision was taken to sign the MOU with the Portugese government.

According to the commitment made by Mr. Miller PEC has to infuse euros equivalent of $20 million in September 2003. As on January 03, 2003 Mr. Miller is expecting to have surplus fund of $20 million at the beginning of April 2003. He wants to keep this fund aside for the project, and decided to invest in LIBOR based deposit with a London based bank in April, for five months maturing in September, so that this fund can be utilized for the project. The London based bank has quoted 6 months LIBOR + 0.10% for the five months deposit at the 6 month LIBOR rate prevailing in April. However, Mr. Miller thinks that after three months the eurodollar interest rates will decline, thus reducing the earnings from the deposit. So he is considering to hedge the fall in interest rate by using either eurodollar futures contract or a FRA quoted by a London based bank.

The following rates are observed by Mr. Miller on January 03:

Exchange rates

$/Euro	Spot	1.0105/1.0108
	September Forward	50/40

Eurodollar Futures

March	97.96
June	97.90
September	97.84

FRA quoted by a London based bank

3/8-months   2.18%

The current 6-month LIBOR is 2.15%

Case Study 8

Read the case carefully and answer the following questions.

1. Which of the two swaps will be beneficial to PG if after 2 years from the date of entering into the swap, the fixed 3-year dollar borrowing rate become 5.5% p.a. and fixed 3-year euro borrowing rate become 6.0% p.a. (Assume interest payments have just been made).

2. What is the effective cost of funds to PG if it swaps into Euro for five years and covers the interest payments in the forward market?

3. Assume that PG opted for the cross-currency swap. On November 01, 2002 PG covers the euro liability due on May 01, 2003 through the 6-month forward contract at $1.0504/Euro, which has exposed PG to foreign exchange risk. The management of PG is trying to find out the 6-month value-at-risk (VAR) for the forward contract at 95% confidence level using variance/covariance approach. Using the additional information given below you are required to calculate the VAR of the forward contract.

    The 6-month interest rate on US$ is 5.25% p.a. and the 6-month interest rate on Euro is 4.75% p.a. The $/Euro exchange rate volatility is 2.20% p.a. and the yield volatility of six-month zero-coupon dollar bond is 1.15% p.a. The yield volatility of six-month zero-coupon euro bond is 0.95% p.a. The correlation between returns from two bonds is 0.60. Exchange rate on November 01, 2002 is $1.0404/Euro.

4. Describe the various motivations for PG to entering into the swap.

5. Explain the various risks faced by BT in doing the swap business.

Derivatives are known for successful deals as well as disastrous debacles, involving large and admired entities of the corporate world. They are highly complex, which adds to the aura of mystery that surrounds these instruments. Financial swaps are a recently developed phenomenon in the derivative markets, in which one of the parties agrees to 'swap' cash flows over a period of time with the cash flows derived from any market based rate defined in the agreement, based on a notional value, which never actually changes hands. One such deal involves Prinster and Gamble (PG) and Bank Transatlantic (BT). The deal involves an interesting deal that BT formulated at the request of PG.

In March 2000, PG requested BT to structure a swap to replace an existing swap, which was maturing in October 2000. The liability, which needs to be hedged with the swap, has a remaining maturity of five years and calls for payment of interest in annual installments. The face value of the liability is $100 million. It carries interest at a fixed rate of 5.30% p.a.

BT offered a swap to PG on the following terms:

*   The contract commences on November 01, 2000.

*   The notional principal for the swap would be $100 million.

*   The interest frequency of the swap would be half-yearly, though the interest payable on PG's liability is annual.

*   The maturity of the contract would be 5 years.

*   On every May 01 and November 01, for 5 years, BT would pay PG 5.30% p.a. on $100 million.

*   At the same time, PG would pay BT the average of 6-month T-Bill rate reduced by a spread.

*   The spread would be the higher of

    –   The excess of the average 30-day CP rate during the half-year over 4.5%.

    –   Zero.

PG also considered whether it should swap the dollar liability into Euro instead of acquiring a floating rate dollar liability as BT is offering a fixed interest rate in Euro which is significantly lower than PG's borrowing rate in Euro fixed rate fund which is 5.15% p.a. BT offered the following terms to PG for the cross-currency swap, which would also commence on November 01, 2000:

• The principal will be exchanged at the beginning as well as at the maturity of the swap at a dollar to euro exchange rate of one.

• BT is willing to receive interest on Euro 100 million at the rate of 4.80% p.a., semi-annually.

• In return, it pays interest in dollars at 5.05% p.a., semi-annually.

• The exchange risk arising from the swap has to be taken care of by PG on its own.

PG is anticipating the Euro to appreciate against the dollar at the rate of 2% every year. The company is planning to hedge its exposure in Euro in the forward markets, and forward rates conform to its expectations regarding the appreciation of the Euro.

PG also expects the interest rates in the next 5 years to be as follows:

Year	Average 6-month T-Bill rate (%)	Average 30-day CP rate (%)
1	3.35 p.a.	4.25 p.a.
2	3.45 p.a.	4.45 p.a.
3	3.28 p.a.	4.60 p.a.
4	3.65 p.a.	4.15 p.a.
5	3.55 p.a.	4.35 p.a.

Assume exchange rate on November 01, 2000 is $1.0/Euro.

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Part IV: Case Studies (Solutions)

Case Study 1

1. **Extendible Swaps**

   In an extendible swap, the fixed rate payer gets the right to extend the swap maturity date. If the interest rates rise and are expected to rise further then such an extendible swap works to the advantage of the fixed rate payer since he is required to pay less than the current rates. The premium charged for this right will be a higher fixed rate than the prevailing rates at the beginning of the agreement. In some cases, an extension fee is also charged. Assume that during the tenor of an interest rate swap, one party to the swap wishes to extend it by two more years and if the proposal is accepted by the counterparty then the swap becomes an extension swap.

2. a. **Unhedged**

   Expected inflow = (44.50 x 0.10) + (45.00 x 0.20) + (45.50 x 0.30) + (46.00 x 0.40)
   $$= Rs.45.50/\$$$

   b. **Hedging with Forwards**

   Inflow = Rs.45.50/$

   c. **Hedging with Futures**

   As the actual price of the 6-m futures at the end of the 6th month is not given, it can be assumed that it will be equal to the then spot rate. Suppose, prevailing spot rate will be Rs.45.80/$. As the firm is long on dollar, so it has sold futures at 45.70.

   ∴ Loss in futures = 45.80 – 45.70 = Rs.0.10/$, and dollars shall be sold in the market at Rs.45.80/$.

   Thus, the effective inflow will be Rs.45.70/$.

   d. **Hedging with Options**

Strike price	Premium (paise)	Minimum inflow per $
46.50	150	45.00
46.00	120	44.80
45.50	95	44.55
45.00	75	44.25
44.50	50	44.00

   Since the firm would not know the actual spot rate at the end of the 6th month in advance, it will need to take a decision based on the expected movements in the exchange rate. As the firm does not yet have a firm order, the decision will depend on two factors:

   a. The company's outlook as to the

   i. Spot rate

   ii. Price of the futures contract after 3 months.

   b. The firm's risk taking capability.

   The first factor is important because the firm will know only at the end of the third month whether it will be receiving dollars at the end of the sixth month. If it does not get the contract, it will have to either cancel the forward contract, or buy futures at the then ongoing rate in order to limit its exposure and possible losses.

   The second factor is important as it will determine the best suited hedging mechanism for the firm. As the case study points out, the firm is entering into international markets for the first time (and hence does not have any experience of the forex markets) and is not interested in taking any risks. Thus, options may be best suited in this case. As the option with the exercise

price of Rs.46.50/$ gives the highest minimum inflow, it is desirable that the company go for that option. Though options give a lower inflow than either a forward contract or futures, they are more suited as the firm will not be exposed in case it does not receive the order. At the same time it saves the firm from the exposure of an unhedged position in case it gets the order.

3.   Unhedged Position

Actual inflow = Rs.45.80/$

Forwards

Actual inflow = Rs.45.50/$

Futures

Actual effective inflow = 45.70/$

Options

Strike price	Whether exercised	Inflow	Premium (paise)	Effective inflow
46.50	Yes	46.50	150	45.00
46.00	Yes	46.00	120	44.80
45.50	No	45.80	95	44.85
45.00	No	45.80	75	45.05
44.50	No	45.80	50	45.30

4.   Unhedged Position

If the firm has kept an open position then no exposure is arising due to not receiving the firm order.

Forwards

If the firm has sold forward, then it will have to cancel the forward contract. The firm has agreed to sell $ at 45.50, 6 months forward. The contract will be cancelled by the bank by selling back to the customer at 3 month forward rate.

$ brought from the firm under original contract	Rs.45.50
$ sold to the firm on cancellation	Rs.45.70
Net amount payable by firm on cancellation	Rs.00.20

Futures

The firm can square the position by buying 3-m futures at 45.80. It has sold futures at 45.70.

Loss on futures = 45.70 – 45.80 = Rs.0.10/$

Options

If the firm has bought any of the put options, then it can cover its exposure by selling put option of same exercise price.

Long on put at 46.50:

So it will sell put at 46.50.

Maximum loss = 150 – 90 = 60 paise per $.

Long on put at 46.00:

Maximum loss = 120 – 70 = 50p/$

Long on put at 45.50:

Maximum loss = 95 – 50 = 45p/$

Long on put at 45.00:

Maximum loss = 75 – 35 = 40 p/$

Long on put at 44.50, there is no put available to counter the position, so maximum loss = 50 p/$.

5. The various internal hedging techniques are:

    i. **Exposure Netting**

       Exposure netting involves creating exposures in the normal course of business which offset the existing exposures. The exposures so created may be in the same currency as the existing exposures, or in any other currency, but the effect should be that any movement in exchange rates that results in a loss on the original exposure should result in a gain on the new exposure. This may be achieved by creating an opposite exposure in the same currency or a currency which moves in tandem with the currency of the original exposure. It may also be achieved by creating a similar exposure in a currency which moves in the opposite direction to the currency of the original exposure.

    ii. **Leading and Lagging**

       Leading and lagging can also be used to hedge exposures. Leading involves advancing a payment, i.e., making a payment before it is due. Lagging, on the other hand, refers to postponing a payment. A company can lead payments required to be made in a currency that is likely to appreciate, and lag the payments that it needs to make in a currency that is likely to depreciate.

    iii. **Hedging by Choosing the Currency of Invoicing**

       One very simple way of eliminating exposure is to invoice all receivables and payables in the domestic currency. However, only one of the parties involved can hedge itself in this manner. It will still leave the other party exposed as it will be dealing in a foreign currency. Also, as the other party needs to cover its exposure, it is likely to build in the cost of doing so in the price it quotes/it is willing to accept.

       Another way of using the choice of invoicing currency as a hedging tool relates to the outlook of a firm about various currencies. This involves invoicing exports in a hard currency and imports in a soft currency. The currency so chosen may not be the domestic currency for either of the parties involved, and may be selected because of its stability (like the dollar, which serves as an international currency).

    iv. **Hedging through Sourcing**

       Sourcing is a specific way of exposure netting. It involves a firm buying the raw materials in the same currency in which it sells its products. This results in netting of the exposure, at least to some extent. This technique has its own disadvantages. A company may have to buy raw material which is costlier or of lower quality than it can otherwise buy, if it restricts the possible sources in this manner. Due to this, this technique is not used very extensively by firms.

Case Study 2

1. **Forward Swaps**

   Forward swaps are those swaps in which the commencement date is set at a future date. Thus, it helps in locking the swap rates and use them latter as and when needed. Forward swaps are also known as deferred swaps (different from deferred rate swaps) as the start date of the swap is delayed (deferred). This is attractive to those users who do not need funds immediately but would like to benefit from the existing rates of interest.

   Suppose your firm is contemplating to invest in a project 2 years hence, and the initial outlay required will be $20 million when the project is started. You are not sure of the movement of the interest rates in the next 2 years. The loan will be taken for a 5-year term. You would like to protect your firm against interest rate risk and want to enter into a fixed-floating rate swap then you can enter into a forward swap agreement with another firm now on which the payments will start 2 years hence.

2. a. **Forward contract (Option forward)**

Rs./Euro spot	:	45.80
3-m forward	:	45.90
4-m forward	:	46.40

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As the Euro is at a premium, the bank charges the highest premium and offers a rate of 46.40 to the company. The outflow in Rupees for the company is Rs.46.40 x Euro 4 million = Rs.185.60 million.

b. **Call Option:**

Expected Rs./Euro rate is: 45.80 x 0.4 + 45.90 x 0.3 + 46.00 x 0.3 = Rs.45.89/Euro.

The spot prices are expected to be Rs.45.80 or 45.90 or 46.00. Hence the options with strike price of less than Rs.46.00 are also to be considered. There are three options with strike price of less than Rs.46.00.

Strike price (Rs./Euro)	Premium (paise)	Effective rate per Euro (Rs.)	Outflow for Euro 4 million (Rs. million)
45.70	125	46.95	187.80
45.80	105	46.85	187.40
45.90	65	46.55	186.20

In view of the outflow on account of the option being a minimum of Rs.46.55 which is well above the expected rate of Rs.46.00, it may be desirable not to cover the exposure for payable through option.

c. **Futures:**

Gain on futures: (46.02 – 45.80) x 4 million = Rs.0.88 million.

Outflow on spot buying: Euro 4 million x 46.05 = Rs.184.20 million

Net outflow = 184.20 – 0.88 = Rs.183.32 million.

On comparing the outflows under each of the above alternatives it can be found that futures contracts are the best, as they result in the lowest outflow, which is lower than the expected outflow in case of uncovered position.

3. Rs./$ option forward: 42.90

Strike price ($)	Premium $	Outflow per Euro ($)	Outflow for Euro 4 million ($) million	Outflow in Rs. million @ 42.90
1.0900	0.005	1.0950	4.3800	187.90
1.0890	0.008	1.0970	4.3880	188.25
1.0880	0.010	1.0980	4.3920	188.42

From the above table, it can be said that the company should buy an option on Euro against dollar at 1.0900 and an option forward on the dollar, with option during the fourth month. The bank offers the company a rate of Rs.42.90, charging highest premium, as the dollar is at a premium against the Rupee.

4. Chemco may write a call option at 42.80 or sell $8 million at Rs.42.90/$ through a forward contract.

Inflow from the forward contract = Rs.42.90 x $8 million = Rs.343.20 million.

Inflow from writing an option = Rs.(42.80 + 0.95) x $8 million = Rs.350.00 million.

Writing call option is better, as the inflow will be higher by writing a call option than taking a forward contract.

5. As on date, the dollar is a more widely used and more acceptable currency than the Euro. Many times more trade is transacted and more reserves are held in dollar than in the Euro currencies. The European Union has been tangled in political crises in the recent past due to resignation of the commissioners of the Union and the Euro has been steadily depreciating against the dollar. The poor performance of some of the member countries also worsened matters. Therefore, it is better to invoice the exports in the dollar. The Euro can be considered for invoicing the imports. The choice of currency of invoicing, apart from the above analysis, should also be based on whether the company has any other receivables and payables denominated in the dollar and the Euro. If it has receivables (payables)

denominated in one of the currencies, it should denominate an equal amount of its payables (receivables) in that currency so that the two can be netted out, eliminating currency risk, provided it wants to eliminate the currency risk.

Similarly, it can be suggested that the company should invoice imports in the currency in which its exports are invoiced and vice versa.

Case Study 3

1.   Major Bottlenecks in Pricing a Swap

   i.   Arriving at an appropriate discount factor to discount the cash flows.

   ii. Unlike bonds, swaps have 2 way cash flows. But we can overcome this problem by calculating the value along with the signs attached to the cash flows or by splitting the incoming and outgoing cash flows and valuing them separately.

   iii. Cash flows on the floating side are unknown but for the first payment which is set at the outset. This problem can be overcome by substituting forward rates for future floating rates or by the discount factors computed from the prices of Eurodollar futures.

2.   Swiss Subsidiary

	With netting	Without netting
Outflow		(30,000)(1.61)(1.49) = 71,967
Inflow	(20,000)(1.60)(1.48) = 47,360	(50,000)(1.60)(1.48) = 118,400
Net inflow	= SF 47,360	= SF 46,433

Benefit due to netting = 47360 – 46433 = SF 927

Alternatively

Without netting:

Inflow   = $ (60,000)(1.6) = 80,000

Outflow   = $ (25,000)(1.61) = 48,500
Net inflow = $ 31,700

With netting:

Net inflow = $(20,000)(1.60)
            = $ 32,000
Benefit   = $ 300

3.   Since no transaction costs are involved, here is no benefit through netting. The bid-ask spread is zero.

4.   Forward Market

Covering in forward market involves entering into a contract today which does not involve any cash flow.

However, covering through money market involves borrowing or lending now and then closing all the transactions on the date of maturity. The steps involved in actual transactions are furnished hereunder.

- Sell receivables forward

- Convert into home currency on the delivery date

- Buy payable forward

- Convert home currency into foreign currency on the delivery date.

Money Market

Receivables

- Borrow receivables/(1 + i)

- Convert into home currency and invest

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- Pay-off loan with receivable

- Realize the maturing investment in home currency.

Payables

- Borrow home currency

- Convert into foreign currency at spot and invest in foreign currency

- Use maturing investment to settle foreign currency payable

- Settle home currency loan.

5. a. | **March 1** | **April 1** |
    | --- | --- |
    | – Yen 130,000,000 | + £ 2,000,000 |
    | + AUD 1,000,000 | – SF 100,000 |
    | | + $ 50,000 |
    | | – SF 100,000 |

Forward Cover

March 1

Yen requirement $= 130{,}000{,}000 - (1{,}000{,}000)(130.5)/(1.81)$

$= $ Yen 57,900,552

Repayment $= (57{,}900{,}552)(1 + .02/12)$

$= $ Yen 57,997,053

April 1

£ needed to settle Yen loan $= \dfrac{57{,}997{,}053}{1.59 \times 131.5} = $ £ 277,385

£ needed to settle SF liability $= \dfrac{200{,}000}{1.59 \times 1.47} = $ £ 85,569

$= $ 362,954

DKK obtained $= (2{,}000{,}000 - 362{,}954)(1.59)(6.20) + (50{,}000)(6.20)$

$= $ DKK 16,448,000

b. **Pure money market cover**

SF 200,000 after one month $= $ SF $\dfrac{200{,}000}{(1 + 0.04/12)} = $ SF 199,336 today

$= $ £ $\dfrac{199{,}336}{(1.60)(1.48)} = $ £ 84,179 today

Yen 130,000,009 $= $ £ $\dfrac{130{,}000{,}000}{(1.60)(130.5)} = 622{,}605$

£ 2,000,000 after one month $= $ £ $\dfrac{2{,}000{,}000}{1 + 0.07/2}$ today

$= $ £ 1,988,400 today

Surplus £ today $= 1{,}281{,}616$

$ 50,000 after one month $= $ $ $\dfrac{50{,}000}{1 + 0.06/12}$ today $= 49{,}751$

DKK which can be invested today

$= (1{,}281{,}616)(1.60)(6.16) + (1{,}000{,}000)(6.16)/(1.81) + (49{,}751)(6.16)$

$= $ DKK 16,341,388

DKK available after one month

$= (16{,}341{,}388)(1 + 0.04/12) = $ DKK 16,395,860

6. **Zero Coupon Swaps:** In a zero coupon swap the fixed rate payer makes a single fixed payment at the maturity of the swap from the proceeds of the bond repayment. It is a variation of the plain vanilla swap. The interest is calculated on a discount basis, while the floating rate payer makes periodic payments.

Assume that your firm has just issued a floating rate 3 year bond in the Eurodollar market and you would like to swap the floating rate liability for a fixed rate liability. But at the same time, you would like to conserve cash as much as possible for operational purposes and hence you prefer zero coupon funding. This can be achieved by making use of zero coupon swap whereby you receive floating rate payments which can be used to pay the liability on the bond and you pay a lump sum at the end of the swap contract, which is effectively a zero coupon liability.

Case Study 4

1. By observing the puts, one can conclude that the put is underpriced, as follows:

Given the fact that the intrinsic value of the strike price of Rs.125 is Rs.25 (Rs.100 being the face value), the put is underpriced at Rs.16. An arbitrage profit of Rs.9 can be made by buying the stock price with the 125 put at a price of Rs.116 and immediately exercising the put at Rs.125, ending up with a profit of Rs.9.

2. **Butterfly Spread:** A butterfly spread involves 4 identical options with the same expiration date but different exercise prices. If you buy a butterfly spread then you buy one option each at strike prices X_1 and X_3 and sell two options at the intermediate strike price X_2. X_1, X_2 and X_3 are chosen such that $X_1 < X_2 < X_3$. The short trader takes the opposite position, i.e. sell one each at a lower strike price and a higher strike price and buy two at the intermediate strike price. The butterfly spread gives a pay-off similar to that of a straddle but the former is less risky compared to the latter while at the same time you have only limited profit potential. The pay-off of a butterfly spread using calls is given below:

Butterfly Spread
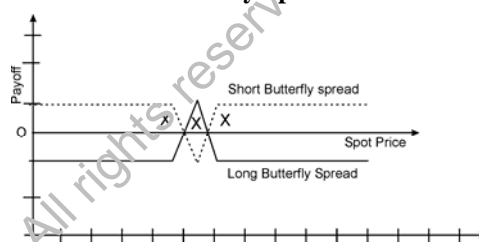
3. As per the option price convexity principle, if the strike prices of an option are equidistant from each other, the premium of the middle strike price will be lower than the average of the other two. Likewise, the average of the call prices of the Rs.95 and Rs.115 calls should

be Rs.10 $\left(\dfrac{\text{Rs.16} + \text{Rs.4}}{2}\right)$, while in reality it is Rs.13 $\left(\dfrac{\text{Rs.4} + \text{Rs.11}}{2}\right)$, so it is overpriced.

The put average should be Rs.7.5 while it is only Rs.6 and it is underpriced and it follows the option price convexity principle.

4. Yes. With the help of a butterfly spread, one should buy a Rs.95 call as well as a Rs.115 call while simultaneously selling two Rs.105 calls. This will involve a net profit in premiums as follows: Rs. (16 – 13 – 13 + 4) = Rs.–6 or in other words a net earning of Rs.6.

5. There are two main reasons for volatility on a stock price in the market:

   i. Trading of the stock in the stock markets which implies that volatility will be more when the markets are operational as compared to the time when markets are closed.

   ii. Information obtained by the investors about the expected future performance of the company or the stock, which affects the stock prices.

While these are two different assumptions about the reasons for volatility, various studies conducted on the subject implied that the volatility was mainly as a result of trading rather than information about future expected returns.

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Case Study 5

1. Contract to deliver 1,00,000 tins of oil on 15th of July, 20x1

    Possibility as on 15th of July, 20x1

    i. No change in the price, so the selling price is Rs.410/tin:

Selling Price		Rs.410
Less:		
Purchase Price	Rs.400	
Carrying Cost	Rs.3	Rs.403
Profit per tin		Rs.7

    ii. Price falls to Rs. 400/tin, so the new selling price is Rs.400/tin:

Selling Price		Rs.400
Less:		
Purchase Price	Rs.400	
Carrying Cost	Rs.3	Rs.403
Loss per tin		Rs.3

2. Go short on futures @ Rs.400/tin

    i. No change in the price, so the selling price is Rs.410/tin:

Selling Price		Rs.410
Less:		
Purchase Price	Rs.400	
Carrying Cost	Rs.3	Rs.403
Profit per tin		Rs.7
Less:		
Loss on futures (410.00 – 410.50)		Rs.0.5
Net profit		Rs.6.5

    Effective Selling Price (Rs.410 – Rs.0.50 = Rs.409.50)

    ii. Price falls to Rs. 400/tin, so the new selling price is Rs.400/tin:

Selling Price		Rs.400
Less:		
Purchase Price	Rs.400	
Carrying Cost	Rs.3	Rs.403
Loss per tin		Rs.–3
Add:		
Profit on futures (410.00 – 400.50)		Rs.9.5
Net profit		Rs.6.5

    Effective Selling Price (Rs.400 + Rs.9.50 = Rs.409.50)

3. Buy July 20x1 puts at Rs.0.25 premium/tin

   i. No change in the price, so the selling price is Rs.410/tin:

Selling Price		Rs.410
Less:		
Purchase Price	Rs.400	
Carrying Cost	Rs.3	Rs.403
Profit per tin		Rs.7
Less:		
Loss on options (only premium)		Rs.0.25
Net profit		Rs.6.75

   Effective Selling Price (Rs.410 – Rs.0.25 = Rs.409.75)

   ii. Price falls to Rs.400/tin, so the new selling price is Rs.400/tin:

Selling Price		Rs.400
Less:		
Purchase Price	Rs.400	
Carrying Cost	Rs.3	Rs.403
Loss per tin		Rs.–3
Add:		
Gain on futures (410.00 – 400.50 – 0.25)		Rs.9.25
Net profit		Rs.6.25

   Effective Selling Price (Rs.400 + Rs.9.25 = Rs.409.25)

4. Buy July 20x1 puts at Rs.0.25 premium/tin

   i. No change in the price, so the selling price is Rs.410/tin:

Selling Price		Rs.410
Less:		
Purchase Price	Rs.400	
Carrying Cost	Rs.3	
		Rs.403
Profit per tin		Rs.7.00
Less:		
Loss on options (only net premium Rs.0.25 – Rs.015)		Rs.0.10
Net profit		Rs.6.90

   Effective Selling Price (Rs.410 – Rs.0.10 = Rs.409.90)

   ii. Price falls to Rs.400/tin, so the new selling price is Rs.400/tin:

Selling Price		Rs.400
Less:		
Purchase Price	Rs.400	
Carrying Cost	Rs.3	Rs.403
Loss per tin		Rs. –3
Add:		
Gain on options (410.00 – 400.50 – 0.10)		Rs.9.40
Net profit		Rs.6.40

   Effective Selling Price (Rs.400 + Rs.9.40 = Rs.409.40)

5. **Bearish Vertical Spreads:** Spread strategies of this type are employed to exploit moderately bearish beliefs about the underlying asset and can be executed using either calls or puts. The following examples illustrate the pay-off patterns associated with this strategy.
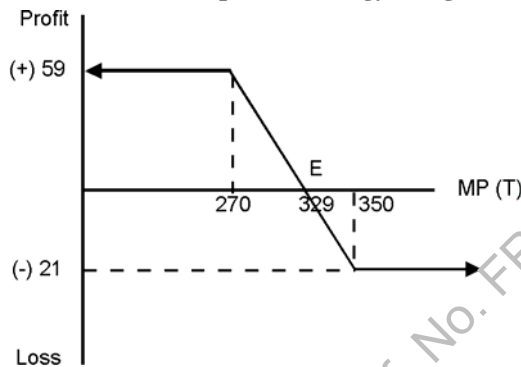
Option 1

(Bearish Vertical Spread using Calls)

Sell October 270 Call	(+) Rs.71
Buy October 350 Call	(–) Rs.12
Initial Cash Flow [CF(0)]	(+) Rs.59

The profit diagram associated with this strategy will be as follows:

Bearish Vertical Spread Strategy using Calls

Option 2

(Bearish Vertical Spread using Puts)

Buy March 350 put	(–) Rs.70
Sell March 270 put	(+) Rs. 2
Initial Cash Flow [CF(0)]	(–) Rs.68

The profit diagram associated with this strategy will be as follows:

Bearish Vertical Spread Strategy using Puts
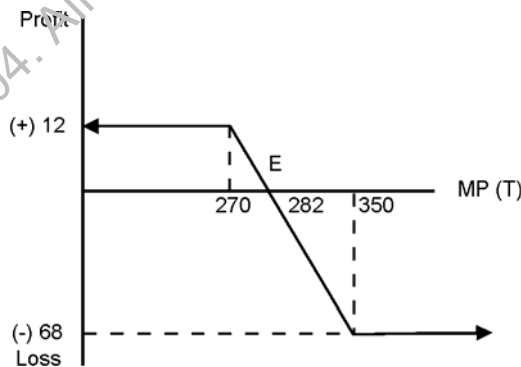
These strategies can be profitably employed when an investor believes that the stock price will move only to the strike price that generates the maximum profit. Put differently, the investor employing any of these strategies does not anticipate a major change in the price of the underlying asset.

Spread strategies can also be used to limit the maximum loss of a naked option writer. For example, an investor who believes that the stock price of Reliance Industries will fall below Rs.300 might write a March 300 call. This short call strategy *per se* produces a pay-off pattern with an unbounded downside risk. The writer can limit the downside risk by buying a March 350 call. The combination of the two positions is nothing, but a bearish vertical spread strategy using calls.

Case Study 6

1. The airline can hedge its future cost of fuel, thus can eliminate uncertainty about prices of jet fuel almost entirely. It can be done by buying a series of oil futures contracts, as it is short on oil so it should go long on futures. The price of jet fuel and gasoline or heating oil futures prices are highly correlated, and those futures are traded regularly, so it can hedge through gasoline or heating oil futures. While the hedge will not be perfect, the risk that remains, called basis risk will be small. The advantage of hedging by futures is that the size of the hedges can be adjusted to changes in anticipated fuel usage. So if fuel price rises, the futures price will also rise, thus buying futures at lower price and selling at higher prices the airline can book a gain which will reduce the loss in the spot market due to increase in fuel price.

    The another alternative airline is having to hedge through commodity swaps. Here, airline would enter a multi-period swap agreement with a commodity swap dealer. Airline would continue to purchase fuel at the spot market, each month, swap dealer would pay the airline average spot price for jet fuel, based on a notional volume of suppose 100 million gallons, and airline would pay the swap dealer at a fixed price just like in fixed to floating interest rate swap.

2. Net premium cost to be over a 10 half-yearly period using a discount rate of 3%.

Face value	= $500 million
Net premium	= 0.50%
Cap rate	= 3.50%
Floor rate	= 2.75%

    Amount of premium = 500 x 0.005 = $ 2.5 million

    Periodic amount to be amortized $= \dfrac{2.5}{\text{PVIFA}(1.5\%,10)} = \dfrac{2.5}{9.2222} = \$ 0.2711$ million.

    In this hedge through cellar there will be cash outflow if LIBOR is less than 2.75% and cash inflow if LIBOR is more than 3.5%.

Time	Libor (%)	CF due to loan	Amortized Premium	CF due to Collar	Total Cash flow
0	–	+500	–	–	+500
6m	3.25	–10.625	0.2711	–	–10,8961
12m	3.10	10.250	0.2711	–	–10.5211
18m	2.80	9,500	0.2711	–	–9.7711
24m	2.60	–9.000	0.2711	–0.375	–9.6461
30m	2.50	–8.750	0.2711	–0.625	–9.6461
36m	2.75	–9.375	0.2711	–	–9.6461
42m	3.00	–8.750	0.2711	–	–10.2711
48m	3.40	–9.375	0.2711	–	–11.2711
54m	3.60	–10.000	0.2711	+0.250	–11.5211
60m	3.90	–11.000	0.2711	+1.000	–11.5211
		512.250			

    Effective cost of the loan is given by 'r' in the following equation:

    500 = 10.8961 x PVIF (r/2,1) + 10.5211 x PVIF (r/2,2) + 9.7711 x PVIF (r/2,3) + 9.6461 x PVIF (r/2,4) + 9.6461 x PVIF (r/2,5) + 9.6461 x PVIF (r/2,6) + 10.2711 x PVIF (r/2,7) + 11.2711 x PVIF (r/2,8) + 11.5211 x PVIF (r/2,9) + 511.5211 x PVIF (r/2,10)

    For r/2 = 2%,   RHS = 503.86

    For r/2 = 3%,   RHS = 461.05

    $\therefore$ r/2 $= 2\% + (3-2)\% \times \dfrac{503.86-500}{503.86-461.05} = 2 + 1 \times \dfrac{3.86}{42.81} = 2.09\%$

    $\therefore$ r = 4.18%

    Effective cost of the long-term loan will be 4.18%.

3. a. Size of eurodollar futures = $ 1 million

Number of contracts require to hedge = 25

To hedge the rise in interest rate, the firm has to sell eurodollar futures contract at $ 99.22.

If 3 month LIBOR turns to 2.90% in December:

Interest expense on loan = $ 25 million x 0.0315 x 3/12 = $ 0.1969 million

Eurodollar futures price = 100 – 2.90 = 97.10

Loss on futures = (97.10 – 96.88) x $\dfrac{\$25}{1\,bp}$ x 25 = 0.22 x 100 x 25 x 25

$\qquad\qquad$ = $ 13750 = $ 0.01375 million

$\therefore$ Effective cost $= \dfrac{0.21065}{25} \times \dfrac{12}{3} \times 100 = 3.37\%$

If 3 month LIBOR turns 3.25% in December:

Interest expense on loan = $ 25 million x 0.0350 x 3/12 = $ 0.21875 million

Eurodollar futures price = 100 – 3.25 = 96.75

Gain on futures = (96.88 – 96.75) x $\dfrac{\$25}{1\,bp}$ x 25

$\qquad\qquad$ = 0.130 x 100 x 25 x 25

$\qquad\qquad$ = $ 8125 = $ 0.00813 million

Net cost of borrowing = 0.21875 – 0.00813 = $ 0.21062 million

$\therefore$ Effective cost $= \dfrac{0.2106}{25} \times \dfrac{12}{3} \times 100 = 3.37\%$

b. Size of US T-bill futures = $ 1 million

Number of futures required = 25

To hedge the rise in interest rate, the firm has to sell 25 T-bill December futures contract
at 97.05

If December futures closes at 96.80 :

Interest expense on Loan = $ 25 million x 0.0365 x $\dfrac{3}{12}$ = $ 0.22813 million

Gain on futures = (97.05 – 96.80) x 100 x 25 x 25 = $ 15625 = $ 0.01563 million

Net cost of borrowing = 0.22813 – 0.01563 = $ 0.21251 million

Effective cost of borrowing $= \dfrac{0.21251}{25} \times \dfrac{12}{3} \times 100 = 3.40\%$

If December futures closes at 97.25

Interest expenses on loan = $ 25 million x 0.0325 x $\dfrac{3}{12}$ = $ 0.20313 million

Loss on futures = (97.25 – 97.05) x 100 x 25 x 25 = $ 12500 = $ 0.0125 million

Net cost of borrowing = 0.20313 + 0.0125 = $ 0.21563 million

Effective cost of borrowing $= \dfrac{0.21563}{25} \times \dfrac{12}{3} \times 100 = 3.45\%$

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4. The eurodollar futures is only have yield volatility and not price volatility, as the underlying is the eurodollar interest rate.

    Yield of eurodollar futures = 3.12%

    Standard deviation for a period of 3 months = $\frac{1.05}{\sqrt{12}} \times \sqrt{3} = 0.525\%$

    The yield for 3 months period at 95.5% confidence level:

    3.12% ± 2 x 0.525% = 4.17% or 2.05%

    So, value at risk at 95.5% confidence level for 1 contract is $10,500

    T-Bill futures is price volatile, as change in interest rate changes the T-bill value.

Yield volatility	= 0.92%
Duration	= 2.5 months = 0.2083 year
Yield	= 2.95%
Modified duration	= $\frac{0.2083}{1.0295} = 0.2023$
Delta yield	= 2.95 x 0.92 = 2.714%
Price volatility	= Modified duration x Delta yield
	= 0.2023 x 2.714 = 0.549%

    Price volatility for 3 months = $\frac{0.549}{\sqrt{12}} \times \sqrt{3} = 0.275\%$

    T- bill futures position at 97.05 = $ 1,000,000 x $\left[1 - 0.0295 \times \frac{90}{360}\right] = \$992,625$

    Yield for 3 months at 95.5% confidence level:

    2.95% ± 2 x 0.275% = 3.50% or 2.40%.

    So, value at risk at 95.5% confidence level for 1 contract is $5459.44.

5. The limitations of using VaR:

    i.   It cannot measure risk accurately in extreme market conditions, because it is difficult to model risk under such conditions. Suppose that the correlation between the US$ and the French Franc falls from 90% to 30%. VaR analysis will not immediately recognize this. It will perhaps take 50 or more days before sufficient daily price data is collected to reveal that the correlation has shifted.

    ii. It focuses on a single arbitrary point. Also, it relies on simplified assumptions which may not be applicable to complex situations like options pricing.

    iii. It uses many models with a wide variety of assumptions and methods of calculation, producing different results under different models.

    iv. It is basically a statistical measure and not a managerial one.

    v.   There is no theory to show that VaR is the appropriate measure upon which to build optimal decision rules.

    vi. It cannot capture model risks, thus requiring the use of model reserves also.

    vii. Volatility also keeps varying with time and is not stable.

    viii. Prices may not respond in a linear fashion to changes in the market variables, resulting in erroneous measurement by VaR.

    ix. The distribution may not be normal distributions in all the given circumstances.

    x.   Correlations may not be stable in all the given circumstances.

    xi. It is based on the past data which may not always prove true in future.

    xii. Intra-day positions are not considered in VaR, which usually takes only the closing position into consideration.

Case Study 7

1. A Forward Rate Agreement (FRA) is a tailor-made, over-the-counter financial futures on short-term deposits, such as Eurodollar contracts. An FRA transaction is a contract between two parties to exchange payments on a deposit, called the notional amount, to be determined on the basis of a short-term interest rate, referred to as the reference rate, over a predetermined time period at a future date.

   An FRA transaction is entered as a hedge against interest rate changes. The buyer of the contract locks in the interest rate in an effort to protect against an interest rate increase, while the seller protects against a possible interest rate decline. At maturity, no funds exchange hands; rather, the difference between the contract interest and the market rate, commonly London Interbank Offered Rate (LIBOR), is multiplied by the notional deposit and the time of period to determine the cash settlement. Since FRAs are priced off LIBOR, if LIBOR is higher than the contract rate, the buyer receives a cash payment from the seller, and vice versa if the interest rate is lower. An FRA is like a short-term interest rate swap.

   A company that seeks to hedge against a possible increase in interest rates would purchase FRAs, whereas a company that seeks an interest hedge against a possible decline of the rates would sell FRAs. If the reference interest rate for a specific period on a specific date in the future is different from the one agreed upon, a settlement of the difference will be made.

   FRAs are more flexible than financial futures in terms of maturity and amounts, they do not involve margins, they are usually not subject to marked-to-market and the consequent cash flows, and they eliminate the basic risk associated with futures. The FRAs credit risk is relatively small – unless interest rate volatility is significant. FRAs are also available in foreign currencies for which the organized exchanges do not trade. FRAs allow market participants to hedge their interest rate exposure without an impact on their liquidity position and/or balance sheet. FRAs cannot be traded unless both parties agree to the contract.

   FRAs offer banks and non-bank corporations the ability to hedge their interest rate exposure without inflating their balance sheets, and they can be used to reduce interbank outstanding. While companies initially used the market for hedging purposes, many corporate participants are presently engaged in trading per se. Accounting treatment of FRA transactions varies among the major industrial countries, with some requiring that they may be market-to-market with the resulting gains/losses flowing through the Profit and Loss account.

2. a. The company needs to hedge the fall in interest rate which will reduce its investment yield. Though the company is exposed to 6-month LIBOR, and Eurodollar futures are based on 3-month LIBOR, still it can hedge it through Eurodollar futures though it will not be a perfect hedge. As the company needs to invest funds, so it should go long on Eurodollar futures contract. As the contract size for Eurodollar futures is $1 million. So the company should buy 20 eurodollar futures contract. If interest rate falls, the price of Eurodollar futures will increase, thus buying futures at lower rate and selling at higher rate the company can book profit, which will reduce the loss in interest income in the actual deposit.

   Now the question arises which Eurodollar futures contract will give the company the best hedge. As the company is expecting the interest rate will fall within April, so hedging with March Eurodollar futures will give the company better hedge, because the fall in interest in next three months will be best reflected in the March futures than longer dated futures. So the company should buy 20 March Eurodollar futures.

   Now in March, futures closes at 98.12.

   ∴ Gain from the futures = (98.12 – 97.96) x 100 x 25 x 20 = $8,000.

   Interest earned on deposit

   $$= 20,008,000 \ \text{x} \ \frac{2.08}{100} \ \text{x} \ \frac{5}{12} = \$ \ 173,402.67.$$

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Effective return on investment

$$= \frac{173,402.67}{20,000,000} \times \frac{5}{12} \times 100 = 2.081\%$$

b.   In between the period of April to September 2003, if interest rate rises, the company will lose the potential higher interest income on the deposit. To profit from the rising interest rate scenario, the company can sell Eurodollar futures contract. So that if interest rate rises, futures will be lower, thus selling at higher rate and buying at a lower rate the company can make profit.

Suppose, the company sold the September futures contract in March which was quoting at 97.92. If it holds the contract till September closing of 97.78.

Profit from each contract = (97.92 – 97.78) x 100 x 25 = $ 350

Thus by selling euro dollar futures contract the company can gain $350 per contract entered.

3.   If 6-month LIBOR in April is 1.98%:

Interest amount receivable on deposit

$$= \$20,000,000 \times 0.0208 \times \frac{5}{12} = \$173,333.33$$

Difference receivable on FRA

$$= \frac{(0.0218 - 0.0198) \times \left(\frac{5}{12}\right) \times 20,000,000}{\left(1 + 0.0198 \times \frac{5}{12}\right)} = \frac{16,666.67}{1.00825} = \$16,530.30.$$

Value of difference received after 5-month

$$= \$16,530.30 \left(1 + 0.0225 \times \frac{5}{12}\right) = \$16,666.67$$

Total interest earned = $ 173,333.33 + $ 16,666.67 = $ 190,000

Effective return $= \dfrac{190,000}{20,000,000} \times \dfrac{12}{5} \times 100 = 2.28\%$

If 6-month LIBOR in April is 2.25%

Interest amount receivable on deposit

$$= \$ 20,000,000 \times 0.0235 \times \frac{5}{12} = \$ 195,833.33$$

Difference payable on FRA $= \dfrac{(0.0225 - 0.0218) \times \left(\frac{5}{12}\right) \times 20,000,000}{\left(1 + 0.0225 \times \frac{5}{12}\right)}$

$$= \frac{5833.33}{1.009375} = \$5779.15$$

Value of difference after 5-month

$$= \$ 5779.15 \left(1 + 0.0225 \times \frac{5}{12}\right) = \$ 5833.33$$

Net interest earned on deposit
      = $ 195,833.33 – $ 5833.33 = $ 190,000

Effective return

$$= \frac{\$190,000}{\$20,000,000} \times \frac{12}{5} \times 100 = 2.28\%$$

So, by FRA the company is able to be locked in a investment yield of 2.28%.

4. Posistion value in $ = $ 20 million

Daily volatility $= \dfrac{5\%}{\sqrt{250}} = 0.3162\%$

Now the potential fluctuation of the $/Euro at 99% confidence level is:

20 (1 + 3 x 0.003162) = $ 19.8103 million

Or,

20(1 – 3 x 0.003162) = $ 19.8103 million

i.e., Daily value-at-risk at 99% confidence level is:

20 x 3 x 0.003162 = $ 0.1897 million

5. The risk management function involves a logical sequence of steps. These steps are:

a. *Determining Objectives*: Determination of objectives is the first step in the risk management function. The objective may be to protect profits, or to develop competitive advantage. The objective of risk management needs to be decided upon by the management, so that the risk manager may fulfill his responsibilities in accordance with the set objectives.

b. *Identifying Risks*: Every organization faces different risks, based on its business, the economic, social and political factors, the features of the industry it operates in – like the degree of competition, the strengths and weaknesses of its competitors, availability of raw material, factors internal to the company like the competence and outlook of the management, state of industry relations, dependence on foreign markets for inputs, sales, or finances, capabilities of its staff and other innumerable factors. Each corporate needs to identify the possible sources of risks and the kinds of risks faced by it. For this, the risk manager needs to develop a fundamental understanding of all the firm's activities and the external factors that contribute to risk.

c. *Risk evaluation*: Once the risks are identified, they need to be evaluated for ascertaining their significance. The significance of a particular risk depends upon the size of the loss that it may result in, and the probability of the occurrence of such loss. On the basis of these factors, the various risks faced by the corporate need to be classified as critical risks, important risks and not-so-important risks. Critical risks are those that may result in bankruptcy of the firm. Important risks are those that may not result in bankruptcy, but may cause severe financial distress. The not-so-important risks are those that may result in losses which the firm may easily bear in the normal course of business.

d. *Development of policy*: Based on the risk tolerance level of the firm, the risk management policy needs to be developed. The time-frame of the policy should be comparatively long, so that the policy is relatively stable. A policy generally takes the form of a declaration as to how much risk should be covered, or in other words, how much risk the firm is ready to bear.

e. *Development of strategy*: Based on the policy, the firm then needs to develop the strategy to be followed for managing risk. The tenure of a strategy is shorter than a policy, as it needs to factor-in various variables that keep changing. A strategy is essentially an action plan, which specifies the nature of risk to be managed and the timing. It also specifies the tools, techniques and instruments that can be used to manage these risks. A strategy also deals with tax and legal problems.

f. *Implementation*: Once the policy and strategy are in place, they are to be implemented for actually managing the risks. This is the operational part of risk management. It includes finding the best deal in case of risk transfer, providing for contingencies in case of risk retention, designing and implementing risk control programs, etc. It also includes taking care of the details in the operational part, like the back office work, ensuring that the controls are complied with, etc.

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g. ***Review***: The function of risk management needs to be reviewed periodically, depending on the costs involved. The factors that affect the risk management decisions keep changing, thus necessitating the need to monitor the effectiveness of the decisions taken previously.

The process of risk management has to be flexible because a company's risk profile keeps changing.

Hence, it needs to be remembered that the emphasis of the risk management process is not an identification of any specific risk, but on developing a method of assessment of risk and of arriving at the best possible way of dealing with them, as and when they arise.

Case Study 8

1. Fixed dollar floating dollar swap:

The value of fixed leg is the present value of the fixed interest payments to be made in future. The present value is to be determined using the fixed rate applicable at the time of valuation of swap.

Period	Cash flows
1	2.65
2	2.65
3	2.65
4	2.65
5	2.65
6	102.65

Present value of cash flows = 2.65 PVIFA (2.75%, 6) + 100 PVIF (2.75%, 6)

= 2.65 x 5.4624 + 100 x 0.8498 = \$99.455

The value of the floating leg at the reset day is equal to the principal.

Value of floating leg = \$100 million

Value of swap for PG = 99.455 – 100 = –\$0.545 million

Dollar-euro swap:

Principal = \$100 million = Euro 100 million

Cash flows from dollar leg:

Period	Cash flows
1	2.525
2	2.525
3	2.525
4	2.525
5	2.525
6	102.52

Value of dollar leg

= 2.525 PVIFA(2.75%, 6) + 100 PVIF (2.75%, 6)

= 2.525 x 5.4624 + 100 x 0.8498 = \$98.773 million

Cash flows from euro leg:

Period	Cash flows
1	2.40
2	2.40
3	2.40
4	2.40
5	2.40
6	102.40

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Value of euro leg

= 2.40 x PVIFA(3%, 6) + 100 x PVIF(3%, 6)

= 2.40 x 5.4172 + 100 x 0.8375

= Euro 96.751 million

= $96.751 x 1.0404 million = $100.660 million

Value of swap for PG = $98.773 – $100.660 = –$1.887 million

So fixed to floating dollar swap is beneficial to PG.

2. Principal = $100 million = Euro 100 million

Interest in year 1 = 100 x 0.048 x 1.02 = $4.896 million

Loss on the existing liability

$$= 100 \text{ x } \frac{(5.30 - 5.05)}{100} = \$ 0.25 \text{ million}$$

Total interest = $5.146 million

Interest in year 2 = 100 x 0.048 x $(1.02)^2$ = $4.994 million

Loss on existing liability = $0.25 million

Total interest = 5.244 million

Interest in year 3 = 100 x 0.048 x $(1.02)^3$ = $ 5.094 million

Loss on existing liability = $0.25 million

Total interest = $5.344 million

Interest in year 4 = 100 x 0.048 x $(1.02)^4$ = $5.196 million

Loss on existing liability = $0.25 million

Total interest = $5.446 million

Interest in year 5 = 100 x 0.048 x $(1.02)^5$ = $5.30 million

Loss on existing liability = $0.25 million

Total interest = $5.55 million

Redemption exchange of principals = $ 100 million = Euro 100 million

The cost of funds is the 'r' in the following equation:

$$100 = \frac{5.146}{1+r} + \frac{5.244}{(1+r)^2} + \frac{5.344}{(1+r)^3} + \frac{5.446}{(1+r)^4} + \frac{105.55}{(1+r)^5}$$

By trial and error, r = 5.34%.

3. Amount of euro required = Euro 2.40 million

PG will purchase Euro 2.40 million at a 6-month forward rate of $1.0504/Euro.

At forward rate, Euro 2.40 million = $2.40 x 1.0504 million = $2.5210 million

The forward position can be broken down into the following two positions:

i. Going short on 6-month zero-coupon dollar bond at $2.4565 million $\left(= \frac{2.5210}{1.02625}\right)$, where maturity value is $2.5210 million.

ii. Going long on 6-month zero-coupon euro bond at Euro 2.3443 million $= \left(\frac{2.40}{1.02375}\right)$, where maturity value is Euro 2.40 million. The value of this bond in dollar is $2.4390 million at spot market.

For US$, yield volatility = 1.15%

　　　Duration　　　　 = 0.5 year

　　　Yield　　　　 = 5.25%

Modified duration = $\frac{0.5}{1.0525}$ = 0.4751

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Delta yield = Yield x Yield volatility = 5.25 x 1.15 = 6.038%

Price volatility = Modified duration x Delta yield

$$= 0.4751 \text{ x } 6.038 = 2.8687\%$$

Price volatility for 6-months $= \dfrac{2.8687}{\sqrt{2}} = 2.0285\%$

6-months volatility of \$ bond = 2.4565 x 0.020285 = \$0.0498 million

For euro, yield volatility = 0.95%

Duration	= 0.5 year
Yield	= 4.75%

Modified duration $= \dfrac{0.5}{1.0475} = 0.4773$

Delta yield = 4.75 x 0.95 = 4.513%

Price volatility = 0.4773 x 4.513 = 2.1541%

Price volatility for 6-months $= \dfrac{2.1541}{\sqrt{2}} = 1.5232\%$

6-months volatility of euro bond

$$= 2.4390 \text{ x } 0.015232 = \text{Euro } 0.0372 \text{ million}$$

6-months volatility of euro bond in dollar term

$$= \$0.0372 \text{ x } 1.0404 \text{ x } \left(1 + \frac{0.022}{2}\right) = \$0.0391$$

The standard deviation of portfolio value for 6-months

$$= [0.0498^2 + 0.0391^2 - 2 \text{ x } 0.60 \text{ x } 0.0498 \text{ x } 0.0391]^{1/2} = \$0.0409 \text{ million}$$

6-month VAR at 95% confidence level = 0.0409 x 2 = \$ 0.0818 million.

4. The basic questions, which nag everyone, are why someone should enter into a swap contract? Why companies want to change their cash flows from fixed to floating or floating to fixed? While there can be many reasons for undertaking a swap transaction, the following are some of the significant motives:

i. Quality spreads (lower financing costs)

ii. Currency risk management

iii. Interest risk management.

In addition, swaps may be used to:

– Enter new markets

– Larger scale of operations.

i. **Quality Spreads (Lower Financing Costs)**

One of the important reasons for entering into a swap transaction is to reduce the interest cost. The reduction in the interest cost can be achieved because of the quality spreads prevailing in the market. Quality spread is the difference between borrowing power of two parties in the market. For example, Firm X can borrow at a fixed rate of 10%, while Firm Y can borrow at a fixed rate of 12%. This difference between the interest rates of X and Y is called the quality spread. This difference in the interest rates arises because of the difference in the credit ratings of the two firms. In the above case firm X could have been rated better by the market in

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comparison to firm Y. Firms X and Y face interest rates of LIBOR + 1 and LIBOR in the floating rate market. The following table summarizes the rates faced by both the firms.

Firm	Fixed Rate	Floating Rate
X	10	LIBOR + 1
Y	12	lIBOR

As seen from the above, firm X has absolute advantage in the fixed rate market whereas firm Y has absolute advantage in the floating rate market. Considering that both have absolute advantage in different markets it can be beneficial if both of them borrow in the markets where they have advantage and swap the borrowings if the same is in line with their objectives of borrowing.

Credit Rating: As stated earlier the firm with a higher credit rating attracts a lower rate of interest. However, when the firm faces a floating rate market the risk premium demanded will be low relative to the fixed rate market, since the interest rate in case of floating rate market moves in line with the market. Hence the spread in floating rate market and fixed rate market are likely to differ.

Market Saturation: Market saturation is one of the important reasons, which results in differential spreads to prevail. For example, IDBI and ICICI raised money through debt issues in the domestic market in the recent past. If this continues, the market is likely to reach a stage where the acceptability of the paper may be low not necessarily because the quality of the paper is low, but because the market has seen too much of the same paper. This can result in the market demanding a return higher than what would be otherwise considered as normal. In such a situation they can raise the funds abroad and swap them for the domestic currency. By this mechanism the firm can achieve the same objective of the borrowing funds in the domestic market.

Financial Norms: The financial leverage of a firm adds to the financial risk thereby influencing the risk premium demanded. However, what is considered as an acceptable level of leverage varies from market-to-market. It is often said that high leverage is an acceptable proposition in the Japanese markets though it might have undergone some change after the real estate bubble. In such a situation, a firm with a particular level of leverage may be able to get a better rate in overseas market when compared to the domestic market thus resulting in the prevalence of quality spreads.

ii. **Currency Risk Management**

Managing the currency risk is vital for modern corporates as they have cash inflows and outflows in different currencies. A corporate can use different methods to manage its currency risk. One of the methods for corporates to manage the currency risk is by entering into currency swaps. Let us take an example: A firm whose exports are denominated in GBP has borrowed funds in dollars in view of the low interest rates in the Euro dollar market. However, since its cash inflows are in GBP, the firm is exposed to exchange risk. At this point, the firm can change its loan portfolio into GBP by entering into currency swap so that both receivables and payables will be in the same currency.

iii**. Interest Rate Risk**

Swap will give an opportunity for the corporates to manage the interest rate risks by entering into interest rate swaps. If a corporate borrowed in floating rate and expects that interest rates will increase, then it can enter into an interest rate swap as a fixed rate payer. Due to this it will be able to manage the increase in interest rates more efficiently. Example: Firm X borrowed floating rate funds at LIBOR + 1%. After sometime if the firm feels that the interest rate may increase it may prefer borrowing in fixed rate. The firm can achieve this by undertaking either of the following activities:

i. Repay the existing loan and borrow at fixed rate.

ii. Enter into an interest rate swap.

The first choice will be more cumbersome because the firm has to go to the market again to borrow at fixed rate, which may not be cost effective. In the second choice, the firm has more flexibility in managing its existing interest rate risk. Also, there will not be any significant costs involved in entering into the swap.

iv. **Real Time Trading on the Swap Market**

In all the above illustrations, we have structured the swap to suit the needs of the client and the basic assumption we have made is that all the swap transactions taken by the bank will be matched with another party. All the above illustrations are, of course, very simplistic, but in real time there can be many more complicated structures in swaps due to the following reasons:

- More than one bank may be involved.

- The swaps and the borrowing in cash market may take place at different times.

- A bank may run unmatched position, either by choice or because of its difficulty in finding a counterparty.

v. **Enter New Markets**

Many companies can enter new markets, mainly in other countries, by resorting to swapping to reduce currency risks, as explained in currency risk management above.

vi. **Larger Scale of Operations**

By swaps a firm may be able to reduce the risks and the volatility of the profits. Thus, for a given amount of capital, more business transactions may be made with the assurance of lower risks. For example, let us assume that XYZ Ltd. must hold £1 of capital to earn £0.1 (10 pence) of profit and the volatility of its profits is £0.01 (1 penny). Without swapping, the company will only try to do £10 worth of trades for every £1 of capital, fearing that the volatility may affect its profits otherwise.

Now, say that by swapping, its risk volatility reduces to 5% of the current £0.01. It means that XYZ Ltd. can increase its trades to £10 x 20 times = £200 of trade for every £1 of capital held.

5. While the earnings of the swap bank are from the bid-ask spread of swaps and the fees charged (upfront fees), it has to entail the following risks, which are inherent to the swap business and are mostly inter-related:

i. **Interest Rate Risks:** Interest rate risks arise mostly on fixed rate legs of swaps. While the floating rate interest can be periodically adjusted to the prevailing interest rates, the fixed rate remains constant, a change in the level of interest rates in the market not accompanied by a change in the yield of debt instruments of the same time period as the interest rates, will entail interest rate losses to the bank. Unless the swap bank is fully hedged, losses will be incurred.

ii. **Currency Exchange Risks:** Currency exchange risks happen when there is an exchange rate commitment given to one party and there is a steep change in the exchange rate between the currencies in the swap. If the swap bank is not able to match the counterparty well in time, it will incur losses due to the exchange rate difference.

iii. **Market Risks:** Market risks occur when there is difficulty in finding a counterparty to a swap. Usually, longer maturity swaps have less takers and vice versa. Lower the number of takers, higher the risks of losses.

iv. **Credit Risks:** Credit risks are those risks which the swap bank has to bear in case the counterparty to a swap defaults on payment due to bankruptcy or any other defaults, legal or otherwise. The bank continues to be obliged to pay the other party of the swap, irrespective of the fact whether the former party defaulted or not. Market risks and credit risks together amount to default risks of the bank.

v. **Mismatch Risks:** Mismatch risks take place when the swap bank comes across mismatches in the requirements of both counterparties to the swap. Usually, banks have a pool of swaps and have no difficulty in finding matches, but if no party is found, the risk of mismatch losses is there. This risk is further aggravated in case one of the parties defaults.

vi. **Basis Risks:** Basis risks take place mostly in floating-to-floating rate swaps, when both the sides are pegged to two different indices and both the indices are fluctuating and there is no proper correlation between them.

vii. **Spread Risks:** Spread risks happen when the spread changes over the time period the parties are matched. The spread risk is not the same as interest rate risk, as spreads may change as a result of change in basis points, while the interest rate may still remain constant.

viii. **Settlement Risks:** Settlement risks take place when the payments of currency swaps are made at different times of the day mainly because of different settlement hours in capital markets of two countries involved in the currency swap. If a limit on the size of the settlement is placed for each day, this risk is minimized.

ix. **Sovereign Risks:** Sovereign risks are those risks that can take place if a country changes its rules regarding currency deals. It mostly happens in the underdeveloped or developing countries which tend to have more political instability than the developed world.

Part V: Caselets (Questions)

Read the caselets carefully and answer the questions preceding each caselet.

Caselet 1

1. Enumerate the main uses of Value at Risk.

2. "VaR is not able to measure extreme variations with accuracy." Elaborate.

Santander Investment is the investment bank of Banco Santander, Spain. It is an active originator of fixed income and equity, issues certain direct loans and trades in the interbank markets as a market-maker and proprietary trader. Santander Investment started to develop an RAPM methodology in 1955, based on the Value-at-Risk (VaR) methodology for market risk and the RAPM process for credit risk developed by Banco Santander several years earlier.

After one year of producing monthly results and including an RAPM-based analysis in the executive committee reporting package, Santander Investment gained sufficient confidence in the results to begin use of the methodology in the budgeting and strategic planning process.

During the development the bank had to think through the questions of what really takes capital and how to motivate and assess the traders. For example, for trading positions capital is assigned on an attribution basis – that is, based only on positions taken. The bank decided not to impose a charge on unused lines because it did not want to create an incentive for traders to take positions without a clear, positive strategy. It was judged better not to earn any money by not trading than to lose money through poor strategies in an attempt to recover an internal capital charge.

According to Juan Pujadas, chief risk officer for Santander Investment, the process has had two important benefits. First, the bank has confirmed that, historically, senior management has conscientiously observed the balance of risk and reward in its decisions. The RAPM results are generally consistent with management expectations of the most-to-least-profitable business, and why.

Second, the methodology has provided an objective means of judging the appropriate allocation of resources and credit to traders and other business. In one area a trader requested a line to maintain a $100 million position and projected an annual profit of only $15 million. This did not meet the RAPM hurdle rates, and the trader was challenged to justify the investment. He returned with a strategy to finance the position with repos and doubled the return on capital. His line was consequently approved. In the annual budget process the distribution of profit targets is now better aligned with each unit's risk limits and is linked to its strategic objectives.

According to Pujadas, the biggest obstacle in implementation is training and communication. The risk manager must devote extensive time to explaining the methodology and results. From the basic components of the difference between RAPM and ROE to subtleties such as capital cost based on allocation or attribution, communication is critical to winning over the users and establishing credibility.

Caselet 2

3. What are the main problems associated with duration?

4. Explain the concept of delta. How is it useful for an investor?

Though not many banks undertake interest rate risk management, the few institutions that do, employ varied techniques. A large nationalized bank uses sensitivity analysis to measure the difference in its rate sensitive assets and rate sensitive liabilities. Splitting of products with uncertain repricing (demand deposits and overdraft) into rate-sensitive and rate-insensitive balances involve a similar process as their division into core and non-core balances. The bank aims to achieve a minimum ratio of 1:1 for RSA and RSL.

A large NBFC uses duration analysis to measure the sensitivity of only its loans and deposits. However, this analysis is not carried to the point of measuring the effect of a change in rates on equity. These measures do not seem to have any further use, besides recognition of sensitivity. Further, duration analysis is just done for marginal lending and borrowing. This is because of the notion that the existing balance sheet composition cannot be altered significantly.

A prominent foreign bank uses Value-at-Risk (VaR) to measure interest rate risk. This is the most advanced tool available for risk measurement. It takes into account the risk of individual assets and borrowings. Also, all risks are quantified in terms of dollars. This enables the managers to see the direct impact of their decisions on the bottom line.

Pension funds are exposed to considerable interest rate risks. The pension funds sell policies to clients. Through these policies pension funds guarantee certain future earnings for certain fixed amount today. The proceeds from the sale of policies is invested in the financial assets that provide return to the funds. Fluctuations in the market interest rate can cause changes in the return of funds and hence to the return to policyholders. An alternative to remove all the interest rate risk is to have assets and liabilities in such a way that their timing of cash inflows and outflows exactly matches. A portfolio created in such a way is called a dedicated portfolio. Unfortunately, it is extremely difficult, if not impossible, to exactly match the cash flows (even a closely relating portfolio to an ideal one is very expensive). The solution is to forget the matching of cash flows and to concentrate instead on the value of the fund's assets and liabilities and to make the value difference interest rate sensitive. The selection of assets so as to minimize interest rate sensitivity in context of Asset-Liability Management is called portfolio immunization. Since the goal of immunization is to make asset-liability mix is insensitive to interest rate fluctuations, the logical starting point is the measurement of interest rate sensitivity. The most widely used measure for interest rate sensitivity is Duration.

There are three problems associated with duration:

1. The duration values are reliable over short periods of time. That is, as the time passes, the duration of assets and liabilities involves changes and the changes are not equal for all instruments involved. As the time passes on, the weighting scheme becomes more unreliable.

2. The duration also changes with yields and these changes are not necessarily the same for all the instruments. Thus, for large variations in interest rate (which could of course happen over a period of time) this strategy will not work.

3. The third problem concerns with the assumption underlying duration strategy, that all movements of the yield curve take the form of parallel shifts. This is simply not the case. Short-term rates are much more sensitive than long-term rates on different types of instruments have different sensitivities even if they have same maturities and the same types of instruments with the same maturities may have different sensitivities due to their individual ratings.

The solution for the problems (1) & (2) is to compute the duration at frequent intervals and readjust the portfolio accordingly. For the third problem, the workable solution is to adjust the size of assets on the basis of historical relationship between the yield changes on liabilities and the yield changes on the assets, that is, if we assume that there is a proportionate relationship between yield changes in assets to yield changes in liabilities then we can measure this proportion using historical data. The proportionality constant thus calculated is called as yield beta.

Y (Liabilities) = Y (Assets) x Beta.

Once we calculate yield beta we can adjust the duration model so as to take into account non-parallel shifts in yield curve.

Our aim in Asset and Liability management is to make the duration gap (defined as Duration (Assets) – Duration (Liabilities)) to be as minimum as possible in the most economical way.

Caselet 3

5. Explain the concept of heating degree days and cooling degree days.

6. What are the factors that contributed to the growth of weather derivatives?

The need for weather derivatives was first felt in the energy industry that was not only affected by the price volatility but also by the uneven demand among different seasons. EI Nino's devastating effect during the winter of 1997 played a catalytic role in triggering huge demand for the weather derivatives market. Many companies, which were affected by seasonal fluctuations, decided to hedge risk using this new instrument and this made weather derivatives an instant success in the markets. Weather derivatives being the logical extension of futures and options were easy to trade.

There are many factors that contributed to the growth of weather derivatives market. The first to mention being the convergence of insurance markets with capital markets by means of alternative risk transfer method. Catastrophe bonds have already established themselves in the financial markets. Weather derivatives can be logical extension of this convergence. The growth of the catastrophe markets and the risk "securitization" phenomena indicates that this market is not going to slow down.

Weather derivatives are traded both over-the-counter and in the exchanges. These are similar to the conventional financial derivatives like futures and options. But they differ from the conventional ones in terms of underlying asset. While the derivatives have either any financial security or index as the underlying security, weather derivatives' underlying asset is actually neither an asset nor an index but a measure of weather like temperature, wind speed, snowfall or precipitation. The most extensively traded variety of weather derivatives are based on daily temperatures/cumulative temperatures for a period.

Weather derivatives enable businesses to hedge against unanticipated temperature swings, thus enabling them to cover the loss of revenue. This sector of hedging and risk management products represents a fast growing derivative market.

Trading in weather derivatives provides both buyers and sellers a platform to manage risk in the case of hedgers and profit from risk in the case of sellers more effectively. By covering the risk from hedging through weather derivatives the revenue loss of a company can be compensated. From the point of view of an hedger, weather derivatives help in transferring the risk to another party who is willing to take this risk.

Weather derivative market in US has originally grown out of energy market. The need for newly deregulated utilities to hedge against volume risk can be primarily attributed to the temperature fluctuations. The most actively traded products among the weather derivatives are based on temperature measures. The individual contracts are calendar month futures contracts on heating Degree Days (HDD) and Cooling Degree Days (CDD) as well as options on futures.

As for the exchange traded weather derivatives, the CME is the first exchange to offer trading in weather derivatives. The weather derivatives in their early days were traded only in the over-the-counter markets. Gradually, the growing importance of weather derivatives in business has prompted many big companies to hedge against weather risk and the exchanges had begun trading in weather derivatives. The volume of trade in exchanges has grown much significantly due to the decline of default risk associated with non-exchange markets. It is estimated that at least 1600 deals worth approximately $4 bn are traded in both the markets in USA.

The CME had begun trading in the weather derivatives in 10 key US cities: Atlanta, New York, Chicago, Cincinnati, Dallas, DesMoines, Las Vegas, Tucson, Philadelphia, and Portland. There are a number of dealers who assist in closing over-the-counter deals. The dealers who assist in the OTC market include big names like Natsource, Euro Brokers, Sakura Dellsher Inc., United Energy, Tradition and others.

Pricing models for weather derivatives are in various stages of sophistication. The market makers use different types of pricing methods that they find more comfortable with. The price of the weather derivative can be different for two parties involved since they do not necessarily follow the same method. No standard method of pricing has evolved so far.

A simple option pricing can be constructed by using a probability distribution with the help of historical data of monthly CDDs or HDDs. Integrating the product of the probability distribution with the pay-offs of the option is one method. Another convenient and simple method is the usage of a Guassian distribution of CDDs and HDDs. Mean and standard deviation of HDDs and CDDs in a location, which relates the price of an option to three factors: the standard deviation of the distribution, the distance of the strike from the mean value and number of dollars per degree day specified in the contract.

The insurance sector while dealing with the weather derivatives market uses a method called Burn Analysis. It is based on the collection of historical data and converting them into CDDs and HDDs and determining what the option would have been paid out the previous years. The average of the payouts is determined and is discounted to the present settlement date. For any pricing method prevailing now historical data invariably forms the basis. Only time will tell whether the use of these methods was appropriate to value derivatives.

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Many market makers face the challenge of an appropriate pricing model. This is a major concern to the participants in the weather derivative market and discussed more among the players. Since option prices are not derived from other prices, usage of these models may not be advisable. Some participants unprepared to deal with this complex phenomenon of pricing do not proceed cautiously. Some market makers are in more advance stage and design their own models. As the competitive edge will be enjoyed by those who have better models, this market wide scarcity of good models presents opportunity for all the players with fair valuation.

Caselet 4

7.   How do you interpret a VaR at a 99% level over a horizon of one fortnight?

8.   Justify the use of VaR for calculating the initial margins of futures.

9.   "VaR is not about any one instrument, it is about the total risk of a portfolio". Why do you think it is so?

Finance is essentially about the valuation of uncertain cash flows in future. Dealing with this uncertainty, and the relationship between risk and return, is the basic challenge faced by everyone in finance, whether in banking or fund management or securities.

Traders and firms need to be extremely careful when dealing with risk. Some amount of risk is inescapable, for otherwise the average returns would be extremely low. Some kinds of risk do not yield higher returns, and are just not worth bearing. Risk and return have to be thought out at the portfolio level, whereas many people are instinctively used to looking at individual securities.

Traditionally, coping with risk has been done by pure intuition. This is becoming increasingly hard given the complexity of the modern financial system, and the competitive pressures generated by 'quantitative' firms. There is a considerable body of pre-scientific "folk medicine" which is widely used in finance. This has generated many disasters, some of which have made front-page news.

If risk and return lie at the heart of finance, then shareholders need to locate the firm on the risk-return trade-off, and ensure that managers cater to the choices of the shareholders. The definition of risk policies in this context requires an explicit specification of risk. This gives an impetus for a more explicit treatment of risk using modern financial economics.

In recent years, the notion of "Value at Risk" (VaR) has come into prominence as a tool towards the risk measurement. In order to measure the risk of a portfolio in terms of its VaR, we need to specify two things: (a) a horizon and (b) a probability level.

Hence, there is no such thing as a single VaR, instead there is a different VaR for different time horizons and for different probability levels. The VaR at a 99 percent level on a one-day horizon is the one-day loss that will only be exceeded on 1 percent of the days. If we assume there are 250 trading days a year, a 1 percent VaR on a one-day horizon is the loss that will be exceeded for two to three days a year.

Thus, the notion of VaR reduces the total risk of an entire portfolio – and not an instrument – into a numerical measure of the losses that will be experienced on bad days on the portfolio. VaR has one great advantage – managers can understand and comprehend it. The chairman of a company can discuss the drafting of a risk policy in terms of VaR, even if he is not familiar with advanced financial economics.

To be sure, the implementation of systems to measure VaR requires advanced financial economics. But the beauty of VaR is that the output that comes out of its implementation is comprehensible. When we deal with complex combinations of spot equity, index futures, index options, forward positions on the currency market, etc., the creation of a VaR system is technically demanding. Yet, any manager would know that something is a miss when the 95 percent VaR on a one-day horizon of a position exceeds the net worth of the company.

VaR is measured at a portfolio level. It is not about any one instrument, it is about the total risk of a portfolio. It is not particularly meaningful to ask: "What is the VaR of the September Nifty futures". The idea of VaR correctly focuses upon the bottom line: "The risk of the portfolio as a whole".

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VaR is closely connected with initial margin requirements of clearing corporations. The initial margin is supposed to be large enough to cope with one-day losses on most days. At the Chicago Mercantile Exchange, initial margin is normally set at a 95 percent VaR on a one-day horizon. Once again, portfolio analysis is important: it is not possible to assign an initial margin to each futures contract and obtain the total risk of the portfolio by summing up. A portfolio "buy August futures and buy September futures" is very different from a portfolio" buy August futures and sell September futures".

Caselet 5

10. With the Insurance Regulatory Development Authority (IRDA) starting to accept foray of private sector into insurance business, what is the future and prospect of this sector in the insurance business?

11. What is the general view of the Indian population about insurance? What are the reasons that prompted a change in this sector?

The last barrier has finally crumbled. With the Insurance Regulatory Development Authority (IRDA) opening its window to applications for licenses from private insurance companies, it's only a matter of time before there's free-for-all in the Indian Insurance market.

Queuing up outside the IRDA are some 20-odd companies, from big names in manufacturing to heavy weights in the financial world (along with a host of smaller wannabees), drooling at the thought of getting a slice of the Rs.32,000 crore insurance pie.

But will there be enough for all of them? Yes, as a study by the Boston-based consulting firm, Monitor Group, which sees room for around 30 players in the life segment and another 20 in the general insurance segment. It estimates the market for new entrants in life insurance at between Rs.30,000 and Rs.40,000 crore and in general insurance at around Rs.25,000 crore.

India, no doubt, is a highly underinsured country, with penetration levels of only 1.3 percent as against 2.86 percent in Israel and 2.43 percent in Hong Kong.

Estimates of the ratio of insured people to total insurable population vary from 15 percent to 22 percent. But with a burgeoning middle class, this is expected to change. The life insurance market, for example, is estimated to increase by between 15 and 25 percent a year. That's what makes executive director of Kotak Mahindra Finance Ltd., Shivaji Dham, 43, state confidently: "Even if penetration levels reach between 2 percent and 3 percent, the numbers are substantial enough to have room for all."

But Country Managing partner and Chairman of Ernst & Young India, K N Memani, 61, is not sure about this. "Only a few players will last," he predicts. The insurance sector, he explains, requires huge initial investments and has a long gestation period. It takes around seven years to break even in the life insurance segment and five years in the general insurance segment. And profits begin trickling in only after the eighth year in the life and fourth year in the non-life segment. Of course, after that, points out managing director-designate of ICICI Prudential Life Insurance, Shikha Sharma, 41, there are guaranteed returns of between 18 and 20 percent.

Memani doubts whether many insurance hopefuls are willing to wait that long. Similar misgivings in the minds of foreign insurance companies about commitment levels have delayed the finalization of several joint ventures.

These apprehensions gain ground because foreign companies are not in a position to call the shots in the joint venture. The 26 percent cap on foreign equity will give them the right only to block special resolutions at shareholders' meetings. But can Indian companies, with no experience whatsoever of the insurance business, really lead from the front? More importantly, will foreign companies, which will bring in expertise into what is basically a skill-driven business, be content with the back seat?

The tough call for companies will be to get people to take to insurance. Points out chief executive officer of HT-CGU Project Services Deepak Verma, 48: "Indians see insurance as a tax-saving device and not as a risk management tool and a means to handle long-term financial needs." But inculcating a habit is a difficult task. Which is why UK-based Royal & Sun Alliance plans risk management workshops to create customer awareness about the need for insurance and will fly in specialist engineers to provide consultancy services for corporate clients. The ING-Vysya bank joint venture also plans to invest in consumer education.

The key to breaking resistance to insurance will undoubtedly be the range and quality of products. Says Chief Executive Officer (India Liaison Office), Royal & Sun Alliance, Antony Jacob, 39: "Customers want a choice of companies and a variety of products". From the little that companies are willing to reveal about their plans, the offerings on the insurance smorgasbord seem fairly similar: Basic life insurance, pensions, annuity plans, life cycle products like education, marriage, personal line products covering expensive household gadgets, health linked plans, and customized unit-linked products.

That's why companies have to innovate, points out Sunil Mehta, 43, Country Head (India), of US-based AIG, even as he remains tightlipped on Tata-AIGs own plans. ING-Vysya is planning adding riders on life insurance policies. These are insurance policies with benefits covering health problems, absence from work due to illness and disability caused by accident. HT-CGU Project Services plans a unit-linked asset management product with insurance benefits. In this, the premium will be invested in a mutual fund product and the earnings on that will be re-invested.

With the IRDA guidelines specifying, 5 percent rural exposure in life and 15 percent in non-life and the rural market booming, companies are paying close attention to that sector. Max New York Life Insurance is promising sachet products that are low-priced units with low premiums. Stipulations about social sector coverage are also being taken seriously. HT-CGU Project Services, for example, has designed flexi-premium schemes that allow the policyholders to vary premium payment depending upon the cash in hand. This is targeted at those working in the unorganized sector whose monthly earnings fluctuate.

Caselet 6

12. According to the caselet, competition among the insurance companies results in better services. But, uncontrolled competition may result in certain problems. What are they? How can they be overcome?

13. Of late, many banks are planning to enter the insurance sector. What are the strengths and weaknesses of banks that should be considered while entering the insurance sector?

The proposed opening up of the insurance sector, in particular the question of foreign participation, has led to a bizarre drama. The different spokespersons of the ruling BJP (not to mention the Swadeshi Jagran Manch) are saying contradictory things at the same time, making the Government a laughing stock in the eyes of the outside world. Fortunately, after a lot of maneuvering it seems that the Insurance Regulatory Authority Bill, now before a Select Committee of Parliament, has a good chance of getting through, perhaps with some changes.

In any case, what are the pros and cons of insurance sector liberalization? The R N Malhotra Committee went into the question and came out with a well-researched and balanced report as far back as in January, 1994.

Most sectors of the economy, hitherto the exclusive preserve of the public sector, have been opened up for private sector participation, including foreigners. In the banking sector, private banks, both Indian and foreign, have been allowed to operate despite protests from the trade unions. No doubt, as a result of competitive pressures, the services of public sector banks have improved in recent years, in terms of providing new types of services (such as the ATM) as well as improved efficiency in the traditional services.

The life insurance business in India has, by contrast, remained the exclusive business of LIC with all the attendant consequences of a public sector monopoly. In general insurance, though there are four public sector companies under the GIC, there is effectively no competition among them in the range of services offered or pricing or customer-friendliness. The question is: As in other areas, why cannot the customers get the benefits of competition in the form of wider choice, lower premium rates and better services in the insurance sector?

The Malhotra Committee, while advocating the opening up, also suggested safeguards to protect the interests of the assured and to ensure that the existing public sector insurance companies do not suffer from the disadvantage of catering to a large number of small customers spread all over the country, especially the vast rural stretches.

Basically, the incumbent public sector companies will have to co-exist with the new entrants, both Indian and foreign. The customers – as in banking – will have the choice of either opting for the safer but less customer-friendly public sector companies or for somewhat riskier but better service providing private sector operators.

Caselet 7

14. Discuss from the regulator's point of view the need for setting entry norms for banks to enter into insurance business.

15. Which of the two insurance segments should the banks enter – Life Insurance or General Insurance? Justify.

16. Which of the two parameters are essential for a bank's foray into insurance – net worth or network? Justify.

The Reserve Bank of India (RBI) draft guidelines outlining the minimum requirements for banks seeking to enter the insurance sector, on the face of it, appear appropriate, but most bankers believe they are not pragmatic. The guidelines rotate around a few issues namely, net non performing assets of one percent below the industry average, minimum net worth of Rs.500 crore, a satisfactory track record of subsidiaries, entry through a joint venture, and 10 percent capital adequacy. The RBI said that it would give approval for insurance foray to only those banks which meet the above criteria for the financial year ended March 31, 2000. According to senior officials in the central bank, the high bar is to ensure that only fundamentally sound banks and financial institutions get in. They said rules would be similar for NBFCs too.

Senior bankers feel that the yardsticks outlined by the RBI are too harsh and not many banks will be able to make a foray into the insurance sector. According to them, the guidelines have been framed in such a manner that neither the public sector nor the private sector banks would be comfortable with the minimum requirements.

A Senior official from a public sector bank feels that the RBI should have a futuristic view. The guidelines, he said, should concentrate on the risk-bearing capacity of each bank instead. However, senior RBI officials say that the Indian banks do not have expertise in the insurance business and, therefore, the high entry barriers.

Caselet 8

17. The RBI is not in favor of permitting corporates to enter into derivative contracts for hedging anticipated exposures. Do you support the RBI's view in this matter? Explain the advantages and disadvantages of using derivatives for anticipated exposures.

18. Explain the key guidelines the risk manager of a company should keep in mind.

19. The BSE has recently introduced trading in futures. Discuss the salient requirements for becoming a member of the BSE futures trading community.

The Reserve Bank of India is not in favor of transactions based on anticipated exposures akin to permitting companies to write options, according to the RBI Deputy Governor, Mr. Jagdish Capoor. "The RBI's decision to permit Indian companies access only to offset hedges and options is in line with the freedom available to them in the currency market," Mr. Capoor said in his paper presented at the workshop on Hedging techniques for Indian corporates'. Mr. Capoor's paper was presented at the workshop in absentia. According to him, derivative instruments such as futures and options offer corporates powerful new tools to manage their risks, but the tools also pose new heavy risks. "The overall impact of derivatives on economic activity can be said to have been positive, but the progress has not been smooth. The reason is the imbalance between the availability of financial instruments and the ability to use them," Mr. Capoor said in his paper. The concern of the RBI in the matter of corporates setting up adequate risk management systems is evident in the elaborate procedure prescribed for approaching it for permission to execute hedges, he added. "It is realized that potential losses on derivatives are not a matter of concern provided companies use derivatives to offset core business exposures," he added. He said that although the RBI has taken only a small step towards facilitating corporates to cover their risks it is a significant step. "As central bankers, the RBI is cautious and conservative in playing its regulatory role. From strict controls it has moved gradually towards selective liberalization," he said.

Caselet 9

20. What is the difference between a swap and a repo? Explain.

21. Is it possible to swap assets instead of liabilities? Explain.

22. Is an overnight rate suitable for a two-year swap? Justify.

How do Interest Rate Swaps (IRSs) function? In a plain-vanilla IRS-which is what is permitted – two counterparties, each of whom has an opposing view on the way interest rates will move, agree to execute the deal via a contract. As per the contract, one of the counterparties (typically, one which has a floating rate liability to be paid and expects call and interest rates to harden) will exchange the floating rate stream with a fixed one to lock-in the existing rates. The other counterparty (one with a fixed rate liability who expects call rates and interest rates to soften), would be one to exchange fixed rate interest streams for a floating rate.

The agreement is to net off the fixed rate of interest against floating rate of interest at maturity. The floating rate payment is calculated at rests against a benchmark (the NSE Mibor is the only acceptable one here today, which is an Overnight Indexed Swap (OIS) with the floating rate linked to overnight call rate). The interest is based on a notional principal. The fixed interest is decided on the basis of the same notional principal, with no recourse to any benchmarks. At maturity, the two are netted off, and the difference paid by one counterparty to the other, as the case may be. Since the calculations are done every day for the entire period of the instrument, the maturity could extend to five years – although in India, one year is about the farthest a participant will go.

For example, consider Party A who is a large lender in the call money market with a view that overnight rates may fall and Party B who is a borrower in the call money market with a view that call money rates may be volatile. Party A is the fixed rate receiver and Party B is the floating rate receiver. A seven-day overnight indexed swap at 9.25% for a notional principal of Rs.10 crore between them would require Party B to pay an amount of Rs.177,397 (100,000,000 x 9.25% x 7/365) to A, in turn, will be required to pay B the floating leg which is calculated as below, and shows that A will be required to pay a sum of Rs.167,649.

A SEVEN-DAY SWAP			
	Actual overnight rate (MIBOR)	Opening principal amount (Rs.)	Interest (Rs.)	Closing principal amount (Rs.)
Day 1	8.00%	100,000,000	21,918	100,021,918
Day 2	8.25%	100,021,918	22,608	100,044,526
Day 3	8.75%	100,044,526	23,983	100,068,509
Day 4	9.25%	100,068,509	25,360	100,093,869
Day 5	10.50%	100,093,869	28,794	100,122,663
Day 6 & 7*	8.20%	100,122,663	44,987	100,167,649
TOTAL			1,67,649	

* Days 6 and 7 are clubbed together to indicate Saturday and Sunday which will have the same call money rate. The interest will be calculated by the simple interest method for these days.

Caselet 10

23. Does hedging always lead to competitiveness in terms of costs? Justify.

24. According to the caselet, it may not be necessary for the corporate to be completely hedged all the time. Critically evaluate the statement.

25. The Reserve Bank of India (RBI) has laid down that there should not be any net receipt of premium to the corporate when using products involving simultaneous purchase and sale of options. What do you think is the justification for such a measure?

Commodity hedging in India has seen more action in the last one year than ever before. About 77 years after the establishment of the first futures exchange in the country (Cotton Exchange of Bombay 1921), on September 28, 1998, the Indian corporate sector was allowed to access the international commodity futures exchanges for hedging its commodity price risk.

This was a step forward in making the country's commodity produces more efficient and thereby enable them to compete in the international markets.

Given the ongoing integration of the Indian economy with the rest of the world, the price risk and the needs for hedging are on the rise. Importers of base metals probably form the largest group of corporates whose cash flows are significantly vulnerable to commodity price fluctuations.

Among the agricultural commodities, the price fluctuations in coffee are also well-known. With progressive deregulation and reduced role of the state in price determination, the market forces will play a greater role in price determination. This will lead to increased volatility and price risk for the corporate. Given the scenario, the freedom to hedge against the price risk is an integral part of the process of liberalization.

The Reserve Bank of India (RBI) as an able regulatory and monitoring authority, seems to have adopted a phased approach, enabling the corporates to expose themselves to international hedging products and practices. In the first phase through its circular on September 28, 1998, the corporates were allowed to use exchange traded futures position and vice versa and thus be immune to price risks. As the market matured, in the second phase, the RBI circular of May 10, 1999, allowed corporates to

- Sell options to cancel options bought,

- Enter into Over-the-Counter (OTC) transactions based on average prices,

- Use products involving simultaneous purchase and sale of options, with a condition that there should not be any net receipt of premium to the corporate, and

- Hedge their bullion price risk (arising from export commitments) through the London bullion market association and recognized international exchanges.

Recently, on October 5, 1999, RBI allowed banks, which were permitted to accept gold under deposit schemes, to use exchange traded and OTC hedging products available overseas to manage price risk arising out of sale of the yellow metal. In products involving options, RBI has clarified again that there should not be any net receipt of premium.

Corporate entities which effectively hedge their risk in various areas will be at a substantial advantage to their counterparts without hedging skills. It may not be necessary for the corporate to be completely hedged all the time, but the ability to hedge will be a definite asset and a parameter for competitiveness in future.

Caselet 11

26. What are the benefits that would flow to Indian consumers with the opening-up of the insurance sector? Explain with special reference to the health-care insurance segment.

27. Justify the entry of foreign players into the insurance sector. State the problems that may arise because of the entry of foreign players.

It has aroused intense debate, pitted political parties against each other and provoked the ire of trade unions. The issue of opening up of the insurance sector has also been dwelt upon in election manifestos, reiterating its importance not only to party politics but also to the national economy.

Ever since the Malhotra Committee recommended in January, 1994 that the insurance sector should be liberalized and opened up to private players, both foreign and domestic private insurers have been gearing up to grab a slice of the seemingly unlimited pie. The main recommendations of the committee were:

- Private sector entry be allowed though on a controlled basis; no single company should be allowed to transact both life and general businesses.

- Minimum paid-up capital to be Rs.100 crore.

- Private promoters' holding not to exceed 40% of total capital after the start up stage and not to fall below 26% at any time.

- If and when foreign entry is allowed, it should be in joint ventures with Indian majority ownership.

- The Insurance Regulatory Authority (IRA) should start functioning effectively before private entry is allowed.

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Caselet 12

28. Who, in your opinion, should be the regulatory authority for insurance industry – Ministry of Finance or Insurance Regulatory Authority (IRA)? Give reasons.

29. Would you feel that both life and general sectors should be opened? Give reasons.

The controversy over whether it will be the ministry of finance's insurance division or the Insurance Regulatory Authority that will issue licenses as and when the sector is opened, has been settled in favor of the latter. Speaking at the international insurance seminar organized by the Confederation of Indian Industry, B K Chaturvedi, special secretary, said "The IRA will be the center-piece of insurance reforms. It will be responsible for registering companies and checking whether they meet all the qualifications." It will be the IRA which will lay down the norms for the capital structure such as capital adequacy ratio and solvency margins, he elaborated.

N Rangachary, Chairman, IRA, announced that an ombudsman would be appointed on the lines of the banking industry. This assumes significance to avoid clashing of operations as in case of TRAI and DoT. An ombudsman will be the arbiter between the two bodies.

Giving a glimpse of how the IRA proposes to screen applications, Rangachary said initially a window will be opened for receiving applications which will be open for a period of 90 days. Thereafter, the IRA will take about three to four months to study the applications. On receiving the nod, the companies will have to start operations within a period of nine months to a year. While extensions for starting business may be provided in some cases, operations will definitely have to kick-off in 15 to 18 months, he said.

Licenses will not be transferable. Under no circumstances will the IRA permit trafficking of licenses, he underscored. To ensure fair pricing, IRA will monitor the pricing structure. The IRA, however, will initially adopt the procedure of 'file and use' whereby companies will file the product structure with IRA and the regulator will allow marketing in good faith.

Caselet 13

30. What are the floating rates that are available in the Indian market which can be used as benchmark rates for interest rate swaps? Explain the pros and cons of each of the rates.

31. What are the advantages of 'synthetic agreement' over a forward contract? What does that mean from the point of view of a hedger?

The market for interest rate swaps really needs a floating rate benchmark based on term money rates that are reliable and market determined. Such term money market benchmarks will also facilitate growth of the interest rate swap market for standard maturities. Many debt issues in the recent past were linked to 91- and 364-day treasury bills, the bank rate and the yield curve on gilts. However, not enough repeat deals took place because of the inherent problems with these benchmarks: Cut-off yields being below secondary market yields, lack of transparency, benchmark prone to regulatory risks, and market yields not being directly linked to the benchmark.

Ideally, a benchmark rate should evolve from an interbank term money market that is where money is lent and borrowed for maturities up to 12 months. Unfortunately, this market has not yet developed although it is recognized that its existence is critical for the survival of the rupee derivatives market. Hopefully, a natural term money market will emerge soon with asset-liability management becoming mandatory from the beginning of this financial year.

Banks are required to compile statements of liquidity and interest rate sensitivity on a quarterly basis. These statements will enable a bank treasurer to lend or borrow money for different maturities, including forward-forward, keeping in view the gaps. This may take some time because banks are putting the guidelines in place. The interest rate swap market, however, cannot wait for the development of a natural term money market and immediate steps need to be taken. We need to find a substitute.

The foreign exchange market offers one the form of a swap rate that is quoted for maturities up to 12 months. The rate is for swapping rupees and dollars for two deliveries say, spot against one month forward or three-month forward to six-month forward. This is the rate paid or received by banks. For example, a spot one-month swap rate of 5 percent per annum means that rupees can be exchanged for dollars for one month (starting the spot date) by receiving the swap rate of 5 percent. This rate is picked up by wire services after polling different rates put out by banks and brokers.

With gradual integration of markets, the swap rate now almost reflects the inflation differential between the rupee and the dollar. This market is sustainable and generates enough liquidity: Banks are prepared to bid for maturities up to 12 months.

Similarly, there exists a money market for Eurodollar at centers like London and Singapore, where banks can borrow or lend dollars for different maturities from overnight to 12 months on spot basis. These Eurodollar money market rates, like the London interbank offered rate or the Singapore interbank offered rate, are used as global benchmarks. The swap rate, which reflects net accessible interest rate differentials, when juxtaposed with dollar Libor rates, will generate a synthetic rupee yield curve for maturities up to one year.

This derivative rupee yield curve becomes a near substitute for the rupee term money market, and can be used for trading term money. This benchmark, if permitted, will help develop a natural interest rate swap market, since term money benchmarks for up to 12 months will be available.

Once this emerges, rates for standard maturities up to seven years will also develop, which would have not otherwise. Moreover, this will also help in aligning the money and forex markets. The RBI, which has been very liberal in its guidelines on rupee derivatives, should now allow market participants to use the dollar Libor plus swap rate as the benchmark for rupee interest rate swap deals.

There is another widely traded product known as a synthetic agreement for forward exchange. While a forward rate agreement is an off-balance sheet forward-forward deposit, a synthetic agreement for forward exchange is an off-balance sheet forward-forward foreign exchange swap.

A synthetic agreement is similar to an ordinary foreign exchange swap, and gives rise to similar cash flows. However, on settlement, one party pays the other the settlement sum calculated on the difference between the rates originally contracted and those prevailing on the date.

That is, instead of parties locking in the settlement amount on the date of contract, the amount is calculated on the date of maturity. This product will further facilitate the development of a forward-forward market, which is essential for both the forward rate agreement and interest rate swap markets.

Caselet 14

32. If the market share vested by foreign companies is low, what is the need for allowing foreign companies? How does participation by foreign companies in the insurance sector contribute to the growth of the domestic public sector companies?

33. Are there any risks in allowing foreign companies into the insurance sector? Explain.

34. If banking is a good example, how do you think the structure of insurance sector will look after it is opened up for foreign participation?

They see foreign insurance companies as predators, wanting to fleece both the public and the country. Foreign insurers, they say, will swamp the market and threaten the existence of Indian companies. Many employees will lose their jobs. And finally, there will be a large outflow of funds from the country as foreign insurers seek to repatriate their profits.

One way to deal with these criticisms is to dismiss them outright as xenophobic fears that have been proved false in sector after sector that has been opened up to foreign participation. A better way, however, would be to take a dispassionate look at the experience of other countries that have opened up their insurance sector to foreign participation.

Cross country experience shows that nowhere in the world has the entry of foreign firms threatened the position of domestic companies. Whether it is Malaysia, where the insurance sector has been open for more than 50 years and foreign companies account for about 10 percent of market penetration or it is Indonesia, Thailand, China or the Philippines, where the market has been opened more recently, the total market share of foreign companies is less than 10 percent save in Indonesia where it is about 20 percent. Closer home we have the experience of the banking sector where despite the presence of 42 foreign banks, their share in total banking assets is less than 10 percent.

Today less than 20 percent of the insurable population in India is insured and insurance premia (life as well as non-life) accounts for just 2 percent of GDP as against the G-7 average of 9.2 percent. Consequently, the fear that new companies will displace existing companies is misplaced.

There is room for not only the existing companies but also for any number of competitors. This is not mere talk. Four years ago, insurance premium accounted for just over 1 percent of China's GDP. But in the four years since the market has been liberalized (albeit partially) spending on insurance has grown at a compound annual rate of 33 percent. Even better, it is not just foreign companies alone that have grown but also the national PICC as well.

The story is no different in South Korea. There, the opening of the sector saw the Big Six domestic players, who initially controlled the entire market, increase their business from 7 to 37 trillion won by 1997. Meanwhile foreign companies were not able to capture more than a miniscule 0.7 percent of the market.

Caselet 15

35. What are the various economic motives for swaps?

36. Funding requirements (Floating vs Fixed Rate) of banks tend to differ from those of manufacturing companies. Explain with reasons why this should be so.

37. Global Bank has to pay additional interest of 0.25% in the case of floating rate loans and 0.50% more in the case of fixed rate loans in London as compared to New York. Explain with relevant arguments, why this may be so?

38. Suppose, Mathews has decided to use the equity route. What are the various factors which should be considered while deciding the currency of issue?

39. Work out the best possible swap arrangement using the information given.

The Vice President of Global Bank, James Mathews was facing an intriguing situation at the beginning of 1998. Global Bank had grown aggressively in the past five years. The bank was desperately looking for additional funds not only to meet client requirements but also to improve capital adequacy. Since Global Bank had only recently floated a major equity issue and its shares were also quoting at below par value, the Vice President ruled out the equity route. Mathews, however, had to choose from a variety of floating and fixed rate debt instruments available at different financial centers.

Background Note

Global Bank was one of the largest banks in the world. Headquartered in New York, it employed more than 70,000 people and operated in 90 countries. The bank provided financial services to individuals, corporations and governments. To service its customers efficiently, Global Bank has divided its operations into three segments: Retail Banking, Corporate Banking and Investment Banking. As the names suggest, Retail Banking provided consumer services like savings accounts, personal loans, mortgages and credit cards. Corporate Banking provided various innovative and traditional services to corporations and governments. Investment Banking helped clients raise funds from the capital markets. It also provided advice on mergers and acquisitions and acted as a depository.

In the mid 1990s, Global Bank had grown impressively. The bank regularly issued equity and debt to mobilize funds for various activities. Global had been quite successful in increasing both primary and total capital as defined by regulators. As a result, it enjoyed a favorable image and very high credit rating in the capital markets.

The Problem

In early 1998, Global had to raise immediately around $500 million. As mentioned earlier, an equity issue did not appear feasible in the short run. Fixed rate perpetual preferred stock also had to be ruled out as it was quite expensive. On the other hand, the bank had an excellent credit rating. Mathews was confident that interest rates would be quite attractive for a bank such as Global.

Mathews was of the opinion that Global Bank would invariably have to add more floating rate debt in order to provide a better match with the growing volume of floating rate assets and thus minimize the sensitivity of overall corporate earnings to changes in the level of interest rates.

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To make a more detailed and systematic analysis, Mathews began to collect information in both New York and London, the two prime centers for raising funds. The information collected is summarized below:

London

Floating rate Eurodollar loan	:	LIBOR + 1%
Fixed rate Eurodollar loan	:	7.5%

New York

Floating rate Dollar loan	:	LIBOR + 0.75%
Fixed rate Dollar loan	:	7.0%

Mathews was also aware that the possibility of swaps also needed to be explored. Fortunately for him, only recently, two of his most prized clients, ABC Ltd. and XYZ Ltd. had approached him with their funding requirements. The quantum of funds needed by these companies roughly matched Global's own requirement of $500 million. As an experienced investment banker, Mathews quickly estimated the cost of funds for both ABC Ltd. and XYZ Ltd. in both the markets.

	ABC	XYZ
London Floating Eurodollar	LIBOR + 1.5%	LIBOR + 2.5%
London Fixed rate Eurodollar	8.5%	8.75%
New York Floating Dollar	LIBOR + 1.0%	LIBOR + 1.25%
New York Fixed rate Dollar	7.5%	7.75%

Both ABC and XYZ were in need of fixed rate funds. US regulations allowed free flow of capital and geography made little difference to Global Bank. Mathews now had to work out in which market he should raise funds and how a profitable swap could be structured.

Caselet 16

40. What is Financial Engineering? Explain the importance of the physical tools in Financial Engineering and briefly explain some tools?

41. "The term financial engineering is often used to refer to risk management also because it involves a strategic approach to risk management." How does financial engineering deal in managing the risk of a concern?

Over the years, financial managers have been coping with the challenges of changing situations. Different new techniques of financial analysis and new financial instruments have been evolved. The process that seeks to adopt existing financial instruments and develop new ones so as to enable financial market participants to cope more effectively with changing conditions is known as financial engineering.

In recent years, the rapidity with which corporate finance and investment finance have changed in practice has given birth to a new area of study — financial engineering. It involves use of complex mathematical modelling and high-speed computer solutions.

Financial engineering refers to and includes all this. It also involves any novel twist to an existing idea and is not limited to corporate finance alone. It has been practiced by commercial banks in offering new and tailor-made products to different types of customers. Financial engineering has been used in schemes of mergers and acquisitions.

The term financial engineering is often used to refer to risk management also because it involves a strategic approach to risk management.

Caselet 17

42. "ICICI, a non-banking financial institution utilized securitization, a Financial Engineering process, while merging itself with ICICI Bank." What is Securitization? Describe its process.

43. What are the advantages of Securitization as a tool for Financial Engineering?

ICICI proposes to sell a portion of its loan-assets to a Special Purpose Vehicle (SPV). This SPV is expected to bundle the loan-assets into securities and sell them to wholesale investors – a process called securitization.

Why is ICICI securitizing its loans? The reason is that ICICI proposes to merge with ICICI Bank and become a single entity that will engage in banking activities. That requires ICICI, now a non-banking financial institution, to adhere to certain regulations that govern banking companies.

Consider the Statutory Liquid Ratio (SLR). Banks are required to maintain 25 percent SLR on their total liabilities. The SLR amount is invested in securities approved by the Reserve Bank of India (RBI).

The rationale for providing SLR is to ensure liquidity and security for depositholders. The SLR requirement of 25 percent forces banks to lend only Rs.75 for every Rs.100 they borrow in the form of demand and term deposits. The remaining Rs.25 is invested in government securities, which are liquid and risk-free assets.

The point here is that ICICI needs to maintain an SLR if it becomes a bank. That means that ICICI will have to find money to invest in approved securities, one reason why it is selling its loan-assets. Another reason could be to meet the Cash Reserve Ratio (CRR) requirement, which is also a percentage of the total liabilities.

These reserve requirements are, in fact, linked to the credit multiplier, which is the number of times banks are able to multiply credit in the system.

The credit multiplier is the inverse of the reserve requirement. A reserve of 10 percent, for instance, means that the credit multiplier is 10 (1/0.10). Of course, the actual multiplier may be less than this due to other reasons.

In short, ICICI is selling loan-assets to generate more money to adhere to the regulations that will govern its operations once it becomes a bank.

Part V: Caselets (Answers)

Caselet 1

1. a. Initially, Value at Risk was used as an information tool to communicate to the management a feeling of the exposure to changes in the market prices or rates. After market risk started being implemented in the actual risk control structure, VaR is being used to calculate and measure the risk adjusted performance and compensation, in addition to remaining a very powerful management information system as far as the risks of investment are concerned.

    b. Value at Risk is also important in identifying the effects caused by substantial future movements to the value of the portfolio. Based on the measurement made by VaR, the portfolio manager can compare it with the maximum acceptable risk and take appropriate measures either by using derivatives to hedge the position or by changing the portfolio components to reduce the risk in Trading Risk Management.

    c. Position limits can also be established as a function of risk and a comparison of the positions and risk in different markets can be made on a common scale in Investment Management.

    d. Firms with market risk measurement systems which apply portfolio diversification theory can lower their project risks.

    e. In 1995, 10 major central banks realized the use of VaR in order to assess the capital adequacy ratio for market risk and started their own in-house VaR modeling. Of course, now this has become a regular practice with most central banks in developed countries.

    f. As discussed above, VaR can be used in ALM to estimate the changes in the net interest income and economic value of portfolio equity.

    g. In addition, VaR can be used in Corporate Applications to measure the risk of foreign exchange exposures, interest rate changes, effectiveness of hedging and derivatives portfolio, management of credit risks of each counterparty, evaluation of complex transactions to be undertaken and investment management in overall.

2. It cannot measure risk accurately in extreme market conditions, because it is difficult to model risk under such conditions. Suppose that the correlation between the US$ and the French Franc falls from 90% to 30%, VaR analysis will not immediately recognize this. It will perhaps take 50 or more days before sufficient daily price data is collected to reveal that the correlation has shifted.

Caselet 2

3. **There are three problems associated with duration:**

    a. The duration values are reliable over short period of time. That is, as the time passes, the duration of assets and liabilities involves changes and the changes are not equal for all instruments involved. As the time passes on the weighting scheme becomes more unreliable.

    b. The duration also changes with yields and these changes are not necessarily the same for all the instruments. Thus, for large variations in interest rate (which could of course happen over a period of time) this strategy will not work.

    c. The third problem concerns the assumption underlying duration strategy, that all movements of yield curve take form of parallel shifts. This is simply not the case. Short-term rates are much more sensitive than long-term rates are much more sensitive than long-term rates; rates on different types of instruments have different sensitivities even if they have same maturities and the same types of instruments with the same maturities may have different sensitivities due to their individual ratings.

4. The delta of a stock option can be defined as the ratio of change in the price of an option to the change in the price of the underlying asset. An increase in the value of the underlying asset makes the premiums on calls to increase and the premiums on puts to decrease, given that all other factors remain constant. Delta measures the sensitivity of the option gives and an idea about the number of units of a stock that should be held by any investor for creating a riskless hedge.

Caselet 3

5. Based on the indices of the climate and weather of 10 major American cities (Atlanta, New York, Chicago, Cincinnati, Dallas, DesMoines, Las Vegas, Tucson, Philadelphia and Portland), weather indices are being traded in the Chicago Mercantile Exchange (CME). Based on the indices of climate that measure the rainfall, day or night temperature, humidity, wind speed, etc., two standard indices have been created, namely:

1. Heating Degree Days (HDD)

2. Cooling Degree Days (CDD).

An investor can buy the weather derivatives with relation to any of the ten cities for which the indices are made, just like buying an insurance product. The value of each of the HDD or CDD is US$100.

1. **Heating Degree Days (HDD):** Based on a standard of 65 degrees Fahrenheit, the Heating Day Temperature is calculated as

   i. 0, if the day's temperature is more than 65 degrees, or

   ii. 65 degrees less the actual temperature if the temperature is less than 65 degrees. The HDD can never be negative.

This index is used during the winter months to measure the cold waves. Higher the index, colder the day and vice versa.

HDD = (`0' or 65 – ACTUAL TEMPERATURE)

2. **Cooling Degree Days (CDD):** This index is similarly using the same technique as the HDD but is either

   i. 0 if the temperature is below 65 degrees, or

   ii. is the actual temperature less 65 degrees of the temperature is above 65 degrees. The CDD can never be negative.

This index is the opposite of HDD and is used in the summer months to measure the warmth. Higher the index, warmer the day and vice versa.

CDD = (0 or ACTUAL TEMPERATURE – 65).

6. There are many factors that contributed to the growth of weather derivatives market. The first to mention being the convergence of insurance markets with capital markets by means of alternative risk transfer method. Catastrophe bonds have already established themselves in the financial markets. Weather derivatives can be logical extension of this convergence. The growth of the catastrophe markets and the risk "securitization" phenomena indicates that this market is not going to slow down.

Caselet 4

7. A VaR at a 99% level over a horizon of one fortnight is the loss that might only be exceeded on 1% of the fortnight.

8. VaR is an estimate of the level of loss on a portfolio which is expected to be equalled or exceeded with a given small probability. The intention in collecting the initial margin is that, if the price of the futures contract moves in an adverse direction for the investor and he either chooses or is forced to default, the clearing corporation, which stands in between the two parties of every transaction and guarantees performance, should not have to bear the loss. Margin calls can be made on the investor on a daily basis. Given this, we can say that if the margin posted by the investor is equal to or more than the loss that may be incurred by the investor before the circuit breakers come into play, then the clearing corporation can avoid losses. If the margin is set at the 95% level over a one day horizon, then there is only a 5% chance of the clearing corporation losing due to default.

9. VaR is based on the concept of probability. Probability works only on large numbers and not in small numbers, let alone a single item. For example, if a coin is tossed, the two possible outcomes have an equal probability i.e. 50% each. But if a coin is tossed only once, one of the outcomes can be said to have occurred 100% of the time. Similarly, the possibility of loss over the time horizon determined using VaR does not work very well for a single security or a few securities.

Caselet 5

10. Private companies are bracing up for designing innovative products in the insurance sector. The companies queuing up outside the IRDA range from heavy weights of various industries to new entrants. With India being a highly uninsured country, all these companies aspire to get a share in the scarcely tapped insurance segment. The penetration level of insurance policies in India is only 1.3 percent. If it is increased to 2-3 percent, all the prospective players in the insurance field stand to gain in the insurance market. However, it is not as easy as it seems to be; only the fittest will survive in the end. The insurance sector requires huge initial investments and has a long gestation period. A minor hiccup in the form of cap on foreign equities can be perceived. Another major problem the players in this field are going to face is the ignorance of majority of the population towards insurance policies. There is a need to create customer awareness, even in rural India. A slew of innovative products and right distribution techniques can prove to be a boon for the companies entering this sector.

11. For most people in India, insurance is another investment avenue that provides some tax benefits. Rather than as a risk cover, people see insurance as a tax-planning tool or as another savings instrument. The poor penetration of a mere 20 percent out of the 30 crore insurable population provides ample evidence to this. And unfortunately insurance is not the right choice for people looking at long-term returns. The debt instruments with almost the same kind of risk element give far more higher returns than even the cum-bonus plans of insurance. On the other hand, the tax-saving feature of insurance pales before other schemes like PPF or national savings certificates. Thus, it is a costly mistake to expect returns or tax-savings from the insurance policies.

    As many financial advisors feel, a true life insurance policy is meant to mitigate the financial loss survivors may suffer on the death of the insured. When a person dies, the emotional loss can be unlimited and immeasurable, but the financial loss can be. So one must assess his/her financial worth to the family. And insurance is a way to create a estate equal to that value in case of the death of the insured.

Caselet 6

12. Competition among the insurance companies results in better services. But in the write-up it is said that uncontrolled competition may result in certain problems. Uncontrolled competition may give rise to the following problems:

    - **Price war:** Due to uncontrolled competition and an urge to secure more and more contracts, these companies will land in a price war, each company quoting a lower premium than the others in order to ensure more and more contracts.
    - **Undertaking too many contracts:** As there is no restriction and control on the number of the contracts each insurance company can undertake, each player will have a tendency to undertake as many contracts as possible in excess of its capacity. Hence, these companies will not be able to give the best service to each of its clients as they would be working beyond their capacity.
    - **Too many players:** Due to uncontrolled competition too many players will enter the field with the hope of getting lucrative returns. But due to large number of players price war will take place and returns would decrease in the long run. Ultimately, the interest of the investors would get hurt.
    - **Too many defaults:** Due to the presence of too many players and not all being efficient, many defaults may take place. Each player, in order to grab market share, will resort to quoting low premium and each player will have the tendency to undertake more contracts than its capacities. Hence, number of defaults will also increase.

- **Neglect to the rural sector:** As there are no stipulations for operating in the rural sector, this sector may be neglected as the expected return from the rural sector would not be high.
- **Remittances abroad:** In the absence of any control the foreign players may remit all the returns they are earning from the Indian market to their home country.

These problems can overcome in the following ways:

- A price band can be fixed which can ensure that there is no price war and undercutting of premium.
- Like NBFCs and banks, for the players in the insurance sector also, capital adequacy norms should be made mandatory. It would ensure that the players are not taking too much of risks.
- Restricting entry of too many players in this sector by placing some entry barriers like, say, a high capital base.
- Like there is priority sector lending in banks, something on the same lines should be made mandatory for the players in the insurance sector.
- Some restrictions regarding remittances to the home countries should be imposed on the foreign players. There should be some restrictions imposed by the RBI like taking permission from it for remitting the profits back home.

13. The strengths and the weaknesses of banks that should be considered while entering the insurance sector are discussed below:

Strengths

- *Infrastructure:* The banks have extensive branch network, which can be a great advantage for tapping the insurance market. The existing infrastructure of the banks can be utilized if they enter the insurance sector.
- *Huge customer base:* Huge customer base of the banks can be fruitfully utilized if the banks enter the insurance business.
- *Skilled manpower:* The Indian banks have a lot of skilled manpower who can very easily take over the insurance business with a little training.

Weaknesses

- For entering the insurance sector capital outlay required is substantial, which can be a deterrent to banks to enter the insurance sector.
- Banks do not have the skills required for marketing insurance at the retail level.
- A significant number of banks are not in a position to withstand the losses that may have to be incurred during the initial years.

Caselet 7

14. The minimum capital requirement of Rs.200 crore is mainly because insurance is a high-risk business. One bad deal and the entire profits will be wiped out. Such high risk may also have a cascading affect on the other operational areas of the bank. Further, for a bank the risk arises from its assets side due to the advances and investments it makes. For an insurance company the risk arises from its liabilities side, due to the policies under written. Thus, if a bank enters into the insurance business, it will expose both its assets and liabilities to risks. For such high-risk levels, there should definitely be high capital requirement. In the case of the NPAs norm, due to the absence of a benchmark level, the regulator has set the standard as one percent below the industry norm. In the case of the JVs with foreign players, the regulator feels that due to the lack of expertise of insurance business, the foreign partner will be able to bring in the required expertise. Further, as the foreign partner will be contributing 26 percent of the equity, it will also reduce the financial burden to that extent for the Indian partner. The CAR requirement is to ensure that the banks, which are foraying, into this business have adequate solvency levels. Finally, the need for having a satisfactory performance by the subsidiaries is to check that the bank does manage the business of its subsidiaries well.

15. To start with, banks can enter the general insurance business as it has a captive market by virtue of the other services that it offers. For instance, the credit card business of the bank can offer a good market for accident insurance. Similarly, there is also a captive market for a bank in the assets that are offered as securities for the loans extended by the bank. The

bank can insure these collateral assets. The bank can also offer health care insurance for its employees. On the other hand, there is no such captive market for the bank for life insurance.

16. Both the net worth and network are important parameters for a bank's foray into insurance. Net worth will decide on its risk taking ability. Most people perceive a need for a bank account and open it on their own whereas an insurance is taken up only if it is mandatory. In addition to this, the lack of awareness for the need for insurance rules out walk-in business for insurance. The bank should reach the customer through field staff. Thus, physical branches may not be the required network. Instead, the network should be by way of field staff, who can reach the rural and semi-urban areas also.

Caselet 8

17. Hedging involves taking on a new risk that offsets an existing one in some part of the underlying business. Hedging transactions are designed to protect normal business profits from adverse price fluctuations.

With the growing integration of the Indian Economy with the rest of the world, exposure of Indian companies to currency fluctuations or commodity price risks has increased considerably. RBI has, therefore, permitted Indian Corporates access to offset hedges.

It should be realized that companies use derivatives to offset core business exposures. To the extent corporates are using derivatives only as hedges, losses on derivatives will be more than offset by gains in operating values. Use of derivatives beyond this point may lead to losses which may not justify undertaking this exercise.

It should be noted that the central bank has been conservative and cautious in facilitating the corporates on covering their risks, but it is a significant step, in the sense that a beginning has been made in a new direction.

18. The hedging exposures undertaken by the companies (if allowed by RBI) can help them in hedging their future risks and ensure the stability of earnings to them for a particular period. The same exercise, however should be done carefully and cautiously as it exposes a company to a new kind of risk. For example, if a company is in the import/export business of goods and services it can anticipate its foreign exchange risk exposure in the beginning of the year itself and hedge itself by undertaking a reverse exposure for the whole year. The year long export/import transactions undertaken by the company will, therefore, not expose it to any forex risk. The same exercise can be done for the commodity risk also. If the company's operations expose it to this kind of risk. However, there are certain problems associated with the companies at the moment and allowing them to undertake such exposures may result in troubles for the companies.

First, the companies may not be able to correctly forecast their anticipitated risk exposure in the beginning of the year. Secondly, as the knowledge about the risk management, hedging techniques and instruments is scarce in our country at the moment. Some companies may end up in selecting the wrong instruments/techniques. Thirdly, certain businessmen in this enthusiasm of taking advantage of such a facility may over hedge themselves thereby exposing them to additional risk rather than hedging it.

19. As per the Rules of the Derivatives Segment, only a member of the Exchange (Cash Segment), can become a Trading Member on the Derivatives Segment. The Exchange has received representations for admitting new members only for the Derivatives Segment who may be desirous of trading only on the Derivatives Segment and not on the Cash Segment.

In view of the aforesaid representations, the exchange has announced that it has decided to offer Limited Trading membership exclusively for the Derivatives Segment of the Exchange. The same has been approved by SEBI also.

This development will make the futures market accessible to those who are not members of the Exchange and are desirous of participating in the Derivatives market.

The Trading Members so admitted will not have the rights and privileges conferred on a member of the Exchange, but would be bound by the Rules of Derivatives Segment of the Exchange. Such Trading Members, with Limited Membership Rights, would be required to

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be registered with SEBI as trading members and would have to satisfy all the eligibility conditions specified by SEBI as per the recommendations of Dr. L C Gupta Committee Report.

A person need not be a member of the Exchange in order to apply for registration as a Limited Trading Member. A Limited trading member shall be a trading member in all respects and for all purposes and shall have all the rights, privileges, obligations and liabilities of a Trading Member and the rules, regulations, business requirement specifications, guidelines and other provisions of the Derivatives Segment, the Exchange, and SEBI shall be applicable to a limited trading member as they apply to any other Trading Member. Such Limited Trading Member shall not be entitled to be a member of the Derivatives Governing Council or any other board, council or committee of the Derivatives Segment, the Exchange or any other segment of the Exchange.

The financial requirements for eligibility for a Limited Trading Member are as under:

- Net worth   Rs.50 lakh
- Minimum Security Deposit   Rs.15 lakh in following proportion:
                                    - 25% in cash
                                    - 25% in cash equivalents
                                    - 50% in cash/equivalents/approved securities
- Admission Fee   Rs.1 lakh
- Annual Charges   Rs.25,000
- One Time Charges   Rs.3 lakh
                                    (– 2 lakh to Investor Protection Fund –
                                    1 lakh to Trade Guarantee Fund)

Caselet 9

20. A repo is a contract to sell securities now and purchase them latter. The word repo is a short-term for repurchase agreements. A swap, on the other hand, involves exchange of interest payments based on a notional principal. While the actual procedure involves exchange of principal as well, in practice, no exchange generally takes place. The payment to be made or received, if identical can be set-off against each other. In a repo, what happens is a reversal of a transaction entered into today, at a latter date, between the same parties, for a consideration. A swap, on the other hand, can be between more than two parties.

21. Yes, assets may also be swapped. For example, a lender who has a fixed rate receivable and expects the interest rates to rise, may swap the receivable for a floating rate receivable, with a counterparty who has a floating rate receivable and expects interest rates to fall. The mechanism of the swap remains the same for liability swaps.

22. Using a very short period floating rate has two basic disadvantages. One, the changes in interest rates affect the cost of funds too frequently and the cost of funds becomes highly unpredictable as short-term interest rates are generally more volatile than the long-term interest rates and are quickly affected by the changes in demand and supply. Two, short-term interest rates get compounded for short periods, setting off some of the possible gain from choosing a short-term rate. For example, with daily compounding the effective rate of interest for nominal rate of 8% is 8.33% and for 10.5% it is 11.07%.

Caselet 10

23. Hedging results in only freezing the cost. Sometimes, an unhedged position may provide lower costs depending on the movement of prices. If, for example, after entering into a contract for purchase of raw material at a price, the price falls, we will be better off without the hedge. The reverse applies to a sale. Another relevant point to be considered is the transactions costs that have to be incurred while undertaking a hedge. Keeping the above in view, it can be said that hedging does not necessarily lead to competitiveness in terms of costs.

24. It may not be necessary to hedge when the risk is thought to be lower. For example, a company requiring cotton shortly may not buy cotton futures if it does not expect an upward movement in cotton prices. But, the company in this case is open to losses due to its expectations going wrong. Similarly, even partial hedging is risky to that extent.

25. If receiving net premium is allowed, it tempts corporates into undertaking speculative transactions for gaining the premium inflow. The losses from such transactions may sometimes be very heavy and may not have any limits. For example, there is no limit on the loss that might be suffered by a call option writer if the asset price moves above the exercise price.

Caselet 11

26. **Benefits of opening the Insurance Sector:**

    i. Long-term savings from the insurance sector will fill the huge gap in resources needed for development of infrastructure sector such as power, telecom, ports and roads. Opening up of insurance can contribute effectively in moving up the savings rate to over 30 percent.

    ii. The consumer will have a choice of cheaper and new products.

    iii. With the removal of monopoly, competition would prevail which ensures better service and quickest settlement of claims.

    iv. The products that would merge might be flexible and tailor-made to the customer's needs.

    v. Employment opportunities will increase.

    vi. Higher pronouncements to health care insurance which means better services in the health care industry. With insurance cover, many can afford the best quality health care which means more number of patients in the hospital which implies better utilization of facilities making it more cost-effective to the hospitals.

27. The main advantage of the entry of foreign players is new products and better service. However, the following might be considered before really funding the entry of foreign players:

    i. Drain of foreign exchange – with the entry of foreign players it is feared that there would be large outward remittances of funds.

    ii. The foreign players lack social commitment and may ignore the rural sector.

    However, both the fears can be countervened since drain of funds in the above first case would happen only after 6-7 years when the companies can break even and IRA the regulatory body of insurance can specify certain requirements whereby the rural sector is not ignored.

Caselet 12

28. The opening up of the insurance industry for private participation is a laudable decision of the government and is a milestone in the process of economic liberalization in our country.

    Having decided that the government now should distance itself from the normal functioning of insurance players in the business, be they private or public companies, the same can be achieved only when the responsibilities and power of supervising and monitoring the various players in the industry are delegated to an independent body i.e., Insurance Regulatory Authority (IRA). The role of IRA in the insurance industry should be similar to the role of SEBI in the capital markets.

    The success of IRA will depend on whether it is equipped with enough powers to punish those indulging in foul play. Otherwise it will be like a toothless tiger ruling the insurance industry. IRA, therefore, should not only be registering and clearing the players after scrutinizing them but should be allowed to do anything and everything to ensure the healthy and rapid growth of the so far chocked Indian insurance industry.

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29. It needs hardly any elaboration that the insurance industry's growth over the past decades has been choked and minimal. The life as well as general insurance have been suffering from many crippling handicaps imposed by the government. Some of the major ones are the control over their investments, lack of autonomy, bureaucracy, over staffing, etc.

   The opening up of the insurance industry has been in a way compelled by such considerations. Having made the decision to allow private participation in the industry, there appears to be no reason why this sector should not be opened for complete and total insurance business in the country whether it is life or general or anything else.

   However, government may limit one part of it to every player which means that one company should choose life or general insurance but not both simultaneously. This will limit their risk exposure to a large extent and improve their sustainability to continue to operate even in difficult times.

Caselet 13

30. The floating rates that are available in the Indian market which can be used as benchmark rates are Mibor, 91-day and 364-day T-bills, Bank rate, PLR of Banks.

   Mibor

   Pros:
   i. These rates are market determined and indicate the actual level of interest rates.
   ii. Information dissemination is fast. Any change in interest rate is quickly reflected in the market rates.

   Cons:

   i. These rates are for very short-term period. Long-term floating rates cannot be linked to these rates.

   ii. These rates are also very volatile. So, benchmarking these rates for longer period is not possible.

   91-day and 364-day T-bills

   Pros:

   i. There is no credit risk and no distortion in the rates.

   ii. These rates are market determined to a reasonable extent.

   Cons:

   i. The RBI can influence the rates according to the central government's requirement.

   ii. Secondary market rates are not continuously available as they are not actively traded in the market.

   Bank Rate

   Pros:

   i. Not a short-term rate.

   ii. Information regarding the rate is easily accessible.

   Cons:

   i. This rate is not linked to the market.

   ii. Relatively stagnant as this rate is fixed by the RBI.

   PLR

   Pros:

   i. These are more stable than Mibor and T-bill rates.

   ii. Linking to this rate makes sense since it is the benchmark generally used by banks for fixing lending rates.

   Con:

   i. The cost of funds of the bank influences the rate. As a result if the cost of funds for a bank is higher, its PLR will also be high.

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31.   In a forward contract both the parties agree upon a fixed rate for transaction at a future date. But in a synthetic arrangement the parties enter into a forward swap and the transaction is settled based on the rates prevailing on the date of entering into the contract and those prevailing on the date of maturity. So, if the forward agreed rate is not in accordance with the rate prevailing on maturity date, the contract is settled taking into consideration the difference between two rates.

Synthetic agreement will be beneficial for those hedgers who have covered their risks in the forward market and in the forward date the rates are moved in his favor. In case of simple forward contract he will not get the benefit of favorable movements of exchange rates, but in synthetic agreement he will not lose the benefit from the favorable movements of exchange rate.

Caselet 14

32.   Foreign companies bring in their expertise in offering better services at a low cost. Their presence generally increases competition and forces the domestic companies also to perform better.

Foreign companies, in a bid to promote this business, spend heavily on advertising. As a result, awareness of the people regarding insurance increases. But, people generally tend to place greater confidence in government companies than private sector companies, particularly when it relates to life insurance. As a result, the business of the public sector companies may increase.

33.   The risks in allowing foreign companies into the insurance sector are:

i.   Domestic companies losing out in competition and the industry getting concentrated in the hands of a few foreign companies, who may then chose to increase the prices of their services and also repatriate huge sums of money.

ii.   Premia received by insurance companies, which are currently available for investment according to national priorities, get into the hands of foreign companies which may invest them according to their own plans.

34.   The insurance sector may continue to be dominated by the public sector companies which operate across the entire range of insurance services. There may also be some private sector companies – Indian and foreign in the metropolitan areas offering high technology services at high prices.

Caselet 15

35.   Economic motives for swaps:

a.   Spread compression – Scope for reducing costs

b.   Market segmentation

c.   Market saturation

d.   Differences in financial norms.

Essentially, different borrowers have differing comparative advantages in different markets. As a result, by borrowing in a form other than preferred and then arranging a swap, not only costs can be reduced but access can be obtained to forms of funding which would otherwise have remained inaccessible.

36.   Banks tend to prefer floating rate loans. Since they play with money, they would like to retain flexibility and keep raising funds at the market rate of interest and lend them out at a spread to clients either as short-term loans or long-term loans on roll over basis.

Manufacturing companies tend to have reasonably certain cash flows from operations. They would like to be locked into a fixed rate of interest so that profit projections can be made with a degree of certainty.

37.   Credit rating in fixed rate markets is more stringent than in floating rate markets. As a result, the spread between top credit rated and lower credit rated borrowers is more in fixed rate markets as compared to floating rate markets.

38. a. Political risk involved
   b. Nominal interest rate
   c. Likelihood of currency appreciation/depreciation
   d. Withholding taxes.

   Effective cost = Nominal interest rate + (Currency appreciation or Currency depreciation) + Withholding taxes.

39. The rates available in New York are lower than the rates in London for all the three – Global Bank, ABC and XYZ. Therefore, they will borrow in New York only. Among ABC and XYZ, ABC has lower rates in floating as well as fixed funds. Therefore, Global Bank will swap with ABC only. As Global Bank wants floating rate funds and ABC wants fixed rate funds, Global Bank borrows at fixed rate, that is 7%, and ABC borrows at floating rate (that is at LIBOR + 1%). Then they do a swap. The total gain from the swap will be:

LIBOR + 0.75 + 7.50 – LIBOR – 1.0 – 7.00 = 0.25%

Assuming this gain is equally shared by Global Bank and ABC, Global Bank will borrow at 7%, lend to ABC at 7% and borrow from it at LIBOR + 0.625%. ABC in turn will borrow at LIBOR + 1%, lend to Global Bank at LIBOR + 0.625 and borrow from Global Bank at 7%.

Caselet 16

40. "Financial Engineering is a sophisticated management technique aimed to manage the risk and return of financial transactions. It involves the design, the development and the implementation of innovative financial instruments and processes, and the formulation of creative solutions to problems in finance."

Financial engineering is wound around the two words – innovative and creative. It is a product with increasingly sophisticated techniques. It is a rigorous application of the scientific methods to finance. It is mostly used to exploit anomalies in the tax, accounting, and regulatory frameworks within which markets operate. It is conducted by 'teams' which bring together traders, financial analysts, syndication staff, corporate finance officers, lawyers, tax specialists, accountants, mathematicians, statisticians, compliance officers, programmers and other specialists.

Physical Tools and their Importance: A financial engineer can make use of two kinds of tools to effectively deal with a problems – conceptual tools and physical tools. Physical tools are used to precisely implement the financial engineering process. The financial engineer makes use of the available instruments and process in various permutations and combinations to create new instruments as per the requirements, or sometimes comes out with a completely new instrument or process. Physical tools are mainly used to accomplish some specific purposes, and are mostly tailor-made. Therefore with these tools, financial engineers are in a position to design solutions to an implausible range of outwardly puzzling problems. Broadly, the instruments consist of equities, fixed income securities, derivatives, and a number of variants of these basic forms.

The following are some of the Physical tools, which got invented recently. They are:

Cushion Bonds: These are high-coupon bonds selling at a premium and it offers a higher YTM and yield to first call than bonds selling at par by the same issuer due to the probability of premature call.

Death Put: It is a provision of illiquid bond issues that permits the successor of the original beneficiary to put the bonds to the issuer at face value in case of holder's death.

Deferred Strike Option: It allows the option buyer to set the strike price at a fixed ratio to the spot price any time within a period after the trade date. If the buyer does not set the strike earlier, the spot determines it at the end of the deferred start period.

Dividend Stripping: It is a technique designed to derive benefit from the comparatively favorable tax treatment of corporate dividends. Here the stocks of those corporates are purchased who have declared the dividend and the record date for buying the stock, to be eligible to receive the dividend.

Falcon: It's a covered warrant in which the issuer is having sufficient shares to meet the equity delivery obligation in case the warrant holder opts for exercise of the warrant. Thus the surplus shares serves as a collateral to the issuer.

CMOs: Collateralized Mortgage Obligations were created to protect the investors from pre-payment risks. The CMO takes the same cash flows that a conventional pass through certificate generates and then carves them into discrete maturities. They are considered to possess a high level of credit quality due to the quality of the underlying collateral.

Adjustable Rate Mortgages: These are also known as variable rate mortgages or roll over mortgages. They reduce the interest rate risk for the lender and borrowers and accept ARMs because the lenders by offering lower initial interest rates express their preference for ARMs. The major disadvantage is that they are difficult to be sold in pooled or security form, as there are no standard clauses.

Puttable-Extendible Notes: At the end of each interest period the issuer may opt to redeem the notes at par or to extend the maturity, and till that time the note holder can exercise its put option if the new terms are unacceptable. Here the put option provides protection to the investor against any degradation in the credit standing of the issuer.

Blended Interest Rate Swap: It is a combination of two or more interest rate swaps usually one with a spot start and one with a forward start for which the payment terms determined based on the weighted average of rates.

Bunny Bond: It gives the investor protection from reinvestment risk by offering the right to receive coupon payments in cash or in additional bonds having same coupon rate.

Carrot-and-Stick Bond: It is a convertible bond with a low conversion premium to support early conversion and a provision allowing the issuer to call the bond at a specified premium if the common stock is trading at a relatively modest percentage above the conversion price.

41. Risk management is one of the aspects in which financial engineers are mostly involved. Most finance professionals in the business arena opine financial engineering synonymous to risk management and equate both.

As the term financial engineering was coined by London banks in mid 1980s to build risk management departments consisting expert teams who would provide structured solutions to corporate risk exposures, it is clear that the cropping up of the term financial engineering is based upon risk management needs. The risk management department's expert teams took new strategic approach towards risk management. They first carefully examine all the financial risks to which a firm is exposed to, some risks are explicit and recognizable by all and some are implicit and not recognizable. Sometimes risk exposures are offsetting and sometimes mutually reinforcing. The expert teams first do an analysis. In the process of analysis, they first identify the risks, secondly measure the risks and finally determine the kind of outcomes the firm's management would like to achieve. After completing the analyses, part of the team applies its financial engineering skills. They will come out with or conceive a solution, sometimes called 'structural deal' for desired outcome achievement, by choosing from a basket of existing products, including swaps, futures, rate caps, rate floors, forward rate agreements, etc. For those financial engineers who are engaged in financial risk analysis this "Building Block" approach becomes a cornerstone.

The risk aversion factor of individuals and firms lead to many financial innovations during the second half of twentieth century. Many risk management instruments and sophisticated risk management strategies were introduced for the purpose of risk management.

Some of the important instruments are interest-rate options, stock-index futures and stock-index options, currency futures and currency options, over the counter contracts as forward rate agreements and forward exchange agreements and a whole array of swap products including interest rate swaps, currency swap, commodity swaps, and equity swaps.

Important among the risk management strategies developed so far are asset/liability management techniques, price management techniques and the development of hedging strategies.

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Some innovations attempt to enhance firms' value or individual investors utility either by reducing an instrument's inherent risk or by creating an instrument, which is useful in managing risk.

Some innovations, which deal with liquidity concerns, have risk limiting capability and they overlap with Risk Management instruments. For example, Collateralized Mortgage Obligation (CMOs) bonds, Adjustable rate debt or Adjustable-rate preferred stock, etc., and are primarily intended to suffice the liquidity needs.

Caselet 17

42. Securitization is picking up as a source of funding, but experts say it still has a long way to go to catch up with the potential. The first securitization deal was started in 1991 when the Citibank raised Rs.16 crore from GIC Mutual Fund by securitizing some of its auto loans.

Notwithstanding this sharp rise in volumes, securitization is yet to happen in the country on a scale consistent with the potential.

The structured deals happen roughly in the following manner: First, a Special Purpose Vehicle (SPV) is created, essentially to delink the assets (cash flows) from the company that wants to securitize (called 'originator'). The SPV is usually a trust and has now borrowings of its own. The assets (such as auto loan or credit card receivables) are placed with the SPV.

The SPV then splits the assets into different categories according to revenue streams and creates marketable securities against each category. For example, if a finance company securitizes its auto loan receivables, the monies receivable in the first month could be one category, which could be sold to investors who might be interested in short-term securities. Similarly, the amounts receivable in the second month could be another category, the third month yet another. Or, the receivables could be split quarter-wise.

This process is called 'stripping'. In other words, if months represent the rows of a table and the auto-loan borrowers represent the columns, then each row, or sets of rows could be different 'strips'.

Then the SPV creates tradable debt instruments called 'pass through certificates' against each strip, and sells them to investors such as mutual funds, banks and financial institutions, and possibly even individuals. The SPV then pays the 'originator'.

43. This form of funding (raising money by selling future revenue streams) has many advantages. First of all, from the perspective of the company that securitizes its cash flows, the major benefits are in terms of getting immediate cash and passing the risk to the investors. Besides, for finance companies, securitization would take the loan assets off the balance sheet, thereby relieving pressures of capital adequacy. They can also 'upfront' profits. Further, the company that wants to securitize can ask for a particular rating from a rating company and get it, by a mechanism called 'credit enhancement.' This refers to shoring up investors' confidence by offering cash collateral to the SPV.

One major advantage of securitization is its flexibility. A pool of receivables could be split into different 'strips' and sold to different types of investors. For example, a money market mutual fund might be interested in a short-term paper (pass through certificate), whereas a pension fund might want to invest in a long-term paper. The SPV can have something to offer to both.

Essentially, the originator gets to raise off balance sheet cash and get rid of risks, (for a price, which is relatively lower), while the investor gets high yielding paper for a relatively better prices. "Typically, yields in asset-backed securities (car loans, lease rentals, etc.) are higher than that of other securities of the same rating."

Part IV: Model Question Papers (with Suggested Answers)

Each model question paper consists of two papers – Paper I and Paper II. Paper I contains three parts – A, B and C. Part A is intended to test the conceptual understanding of the students. It

4. Which of the following is an external business risk?

    a. Key personnel risk.

    b. Regulatory risk.

    c. Machinery breakdown.

    d. Labor strike.

    e. None of the above.

5. Corporates do risk management to

    a. Totally eliminate the risk

    b. Keep risk at an acceptable level

    c. Make gains from the process

    d. Reduce unavoidable losses

    e. All of the above.

6. Which of the following statements is false?

    a. VaR can be used in isolation to quantify risk.

    b. VaR is used to quantify risk arising out of individual assets/liabilities.

    c. VaR makes a distinction between downside and upside movements.

    d. VaR can be used to lay down policy for acceptable level of risk.

    e. None of the above.

7. When does a financial instrument have off-balance sheet risk of accounting loss?

    a. If the risk of accounting loss to the entity exceeds the amount recognized as an asset.

    b. If the risk of accounting loss to the entity exceeds the amount recognized as a liability.

    c. If the ultimate obligation exceeds the amount that is recognized as a liability.

    d. If the ultimate obligation is less than the amount that is recognized as a liability.

    e. Both (a) and (c) above.

8. The objective of introducing weather derivatives is to

    a. Help the corporates gain from favorable weather conditions

    b. Make speculative profit from the uncertain weather conditions

    c. Reduce the uncertainty in revenue expectations of a firm from adverse weather conditions

    d. Both (b) and (c) above

    e. All of the above.

9. VaR is useful in

    a. Estimating gain from an exposure

    b. Estimating loss from an exposure

    c. Estimating chances of loss from an exposure

    d. Estimating chances of gain from an exposure

    e. Both (a) and (b) above.

10. Hedge ratio of an option is given by its

    a. Delta

    b. Gamma

    c. Theta

    d. Reciprocal of gamma

    e. Reciprocal of delta.

11. Which of the following equations gives the put-call parity?

    c = Value of the call option

    p = Value of the put option

    S = Spot price of the underlying asset

    X = Exercise price of the option

    a. $c = p + X - S$.

    b. $p = c + S - X$.

    c. $c - p = S - X$.

    d. $p - c = S - X$.

    e. $p = c + S - X$.

12. A swap that gives the floating rate payer the option to terminate the swap before its maturity is known as

    a. Callable swap

    b. Putable swap

    c. Call swaption

    d. Put swaption

    e. None of the above.

13. Which of the following combinations would give the same profit and loss pattern similar to that given by owning the underlying asset?

    a. Long call and short put.

    b. Long call and long put.

    c. Short call and long put.

    d. Short call and short put.

    e. None of the above.

14. Which of the following is/are true?

    i. The lower the exercise price, the more valuable the call.

    ii. The difference in two call prices cannot exceed the difference in their exercise prices.

    iii. The more time till expiration, the lesser the call price.

    a. Only (i) above.

    b. Only (ii) above.

    c. Only (iii) above.

    d. Both (i) and (ii) above .

    e. All of (i), (ii) and (iii) above.

15. The delta of a call option changes from 0.5 to 0.3. The change in the price of the underlying asset is 0.30. Find the gamma of the call option.

    a. 1.7

    b. 0.67

    c. 0.76

    d. 1.0

    e. Cannot be determined from the given data.

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16. If gamma of an option is large in absolute terms then which of the following is true?

    a. Its delta is large.

    b. The price of the underlying asset is high.

    c. It is better to leave the delta neutral position unhedged.

    d. Both (a) and (c) above.

    e. Both (b) and (c) above.

17. If V is the vega of the portfolio, and V_t is the vega of a traded option, what position in the traded option will make the portfolio vega neutral?

    a. V/V_t

    b. $-V/V_t$

    c. V_t/V

    d. $-V_t/V$

    e. $V \times V_t$.

18. The delta of European put option on a non-dividend paying stock is given by

    a. $N(d_1)$

    b. $N(d_2)$

    c. $N(d_1) - 1$

    d. $N(-d_1)$

    e. $N(1 - d_1)$.

19. In which type of swap, does a firm receive single payment of fixed rate at the termination or the inception of the swap?

    a. Zero-coupon swap.

    b. Forward swap.

    c. Plain vanilla swap.

    d. Accreting swap.

    e. Currency swap.

20. A currency swap is equivalent to

    a. Currency option with the exercise price equal to the current spot rate

    b. Long dated forward foreign exchange contract where the forward rate is the current spot rate

    c. Interest rate swap, where the basis is the differential between the fixed and floating interest rate

    d. Short-term currency futures contract

    e. None of the above.

21. Which of the following is not a feature of a currency swap?

    a. There is an initial exchange of principals at the spot rate.

    b. There is a final exchange of principals at the spot rate.

    c. There is a final exchange of principals at the forward rate.

    d. Interest payments are made by the payer in the currency of the payee.

    e. None of the above.

22. An option to enter into a swap as a fixed rate payer is known as

    a. Callable swap

    b. Putable swap

    c. Call swaption

    d. Put swaption

    e. None of the above.

23. When a transaction consists of both a currency swap and an interest rate swap with LIBOR based pricing for the floating side of each, the swap is called

    a. A deferred swap

    b. A forward swap

    c. A circus swap

    d. Roller-coaster swap

    e. Amortizing currency swaps.

24. In terminating the swap contract, when the party pays to or receives from the counterparty a lump sum payment equal to the swap's present value is called

    a. Buyout

    b. Sell-off

    c. Assignment

    d. Offset

    e. None of the above.

25. In the context of futures market, if the basis is negative, the markets are said to be

    a. In contango

    b. In backwardation

    c. In normal backwardation

    d. Showing that perfect-cost-carry relationship exists

    e. Showing that perfect-cost-carry relationship does not exist.

26. On the maturity day, the price of a futures contract will be

    a. More than spot rate

    b. Less than spot rate

    c. Equal to spot rate

    d. More than forward price

    e. Either (a) or (b) above.

27. On 01.03.97, a speculator expects the dollar to appreciate against the yen roughly six months from then. This expectation is however not reflected in the July and September dollar futures rates. To make profits by spread trading, the speculator will

    a. Buy July futures now and reverse transaction later

    b. Buy September futures now and reverse transaction later

    c. Buy July futures and sell September futures now and reverse transaction later

    d. Sell July futures and buy September futures now and reverse transaction later

    e. None of the above.

28. An option trader buys a call option and a put option with the same exercise price and the same expiration date. What is this trading strategy called?

    a. Straddle.

    b. Long straddle.

    c. Short straddle.

    d. Long strangle.

    e. Short strangle.

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29. Immunization of a portfolio changes in the price of the underlying asset in the next small interval of time is known as

    a.   Hedging

    b.   Gamma hedging

    c.   Delta hedging

    d.   Optimal hedging

    e.   None of the above.

30. Operating exposure can be caused by

    a.   Competitive effect

    b.   Conversion effect

    c.   Both (a) and (b) above

    d.   Either (a) or (b) above

    e.   None of the above.

Part B: Problems (50 Points)

Solve all the problems. Points are indicated against each problem.

1. An Australian firm swapped AUD 10 million fixed rate liability into \$5.56 million floating rate at the rate of AUD/\$ 1.80. The fixed vs 6-m Libor swap rate was 10%. The swap now has remaining maturity of 5 years 3 months. The US dollar depreciated to AUD/\$ 1.60. The present 6-m Libor fixed three months ago was 9% whereas current 3-m Libor is 8%. The current 5-year swap rate is 8%. Do you think that the firm can make a gain by selling the swap? Show the necessary calculations.

(12 points)

2. The current price of stock is Rs.40. The price of stock at the end of 1-month is expected to be either Rs.42 or Rs.38. What is the value of a European call option at a strike price of Rs.39, if the risk-free interest rate is 8%?

(9 points)

3. Consider the following data:

	AUD/\$	¥/\$
Spot	1.620	141
June futures	1.600	145
September futures	1.550	148

    a.   What do these prices on futures on AUD and Yen imply?

    b.   How can a speculator, who thinks against the market, make profit?

(9 points)

4. If a speculator has sold a butterfly, based on the following call options, work out the pay-off profile. What do you think is the view of the speculator about the movement of the US/\$ ranging from \$42 to \$44.5 with the difference of \$0.5.

Strike rate (Rs./\$)	Premium (Rs.)
42.50	1.25
43.00	1.00
43.50	0.75

(10 points)

5. An exporter has a receivable of the US$ 5 million which is expected to be received 3-m from now. The following options are proposed to be used for hedging:

Type of option	Strike price	Premium
Call	Rs./$ 43.00	0.75
Put	Rs./$ 43.25	1.00

If the spot rate is Rs.42.50 and 3-m forward rate is Rs.42.75, which alternative will you suggest for hedging?

(10 points)

Part C: Applied Theory (20 Points)

Answer the following questions. Points are indicated against each question.

1. "Derivatives became very popular because of their unique nature to offer a combination of characteristics not found in the underlying assets." What are the features of the derivatives that distinguish them from underlying assets?

(10 points)

2. You are expecting a cash inflow of $5 million two months hence from your clients. You plan to invest for a period of 6 months before you need them. You are not sure of the interest movements too. You have the following information: A put option on 6-month LIBOR with strike rate of 6%. The current 6-month LIBOR is 6.4%. Exercise date is 2 months hence. As a treasurer, what action will you take from the following two situations: (i) The interest rate at expiration is 6.8% and (ii) The interest rate at expiration is 5.6%.

(10 points)

Paper II

Time: 3 Hours   **Points: 100**

Part D: Case Study (50 Points)

Read the case carefully and answer the following questions.

1. Explain the terms HDD & CDD.

    (10 points)

2. Explain how the weather index is calculated.

    (10 points)

3. Discuss briefly the methods of hedging the weather risk with the help of the weather indices.

    (15 points)

4. Do you think weather derivatives could be used in India? Discuss.

    (10 points)

5. Explain the meaning of the term out-of-the-money option.

    (5 points)

During the winter of 2000, the Warm Ice Fuel Corporation, a small electricity generating company faced the possibility of going into losses. For the last 3 years, the winters had been very warm in the small town bordering Canada and the revenues generated were not enough to pay for the fixed costs. Another warm winter would affect the very existence of the company.

Mr. Jack, the family-owned company's Chairman decided not to depend on the weather uncertainties again. He decided to hedge his exposure with the help of weather derivatives. He knows that he cannot afford to have losses again.

He starts by working out the measurements of the last 40 years of winter temperatures in the town. His findings are:

i.   The town is a cold place with average temperature of 15 degrees fahrenheit.

ii. Of late, the temperature has been very erratic with a few years being very cold (in the range of 10 to 5 degrees fahrenheit) and a few years being quite warm (temperatures in the range of 20 degrees fahrenheit).

iii. There is a very good correlation between the December to February temperature and the heating degree-days with a coefficient of 0.96.

Mr. Jack further discovers that in order to break even, the company has to make revenues of at least $2 million in the current year. There is a 20% probability that the winter will be quite warm (above 20 degrees fahrenheit) and a 5% probability that the winter will be colder than 5 degrees fahrenheit.

He further estimates that if the winter is warm, it will get to less than 5,600 HDD and if it is colder than expected it will close at 6,500 HDD. He must strike at a level in between these two figures to survive. Finally, Mr. Jack decides to buy an out-of-the-money call on HDD to compensate the possible losses of a warm winter.

He contacts a broker in CME who tells him that a call struck in the range of 5,600 HDD will cost between $125,000 and $150,000, but will compensate for the loss by paying $20,000 per degree-day with an upper cap of $7.5 million.

Mr. Jack executes the deal at $130,000 and is now sure that the chances of a warm winter will not affect the existence of his company.

Part E: Caselets (50 Points)

Caselet 1

Read the caselet carefully and answer the following questions.

1. What are the tools available in the derivatives market to help the players hedge against forex risks?

(9 points)

2. Explain the concept of hedging with futures.

(8 points)

A large Indian Company, Comco manufactures and sells leather shoes in the domestic market. This company competes not only with other local commodity producers but also with landed imports. The Business Risk: if Comco's input costs rise faster than the dollar's rise against the rupee, Comco could be outpriced by cheaper imports. Though Comco does not deal in dollars anytime, it is nevertheless exposed to the currency risk. While identifying the business risk may be relatively easy, quantifying and hedging this risk is not.

Another major forex related risk is transaction risk. It arises from a time delay between the receipt and the payment of the foreign currency. Suppose XYZ, after contracting the raw material from its supplier, takes 20 days to process, sell the finished good and collect the payment from its buyers. Since the receipt and payment are made at the prevailing spot dollar/rupee rates, XYZ would suffer if the value of the greenback falls in these 20 days.

Lastly, portfolio risk arises when a company operates in a number of countries. The cash flows and the profits of a local business unit, when translated into the home currency of the company's shareholders, would be subject to the exchange rate movements.

With respect to accounting treatment, transaction risk, the most visible of the three, normally shows up in the 'foreign exchange gains or losses' account of a company. Unfortunately, most companies define their risk as the accounting gains or losses they incur. They assume themselves to be short of dollars (because of the dollar payables), when in fact they may be long on dollars (if their inventory exceeds their payables). Portfolio risk appears as higher or lower operating profit when the local currency profit is translated into the shareholder's currency. In addition, there is a translation impact on the equity accounts of the company based on the exchange rate effect on its assets and liabilities. The business risk, the trickiest of all, makes itself felt through the revenue and the operating margin numbers.

Once the company has identified the risk, it can employ a number of strategies to manage these risks. Transaction risk can be managed using simple forward covers. XYZ, for example, can sell dollars 20 days forward at a fixed rate as soon as it enters into a purchase contract. The dollar denominated revenue that flows in after 20 days can then be converted into rupees at the predetermined rate.

To reduce portfolio risk, a multinational company can estimate its future stream of profits or dividends and enter into a long-term derivative like a cross currency swap. But the local regulation restricts a company from hedging uncertain business cash flows. The company can hedge only its declared profits or dividends. The company can however hedge only its capital in the local branch or subsidiary through forward covers.

Business risk is not only difficult to manage but also almost impossible to expel. Take XYZ's case once again. Based on the sensitivity of its competitiveness (i.e., revenues) to the euro/dollar rate, it can establish a long-term euro/dollar hedge of the right size. And based on the sensitivity of its operating margin to the dollar/rupee rate, it can set-up a long-term dollar/rupee hedge for the required amount. In other words, the company attempts to protect its present value in rupee terms, by using derivatives that create value when the business suffers. There are two objections to use derivatives. First, as we know, the Reserve Bank of India does not permit the hedging of uncertain business cash flows. Second, the company's creditors and shareholders may perceive the company to be more risky if it uses large derivatives even when these deals explicitly aim to reduce the overall business risk.

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Is there a way out? While business risk cannot be eliminated, the company can devise two broad operating strategies to mitigate it. To begin with, it can align its cost structure to that of its competitors and to its markets. For example, XYZ can set-up a manufacturing base in Europe, and Comco can switch its rupee debt into dollar debt through cross currency swaps. Next, the company can increase its flexibility to expand or contract its capacity to respond to uncertainty in product demand. One could equate acquiring flexibility to purchasing a real option. The greater the flexibility, the greater is the company's ability to capture larger profits when demand increases and to contain losses when demand falls. The latter strategy is the most convincing approach to meeting demand uncertainty arising out of currency movements or any other externality.

Caselet 2

Read the caselet carefully and answer the following questions.

1. Explain the concept of total risk and expected returns.

(7 points)

2. Explain briefly the important features of derivatives.

(9 points)

Risk taking is at the core of entrepreneurial spirit. Without embracing risk businesses cannot reap rewards. Risk and return are the two sides of a coin. While risk taking has been known to businessmen for ages, the emergence of risk management as a specialized field is a fairly recent phenomenon, especially when we look at its evolution over the past millennium. If there is one area in the financial arena that has seen most innovations, it is the field of derivatives. As the businesses evolved, markets expanded and the financial markets matured and grew in complexity, the need for instruments to manage the risks inherent in the business was felt. It is out of this necessity that derivatives were born.

The contribution by the financial economists in the form of design of quantitative models like the Black & Scholes model have literally transformed the shape of financial markets. While this laid the building block for derivatives, a plethora of innovations followed. Options, futures, swaps, credit derivatives and weather derivatives to name a few. The sophisticated models developed by financial rocket science like VaR have been embraced by financial entities wholeheartedly.

Derivatives instruments are akin to a double-edged sword. They can be employed as risk management tools as well as risk-profiting tools. What began as the risk management function soon became a wild beast which, like Frankenstein's monster created havoc in the financial markets. Rogue traders abused derivatives to their own peril. The collapse of Long Term Credit Management (LTCM) at the fag end of the millennium, a classic case of the downside of risk management where a hedgefund led to losses.

Caselet 3

Read the caselet carefully and answer the following questions.

1. Discuss briefly the main limitations of risk management.

(9 points)

2. Elaborate on the main types of pure risk.

(8 points)

In 1995, Daimler-Benz reported the largest first-half losses of DM1.56 billion in the history of the company. The management of the company attributed it to exchange rate losses due to the weakening dollar. Daimler-Benz Aerospace, a subsidiary of Daimler-Benz, had an order book of DM20 billion, of which 80 percent was fixed in dollars. As the company failed to hedge its dollar receivables, it had to make provision for losses of DM1.2 billion. The company failed about the exchange rate, ranging from DM1.2 to DM1.7 per dollar, whereas its own forecast was pegged at DM1.55.

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But what if a company has a definite comparative advantage? Many companies in the course of their operations acquire definite specialized information. In such cases, the company can certainly allow that specialized information to play a role in its risk management strategy. Let us consider a hypothetical example wherein a particular company produces a particular product which uses copper as a major input. Let us further assume that when it has no knowledge about the future movement of copper prices, it hedges 50 percent of the expected copper purchases.

In the process of ensuring that it has adequate quantity of the input on hand, it acquires certain specialized information about the copper market. The specialized information is that it is far more likely copper prices will shoot up rather than fall. Then the risk manager will hedge as much as 100 percent of its expected purchases, instead of the regular 50 percent. Conversely, if the information acquired had been with respect to a fall in copper prices, then the risk manager might choose to hedge only 20 percent of the expected purchases.

Although there are definite risks to selective hedging, the information companies acquire about certain financial markets may prove to be a reasonably reliable source of gain in risk management decisions. But, once a company has decided that it has a comparative advantage in taking certain risks, it must determine the role of risk management in exploiting this advantage. Nevertheless, a company's ability to withstand losses depends not only on its risk management policy, but also on the capital structure and the general financial health. Though selective hedging contains a lot of potential for abuse, it may also represent a value-adding form of risk-taking for many companies.

At the outset, it was mentioned that corporate risk management has expanded tremendously. This can be attributed to the increasing sophistication of risk management instruments. For the pro-active risk manager, there are various methods to hedge risks. The kind of hedging mechanism required, however, would depend on the type of risk exposure. Moreover, risk management strategies should be dynamic and subject to continuous review. But, the experience of certain companies reveals a lack of clarity in understanding these instruments and its users. Understanding the motives for risk management is a critical step in designing an effective risk management program for a company. If the hedging instruments are used appropriately, they reduce risk and increase firm value. However, misuse of these instruments can lead to the collapse of even well-established institutions like the Barings Bank.

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Model Question Paper 1

Suggested Answers
Paper I

Part A: Basic Concepts

1. *(d)* Any investment in the secondary market faces the risk that the security may not have enough liquidity in future.

2. *(e)* Financial risk and business risk are firm specific. They do not affect all the securities in the market. Inflation risk and risk due to variability in returns due to changed investors' expectations affect all the securities equally because they are not firm specific.

3. *(e)* Systematic risk is that risk which cannot be mitigated by the corporates. It equally affects all the securities in the market. Since here inflation risk and interest rate risk are not firm specific, they comprise the systematic risk. Financial risk and business risk are firm specific.

4. *(b)* Regulatory risk is external to the business of a firm and happens due to changes in the regulations of the country.

5. *(b)* Corporate risk management refers to the process of a company managing its risks at an acceptable level.

6. *(a)* VaR cannot be used in isolation to measure risk and is used with stress testing to overcome its limitations.

7. *(e)* A financial instrument has off-balance sheet risk of accounting loss if the risk of accounting loss to the entity exceeds the amount that is recognized as an asset or if the ultimate obligation exceeds the amount that is recognized as a liability in the statement of financial position.

8. *(c)* The objective of introducing weather derivatives is to ensure that the profitability or revenue expectations of a company are not adversely affected by the playfulness of the weather.

9. *(c)* VaR is useful in estimating chances of loss from an exposure.

10. *(a)* Delta of an option gives the hedge ratio of the option, because

    Delta call = c/s = $N(d_1)$

    Delta put = $N(d_1) - 1$

    $N(d_1)$ is the hedge ratio.

11. *(c)* Put-call parity is given by $c + Xe^{-r(T-t)} = p + S$. This can also be written as $c - p = S - X$.

12. *(b)* A callable swap gives the holder the right to terminate the swap at any time before its maturity. A putable swap gives the seller of the swap the right to terminate the swap at any time before its maturity. Call/Put Swaptions are options on swaps where the buyer/seller of the swaption is entitled to perform a specific swap deal for a defined period of time.

13. *(a)* Under a long call, the investor is bullish on the underlying asset and purchases the call. Under a short put, the investor is bullish about the underlying asset and sells the put. This is equivalent to owning the underlying asset under which one can either short sell it or buy it depending on the movement of the market.

14. *(d)* The value of the call option increases with decline in strike price and it decreases with increase in strike price. The longer the "time to expiration", the higher the option price. The difference in two call prices cannot exceed the difference in the exercise prices. Hence only statements (i) and (ii) are true and (iii) is false.

15. *(b)* Gamma is the rate of deviation of the delta to the price of the underlying stock. So, 0.2/.03 = 0.67.

16.   *(a)* Gamma is the rate of deviation of the delta to the price of the underlying stock. Higher gamma reflects the greater sensitivity of the option's delta with respect to the stock price.

17.   *(b)* Vega of all options decreases as the expiration date approaches. So, a negative vega of the portfolio by the vega of the traded option will make the portfolio vega neutral or in other words, the option premium will not be sensitive to changes in the volatility of the underlying asset.

18.   *(c)* Delta put = $N(d_1) - 1$ where, $N(d_1)$ is the hedge ratio.

19.   *(a)* In a zero-coupon swap, the fixed rate payer makes a single fixed payment at the maturity of the swap from the proceeds of the bond repayment. A forward swap is one in which the commencement date is set at a future date, and it helps in locking the swap rates and use them later as asd when needed. Plain vanilla swaps are those swaps where fixed rate obligations are exchanged for floating rate obligations over a specific period of time on a notional principal. Accreting swaps can be used to convert floating rate payments into fixed rate payments if the principal amount increases every time additional loan is availed. A currency swap is a contract involving exchange of interest payments on a loan in one currency for fixed or floating interest payments on equivalent loan in a different currency.

20.   *(b)* A currency swap is equivalent to a long dated forward foreign exchange contract where the forward rate is the current spot rate.

21.   *(c)* In a currency swap there is exchange of interest payments only and no exchange of principals at any time during the life of the swap.

22.   *(c)* A callable swap gives the holder the right to terminate the swap at any time before its maturity. A putable swap gives the seller of the swap the right to terminate the swap at any time before its maturity. A call swaption gives its buyer the right to enter into a swap as a fixed rate payer. Put swaption gives the buyer the right to enter into a swap as a floating rate payer.

23.   *(c)* Two fixed-floating currency swaps are combined to form a fixed to fixed currency swap, which is known as circus swap. It can be created by combining a currency swap and an interest rate swap with floating rate or both having LIBOR pricing.

24.   *(a)* While terminating a swap contract, if the party pays to or receives from the counterparty a lump sum payment equal to the swap's present value, then it is called a buyout.

25.   *(a)* If the futures prices obtained by full-carry relationship are accurately projected, the basis is negative, as the futures prices are higher than the cash prices. This is referred to as 'Contango' market.

26.   *(c)* On the maturity date, the price of a futures contract is equal to the spot price in order to avoid the risk-free arbitrage.

27.   *(c)* The practice of buying one option contract and selling another for the same underlying investment at the same time. The difference between the profit from one transaction and the loss on the other is the spread. The spread can either work for or against the trader. If the spread works in his favor, he makes a profit. If it works against him, he suffers a loss. Spread trading is used by futures and options traders to reduce the risk of losing large sums from a sudden movement in the market. In this case the speculator buys the July futures and sell September futures and reverse the transaction later.

28.   *(b)* A straddle involves a call and a put option with the same exercise price and the same expiration date. In a short straddle, the seller sells a call and a put option at the same exercise price and the same expiration date. In a long straddle, the buyer buys a call and a put option at the same exercise price and the same expiration date.

29.   *(e)* Theta hedging is used to immunize the portfolio changes in the price of the underlying asset in the next small interval of time.

30.   *(a)* Operating exposure is dependent on the degree of competition, location of the competitors and the degree of product differentiation.

Part B: Problems

1. **Fixed Leg**

Months from now	Cash flow (Million AUD)
3	0.50
9	0.50
15	0.50
21	0.50
27	0.50
33	0.50
39	0.50
45	0.50
51	0.50
57	0.50
63	10.50

Value of the leg 3-m from now @ 8% = AUD 11.31 million

Present value of the leg = $\dfrac{11.31}{1+0.08/4}$ = AUD 11.09 million

Floating Leg

Value of the leg 3-m from now will be at par.

Present value of the leg

$$= \frac{5.56 \times \left(1+\dfrac{0.09}{2}\right)}{1+\dfrac{0.08}{4}} = \frac{5.81}{1.02} = 5.70 \text{ million}$$

Value of the floating leg in AUD = 5.70 x 1.60 = AUD 9.12 million

The Australian firm has an asset worth AUD 11.09 million and liability worth AUD 9.12 million. It can lock in the difference by selling the swap.

2. Consider a portfolio consisting of one short call option and shares

If the stock prices rise to $42 this is worth $42\alpha - 3$. If the stock price fulls to $38, it is worth 38. These are equal when

$$42\alpha - 3 = 38\alpha$$
$$\text{or } \alpha = 0.75$$

The value of the portfolio in one month is $28.5 for both stock prices. Its value today must be the present value of 28.5 or 28.5 x $e^{-0.08 \times 0.0833}$ = 28.31.

That is, $- C + 40 = 28.31$

Where, C is call price

Since $\alpha = 0.75$, the call price is 40 x 0.75 – 28.31 = Rs.1.69.

3.

AUD/$	¥/$	AUD/¥	¥/AUD
1.620	141	0.0115	87.04
1.600	145	0.0110	90.63
1.550	148	0.0105	95.48

a. Market expectation is that the Yen will depreciate against the AUD.

b. The speculator thinks that the Yen will appreciate.

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The Yen is underpriced, so he buys it.

The AUD is overpriced, so he sells it.

The speculator may, in other words, sell dollar futures against the Yen at ¥/$ 148. Let us assume that the futures will be squared off at ¥/$ 150. The speculator loses ¥2 per $ sold.

Again, the speculator may buy dollar futures at AUD/$ 1.550. If the contract is squared off at AUD/$ 1.650, he gains Euros 0.10 per dollar bought.

If the expectations of the speculator come true, the gains from one transaction will be more than the losses from the other.

4. Selling a butterfly is buying two call options at the middle rate and selling one each at the higher and lower rates. That is,

Buy two options at Rs.43.00

Sell one option at Rs.42.50

Sell one option at 43.50

Net premium: – 1.00 x 2 + 1.25 + 0.75 = 0

Spot price	Buy two calls at 43.00	Sell one call at 42.50	Sell one call at 43.50	Pay-off	Profit
42.00	0	0	0	0	0
42.50	0	0	0	0	0
43.00	0	– 0.50	0	– 0.50	– 0.50
43.50	1.00	– 1.00	0	0	0
44.00	2.00	– 1.50	–0.50	0	0
44.50	3.00	– 2.00	–1.00	0	0

A butterfly spread is sold when a significant appreciation or depreciation is expected.

5. i. **Buying a put option**

    Inflow = ($5 million x 43.25) – ($5 million x 1.00)

    = Rs.211.25 million or Rs.21.125 crore.

    ii. **Writing a call option**

    Inflow = Rs.[5 million x (43.00 + 0.75)]

    = Rs.218.75 million or Rs.21.875 crore.

    iii. **Forward cover**

    5 x 42.75 = Rs.213.75 million or Rs.21.375 crore.

Writing a call option is best alternative as it provides the highest inflow.

Part C: Applied Theory

1. Derivatives became very popular and because of their unique nature, they offer a combination of characteristics which are not found in other assets. There are four important features that distinguish derivatives from underlying assets and make them useful for a variety of purposes:

    a. Relation between the values of derivatives and their underlying assets.

    b. It is easier to take short position in derivatives than in other assets.

    c. Exchange traded derivatives are liquid and have low transaction cost.

    d. It is possible to construct the portfolio which is exactly needed, without having the underlying assets.

    a. **Relation between the values of derivatives and their underlying assets:** When the values of underlying assets change, so do the values of derivatives based on them. For some derivative instruments such as swaps and futures, the relation between the underlying assets and the instrument is straight forward, i.e., if the product price changes the instrument price also changes. In a currency future

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contract, the price to be paid when the currency is delivered will be fixed by the future contract, the value of the currency delivered will fluctuate depending on the movements of the underlying currency. Thus, the value of the future contract depends on the value of the underlying currency. The relation between values of the underlying asset and option are more complicated, but the values of the option and underlying assets are still to be related. Due to this unique quality, the derivatives appear similar to real commodities for many traders.

b. **It is easier to take short position in derivatives than in other assets:** As all transactions in derivatives take place in future specific dates it is easy for the investor to sell the underlying assets, i.e. in an asset he is obligated to deliver it in future. The short position means taking stand for selling the underlying asset, with or without possessing the asset. He can take view of the market or product which is not possible in any other asset.

c. **Exchange traded derivatives are liquid and have low transaction cost:** Exchange traded derivatives are more liquid and have lower transaction costs than other assets. They are more liquid because they have standardized terms and low credit risk. Furthermore, their transaction costs are low due to high volume in trade and due to high competition. In addition, margin requirement in the exchange traded derivatives is relatively low, which reflects that the risk associated with this instrument is low.

d. **It is possible to construct portfolio which is exactly needed, without having the underlying assets:** Derivatives can be constructed or combined to closely match specific portfolio requirement. For example, suppose a firm with a floating-rate loan needs to limit its exposure to sharp increases in the interest rate. The firm can purchase a derivative called an interest rate cap. This derivative pays the firm the difference between the floating rate of interest and a predetermined maximum called the cap rate whenever the floating rate exceeds the cap. Similarly, the lender can protect the decrease in the interest rate by buying the floor. The derivative product seller pays the lender the difference between a predetermined rate maximum called the cap rate whenever the floating rate falls below the floor rate.

2. You buy the put option on 6-month LIBOR with a strike rate at 6% to hedge against the unexpected movements of interest rates.

   i. The interest rate at expiration is greater than the strike rate hence you allow the put option to lapse. Though you lose the premium you can invest your funds at a higher rate.

   ii. The interest rate is less than the strike and hence you exercise the put option and thus you get an opportunity to invest the funds at a higher rate than what would have been possible if the put option is not purchased.

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Paper II

Part D: Case Study

1. **Heating Degree Days (HDD):** Based on a standard of 65 degrees Fahrenheit, the Heating Day Temperature is calculated as

   i.   0, if the day's temperature is more than 65 degrees, or

   ii.   65 degrees less the actual temperature if the temperature is less than 65 degrees. The HDD can never be negative.

   This index is used during the winter months to measure the cold waves. Higher the index, colder the day and vice versa.

   HDD = (0 or 65 – ACTUAL TEMPERATURE)

   Cooling Degree Days (CDD): This index is similarly using the same technique as the HDD but is either

   i.   0 if the temperature is below 65 degrees or

   ii.   is the actual temperature less 65 degrees of the temperature is above 65 degrees. The CDD can never be negative.

   This index is the opposite of HDD and is used in the summer months to measure the warmth. Higher the index, warmer the day and vice versa.

   CDD = (0 or ACTUAL TEMPERATURE – 65)

2. **Value of the Weather Index:** The weather index is nothing but the total of the CDD or HDD for the given period multiplied by US$100. One can accumulate the HDD or CDD and the weather index is written on the cumulative total of the HDDs or CDDs.

   Example: For one week of April 2000, the value of the weather index will be $100 x (25 + 26 + 28 + 22 + 21 + 18 + 19) or US$15,900. In other words, the temperature on 1st April was 25^0, 2nd April was 26^0, 3rd April 28^0 and so on. The addition of the index of each of the 7 days will result in a total of 159^0 which when multiplied by $100, will result in a total value of $15,900.

   It is to be noted that the CME trades the index for a month or part of a month only and never more than that. This means that the weather derivatives have a specific strike for each month. An investor who wishes to hold the weather derivatives for the entire winter season will have to buy various contracts covering all the months of the season, i.e. one separate contract per month to be covered.

   Given the fact that each of the two indices only measures the warmth or the coolness of the weather, it is essential to have both the indices operating together. If only one index was there, it would show an accurate measurement say, for winter while extreme summers would be measured as 0 or near zero, thus not enabling the companies from buying the index even when expected to be affected by the summer conditions.

3. **Trading the Weather Indices (Hedging the Weather Risk):** The CME weather indices are mostly used to ensure that there is no loss due to unexpected weather irregularities. Futures or options are used to hedge the weather risks, and of the two, the use of options is more common.

   Theoretically, futures would work as follows:

   A business may opt to buy or sell a futures contract which is equivalent to a swap contract in such a way that one counterparty gets paid if the Degree Days (DD) over some period of time are higher than the strike level and the other counterparty gets paid if the DD are lower than the strike level.

   Now, taking a simple example:

   If a company expects the coming month to be hot, it should either sell CDD indices in summer or buy the HDD indices in winter. In case the summer in the coming month does not turn to be as hot as expected and the company incurs losses, it should square off the indices by buying them at a lower price and thus ensure that the revenue stream is not affected.

Similarly, in winter, a company that expected the days to be very cold should sell the HDD index. If the weather does not perform as per the expectations and the winter nights turn out to be warmer than expected, the HDD index should be lower at that time and the same can be bought, thus ensuring that the profit earned in the difference of sale and purchase offsets the loss made in the lower revenues.

In case of options, the following should be the course of action:

The company above, which is expecting hot days in summer should buy call option of the HDD in winter. If the days turn out to be as hot as expected, the revenues earned will be high and the option should be allowed to expire. Else, if the days are cold and the revenues are not as expected, the put option can be exercised and the gain on the option can offset the loss in the revenues. E.g., an air-conditioner company may be expecting to sell 10,000 air-conditioners, in summer if the temperature touches 70^0 F. If the temperature is 50^0 F the sale will reduce to 5,000 units. If it is still cooler, the sale shall be only 2,000 or less units. In order to avoid such a fluctuation in sales the company can buy put options or sell call options of the HDD. If the temperature is 70^0F or above, the option will be allowed to expire. If the temperature is lower, the option can be exercised.

Similarly, the company expecting the winter nights to be cold in future should buy call options of CDD in summer. If the expectation of weather is achieved, the company will obviously earn good revenues and should allow the call option to expire without exercising it. Else if the reverse situation takes place and the company loss as a result of lower turnover, it should exercise its options as the CDD index will be quite high and the gains from the options will balance the losses in the revenues. E.g., let us understand the same with the help of an electricity utility company. If the winter is very cold, people are expected to run their heaters for longer hours, resulting in higher revenues. But if the winter is mild, the heaters will be operated for a shorter period. Based on the past 3 years experience, it is observed that the revenues are at least 30% lower than the forecast because of erratic winters. The electricity company this year can buy call options of CDD. If the winter is mild, the options can be exercised. If the winter is very cold, the utility company will earn high revenues and can afford to let the options expire without exercising.

It is a fact that in any options contract, the longer the out-of-money strike situation, lower the premium on the option. As discussed above, the weather derivatives are for a month or part of a month and in order to cover the entire season one has to acquire a strip of CDD or HDD. This is beneficial as the strips can be broken apart easily as compared to a single contract with a long-term period to maturity.

The strike level is usually set-up in relation to the normal climatic conditions of the city for which it is being measured. On average, 10-15 years of data of climate, data of the city, properly averaged is taken to decide the strike value. Even such a figure may not be very accurate given the fact that the weather keeps changing as a result of the green house effect and increasing burning of fossil fuels. Some researchers are of the opinion that instead of an average of 10-15 years, 20 or 50 years average should be taken. It is still a matter of debate.

4. India is basically a rural country with a very high dependency on farming for subsistency of almost 70-80% of the population. Farming is not automated and depends mostly on rainfall as irrigation facilities are not there in most of the areas.

   Needless to say, the monsoon is very erratic in the country and this entails heavy losses to the farmers and related industries as well. At present, crop insurance is the only way through which farmers can ensure their crops. Crop insurance is a Government of India scheme falling under the purview of the Agriculture ministry. GIC nearly acts as the implementing agency on behalf of the Government. The premiums for 2001-01 are expected to be in the range of Rs.175 crore which shows how low the number of farmers must be who opt for crop insurance. This could be because of lack of awareness among the farmers, illiteracy, poverty or too much reliance on old methods of farming.

   Weather related derivatives would be a very good way of ensuring that the agro-industries and related ones do not suffer losses as a result of erratic monsoons. While the meteorological departments calculate the temperature and other related data for the major cities and towns of the country, the concept of weather derivatives is relatively new to the world and has never been implemented in a developing nation like India.

5. An option that has no value. In the case of a call option, the option whose exercise price is greater than the market price of the underlying asset. In the case of a put option, the option whose exercise price is less than the market price of the underlying asset.

Part E: Caselets

Caselet 1

1. Once the company has identified the risks, it can employ a number of strategies to manage these risks. Transaction risk can be managed using simple forward covers. XYZ, for example, can sell dollars 20 days forward at a fixed rate as soon as it enters into a purchase contract. The dollar denominated revenue that flows in after 20 days can then be converted into rupees at the predetermined rate.

To reduce portfolio risk, a multinational company can estimate its future stream of profits or dividends and enter into a long-term derivative like a cross currency swap. But the local regulation restricts a company from hedging uncertain business cash flows. The company can hedge only its declared profits or dividends. The company can however hedge only its capital in the local branch or subsidiary through forward covers.

While business risk cannot be eliminated, the company can devise two broad operating strategies to mitigate it. To begin with, it can align its cost structure to that of its competitors and to its markets. For example, XYZ can set-up a manufacturing base in Europe, and Comco can switch its rupee debt into dollar debt through cross currency swaps. Next, the company can increase its flexibility by expanding or contracting its capacity to respond to uncertainty in product demand. One could equate acquiring flexibility to purchasing a real option.

2. The advantages of derivative products emanate from the flexibility they have in providing hedge to the persons who have exchange exposure. We know that exports and imports are exposed to currency risk. This exposure can be hedged through derivatives like futures, options, etc. Futures are one of the derivatives where an exporter and importer can hedge their positions by selling or buying futures. Since the futures market does not require upfront premium for entering into contract as in the case of options, it provides a cost-effective way for hedging the exchange risk. The basic advantage of using currency futures is that it provides a means to hedge the trader's position or anybody who wishes to lock-in exchange rates on future currency transactions. By purchasing (long hedge) or selling (short hedge) foreign exchange, a corporate or an individual can fix the incoming and outgoing cash flows in one currency with respect to another currency. Anyone who is dealing with a foreign currency is faced with an exchange risk since the cash flows in terms of domestic currency are known only at the time of conversion. The objective of avoiding exchange risk can be achieved by using different tools including futures. A person who is long or is expected to go long in a foreign currency will have to sell the same on a given day. A hedge can be obtained now by selling futures in that currency against the domestic currency. Similarly, a person who is short or is expected to go short in a foreign currency will have to go long on the same on a given day. A hedge can be obtained now by buying futures in that currency against the domestic currency instead of buying the currency latter in the spot market. However, the major disadvantage in foreign exchange futures is that they are limited to a few currencies only.

Caselet 2

1. Investors want to maximize their expected returns subject to their tolerance for risk. Return is the motivation for investing. There could be two types of returns: realized return (the de facto return) and expected return (or what the investors anticipate to earn). Return consists of the basic component in the form of interest or dividends and capital gains or losses due to the changes in the price of the asset. Total return can be defined as:

$$\frac{\text{Cash payments received} + \text{Price changes over the period}}{\text{Purchase price of the asset}}$$

$$\text{or} = \frac{(P_1 - P_0) + D_1}{P_0}$$

In the field of finance, in general and security analysis in particular, the term return is almost invariably associated with a percentage (for example, return on investment of 15%) and not a mere amount (like profit of Rs.100). But then again, even in terms of a percentage, exactly what is return? Is it the return on investment or return on assets (profit as a percentage of assets)? Is it the return on total capital or return on equity? Is it the accounting rate of return or the internal rate of return? In corporate finance, from the corporate perspective, each of these definitions have a specific significance and the use of any one specific definition depends upon the purpose for which the return is being measured. For example, if the purpose is to measure the productivity of capital as a whole, one may measure the return on total capital; if one is concerned with the productivity of assets, one may compute return on assets and so forth.

2. a. **Relation between the values of derivatives and their underlying assets:** When the values of underlying assets change, so do the values of derivatives based on them. For some derivative instruments such as swaps and futures, the relation between the underlying assets and the instrument is straight forward, i.e. if the product price changes the instrument price also changes. In a currency future contract, the price to be paid when the currency is delivered will be fixed by the future contract, the value of the currency delivered will fluctuate depending on the movements of the underlying currency. Thus, the value of the futures contract depends on the value of the underlying currency. The relation between values of the underlying asset and option are more complicated, but the values of the option and underlying assets are still to be related. Due to this unique quality, the derivatives appear similar to real commodities for many traders.

    b. **It is easier to take short position in derivatives than in other assets:** As all transactions in derivatives take place in future specific dates it is easy for the investor to sell the underlying assets, i.e. in an asset he is obligated to deliver it in future. The short position means taking stand for selling the underlying asset, with or without possessing the asset. He can take view of the market or product which is not possible in any other asset.

    c. **Exchange traded derivatives are liquid and have low transaction cost:** Exchange traded derivatives are more liquid and have lower transaction costs than other assets. They are more liquid because they have standardized terms and low credit risk. Furthermore, their transaction costs are low due to high volume of trade and due to high competition. In addition, margin requirement in the exchange traded derivatives is relatively low, which reflects that the risk associated with this instrument is low.

    d. **It is possible to construct portfolio which is exactly needed, without having the underlying assets:** Derivatives can be constructed or combined to closely match specific portfolio requirement. For example, suppose a firm with a floating-rate loan needs to limit its exposure to sharp increases in the interest rate. The firm can purchase a derivative called an interest rate cap. This derivative pays the firm the difference between the floating rate of interest and a predetermined maximum called the cap rate whenever the floating rate exceeds the cap. Similarly, the lender can protect the decrease in the interest rate by buying the floor. The derivative product seller pays the lender the difference between a predetermined rate maximum called the cap rate whenever the floating rate falls below the floor rate.

Caselet 3

1. Risk management although essential to control risks and avoid losses cannot guarantee full success. Risks can be minimized but never completely erased. While various theories discuss the benefits of diversification, careful investments in selected sectors, hedging and arbitraging, no money manager can guarantee a fool proof system against risks, mainly because many risks are unexpected and as a result from events of God. The remedial measures available to manage the risk are mostly based on general experience from the past. Managing risk tools may prove to be very costly and the investment in such tools may not justify the returns.

    Out of the various ways in which risks are being managed, none of the methods is perfect and may not even work in a similar situation in future.

The selection of suitable methods for risk management depends on the firm's expectations regarding the future as well as the degree of risks acceptable to the management.

In short, given the uncertainty of returns and the occurrence of risks, the management should undertake to the extent of risk management which is appropriate to its level of operations.

2. The main pure risks can be described as under:

   i. **Property Exposure**

   Any business or individual that uses any kind of property whether owned, leased, rented or otherwise is exposed to the risk of loss, theft and damage that may be caused by man-made reasons or natural reasons. Depending on the extent of exposure and damage, the business may be affected.

   ii. **Liability Exposure**

   Around the world, liability to any business due to litigation, damages, claims, etc., has become a major issue of concern. Millions of dollars are lost by companies over legal suits and settlements. Such risks are there to an individual also.

   iii. **Life and Health Exposure**

   Human beings have a certain death, although the extent of life and its quality cannot be determined. An individual may die while still young or may be bed-ridden for most of his life. Some people are healthy while others have to spend a major part of their earnings on health related matters. This exposure leads to loss of earnings for the individual, as well as loss of man-hours to the business to which he is associated.

   iv. **Financial Exposure**

   The three exposures mentioned above involve pure risks. Financial exposure can be because of speculative nature also, and should not always be considered as a pure risk, but it still has the same problems associated with pure risks. Although the techniques associated with these risks may be different from those used to manage the other risks mentioned above, it remains critical that these risks be identified and assessed in order for the firm to achieve its business goals.

Model Question Paper 2

Time: 6 Hours   **Total Points: 200**

Paper I

Time: 3 Hours   **Points: 100**

Part A: Basic Concepts (30 Points)

Answer all the questions. Each question carries one point.

1. Which of the following methods is considered as the traditional method to quantify the risk?

   a. Maturity gap approach.

   b. Simulation.

   c. Rate sensitive assets and liabilities approach.

   d. Duration approach.

   e. Hedging approach.

2. By investing in bonds, an investor is exposed to which of the following risk(s)?

   a. Interest rate risk

   b. Reinvestment risk.

   c. Default risk.

   d. Maturity risk.

   e. All of the above.

3. _____ risk arises when the income of a company is sensitive to the interest rate fluctuations.

   a. Contingency risk

   b. Credit risk

   c. Liquidity risk

   d. Interest rate risk

   e. Currency risk.

4. Risk of the assets of a firm not being readily marketable is called

   a. Market risk

   b. Systemic risk

   c. Liquidity risk

   d. Marketability risk

   e. Both (a) and (d) above.

5. Risks arising out of foreign exchange exposure is/are

   a. Primary risks

   b. Secondary risks

   c. Systemic risks

   d. Unsystematic risks

   e. Both (b) and (c) above.

6. The first step of risk management process is
   a. Review
   b. Development of strategy
   c. Identifying risk
   d. Determining objectives
   e. None of the above.

7. Which of the following statements is false?
   a. In a derivative instrument the initial net investment is less than the notional amount.
   b. In a derivative instrument the initial net investment is greater than the notional amount.
   c. Fair value is defined as the net present value of the cash flows associated with the asset.
   d. A derivative instrument need not have initial net investment.
   e. Both (b) and (c) above.

8. Which of the following factors, affecting profitability of a company cannot be related to the weather uncertainties?
   a. Increased cost of production.
   b. Increased or decreased prices of inputs.
   c. Anti-dumping duty imposed on the product in country of export.
   d. Increased demand for substitute products.
   e. Both (c) and (d) above.

9. To extend daily VaR for one year, the one figure is multiplied by
   a. 365 days
   b. Square root of 365 days
   c. Number of working days in a year
   d. Square root of number of working days in a year
   e. None of the above.

10. A strap is
    a. A long position in one call and 2 puts with the same strike price and expiration date
    b. A long position in 2 calls and one put with different strike prices and expiration date
    c. A long position in 2 calls and one put with same strike price and expiration date
    d. A long position in 2 calls and one put with same strike price and different expiration dates
    e. A long position in 2 calls and one put with same strike prices and same expiration date.

11. A bullish put spread consists of
    a. Selling put with higher strike price and buying put with lower strike price
    b. Buying and selling put of near and long-term respectively
    c. Writing a call and buying a call with different strike prices but identical maturity
    d. Write a put option at current spot rate
    e. Write a call option and buy a put option of identical strike price.

12. In which of the following cases is time value the highest?
    a. Strike price ≥ spot price.
    b. Strike price ≤ spot price.
    c. Strike price = spot price.
    d. Strike price > spot price.
    e. Strike price < spot price.

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13. Which of the following statements is/are true in case of a "put and call option"?
    a. It is a Bormudan option.
    b. It is a forward-start option.
    c. It has 2 strike prices and two exercise dates.
    d. It has 2 strike prices and one expiration date.
    e. None of the above.

14. In an exchange traded option, if stock split occurs at x for y, the exercise price is reduced to
    a. y/x of the previous value and the number of shares covered by one contract is increased to y/x of its previous value
    b. y/x of the previous value and the number of shares covered by one covered by one contract is increased by x/y of the previous value
    c. x/y of the previous value and the number of shares covered by one contract is increased to y/x of its previous value
    d. x/y of the previous value and the number of shares covered by one contract is increased to x/y of the previous value
    e. None of the above.

15. A portfolio fund manager in the USA holds a portfolio of stock in Euro which is supposed to be liquidated in 6 months time. Which of the following is an appropriate tool for hedging?
    a. Buy a put option on Euro.
    b. Write a put option on Euro.
    c. Write a call option on $.
    d. Buy a call option on Euro.
    e. None of the above.

16. Lambda of an option is the rate of change in the value of option with respect to change in
    a. Time
    b. The volatility of the underlying asset
    c. The spot rate of the underlying currency
    d. The delta of the option
    e. None of the above.

17. A 'chooser' option is one
    a. In which the holder has an option to make a choice between a call and a put
    b. In which the holder has an option to make a choice between a European call and an American call
    c. In which the holder has an option to make a choice between an American and a European put
    d. In which the holder has an option to make a choice between an American call and an American put
    e. In which the holder has an option to make a choice between a European call and an American put.

18. You wrote a call option contract for a premium of Rs.250. The exercise price of option is Rs.50 and the current market price is Rs.45. After a period of four months the price of the stock is Rs.53. If the option holder exercises the option, total loss will be Rs._____. Ignore the transaction costs and the contract is for 100 shares.
    a. 50
    b. 100
    c. 250
    d. 450
    e. 550.

19. Which of the following statement(s) is/are true in a cross-currency interest rate swap?

    a. The interest flows are exchanged as per agreed terms.

    b. No principal amounts are exchanged during the life of swap.

    c. Principal amounts are exchanged at the beginning and the end of the swap life.

    d. Both (a) and (b) above.

    e. All of (a), (b) and (c) above.

20. A manufacturer borrowed $100 million at 8% for five years. The principal needs to be paid in five equal annual installments starting from end of first year. The manufacturer wants to enter into a fixed to floating swap. Which of the following swaps will match the cash flows of the manufacturer?

    a. Accreting swap.

    b. Amortizing swap.

    c. Roller coaster swap.

    d. Forward swap.

    e. None of the above.

21. If a firm enters into a Swap, which has the following sets of cash flows

    i. It pays Libor plus 0.5% to its lender

    ii. It receives Libor under the terms of the Swap

    iii. It pays 4% under the terms of the Swap.

    The interest payment to the firm works out to

    a. Libor

    b. Libor + 0.5%

    c. 4%

    d. 4.5%

    e. None of the above.

22. Which of the following is/are true about currency swaps?

    i. It is a contract between two parties to exchange payments denominated in one currency for payments denominated in another.

    ii. It involves only exchange of principal.

    iii. It involves exchange of interest only.

    iv. Foreign currency interest payments are usually hedged.

    a. Only (i) above.

    b. Both (i) and (ii) above.

    c. Both (i) and (iii) above.

    d. Only (i), (ii) and (iii) above.

    e. All of (i), (ii), (iii) and (iv) above.

23. Which of the following statements is/are true?

    a. The economic purpose of a currency swap is similar to a parallel loan.

    b. The currency swap is not a loan.

    c. Currency swaps involve exchanging the principal amount at maturity at a predetermined exchange rate.

    d. Both (a) and (b) above.

    e. All of (a), (b) and (c) above.

24. Choose the correct response from the following.

    a. Futures is an OTC product and forwards is exchange traded.

    b. Futures provides perfect hedge and forwards does not.

    c. Liquidity in futures market is more than the forward market.

    d. Futures prices will be more than forward prices.

    e. Both (a) and (c) above.

25. Which of the following is the reason to believe that futures prices and forwards prices will be different?

    a. Futures are liquid whereas forwards are not.

    b. Futures are exchange traded products whereas forwards are not.

    c. Futures are marked-to-market whereas forwards are not.

    d. Futures and forwards prices will not be different.

    e. None of the above.

26. In case of futures markets, scalpers are

    a. Floor traders who perform the role of market makers

    b. Floor brokers who do not trade on their own account

    c. Floor traders who trade on behalf of others and also on their own account

    d. Floor traders who operate with a bullish view on the market

    e. Floor traders who operate with a bearish view on the market.

27. When a transaction consists of both a currency swap and an interest rate swap with LIBOR based pricing for the floating side of each, the swap is called

    a. A deferred swap

    b. A forward swap

    c. A circus swap

    d. Roller-coaster swap

    e. Amortizing currency swaps.

28. In an efficient market, the expected cost of the forward contract must be

    a. $= 0$

    b. > 0

    c. ≥ 0

    d. < 0

    e. ≤ 0

29. A swap quote of LIBOR/fixed 5 year swap at 85/95 over 5 years treasury by a bank means that

    a. Bank is willing to pay LIBOR and receive fixed rate to be determined in the given range

    b. Bank is willing to receive LIBOR and pay fixed rate to be determined in the given range

    c. Bank is willing to pay 5 year treasury rate + 85 bp and receive LIBOR

    d. Bank is willing to receive 5 year treasury rate + 85 bp and pay LIBOR

    e. None of the above.

30. When a trader sells a call, if the call expires without being exercised, the gain is a

    a.   Long-term gain if the position is held for more than a year

    b.   Short-term gain always

    c.   Short-term gain only when it is held for less than a year

    d.   Equals the price of the option

    e.   Both (b) and (d) above.

Part B: Problems (50 Points)

Solve all the problems. Points are indicated against each problem.

1. An investor bought a 3-month call option on a stock at Rs.325 when the current stock price is Rs.315. The call option is priced at Rs.12.

    a.   What will be the price of a corresponding put option, if risk-free rate is 9%?

    b.   If the underlying stock has an expected return of 20% and volatility of 30%, what is the expected price of the stock two weeks latter?

<div align="right">(5 + 5 = 10 points)</div>

2. The current spot rate is Rs./$43.50/70

A speculator found the following options traded in the market:

Strike price	Call premium	Put premium
43.30	0.90	0.40
43.50	0.50	0.60
43.70	0.30	1.00

She is of the opinion that the spot rate is likely to experience wide variation though the direction is not clear. Work out the pay-off profile over a range of spot rates from Rs.43.00 to Rs.44.00 if a straddle is bought? (Round off the price to 10 paise).

<div align="right">(10 points)</div>

3. The following is the information regarding the market rates and the objectives of three corporates.

Name of the company	A	B	C
Objective	Floating $	Fixed $	Fixed
Fixed rate $	5.50	6.75	7.00
Floating rate $	Libor + 0.25	Libor + 0.75	Libor + 0.50
Fixed	6.00	5.50	6.25

Arrange a swap in such a way that the benefit is equally distributed among the three parties.

<div align="right">(12 points)</div>

4. An American importer has a payable in Yen six months latter. The market quotes are as under:

Spot Y=/$	125.00
Forward 6-m Y=/$	122.30

Nature of Option	Strike Rate (Y=/$)	Premium
Call (6-m)	122.30	3.25%
Call (6-m)	120.00	2.15%
Put (6-m)	126.00	2.15%
Put (6-m)	127.50	1.75%

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Which of the following alternatives is preferable when comparable to a forward contract?

a.   Buy a 6-m call at ¥/$ 122.30.

b.   Buy a 6-m call at ¥/$ 120 and write a put at ¥/$ 126.

c.   Write a 6-m put at ¥/$ 127.50.

(3 + 4 + 3 = 10 points)

5.   A corporate treasurer expects to receive 2 million after six months. The interest rate on a six-month deposit is currently 11% per annum. Standard size of 6-month deposit sterling interest rate futures is 500,000. The futures are now trading at 88.77. The treasurer decides to hedge using these futures. After six months, when he closes out, the interest rate has decreased to 8% while the futures trade at 91.83. Explain how the treasurer has benefited by hedging.

(8 points)

Part C: Applied Theory (20 Points)

Answer the following questions. Points are indicated against each question.

1.   "Managing of risk involves identifying the alternate tools available for doing so". Describe the tools available.

(10 points)

2.   "Both risk-neutral and risk-altering swaps are very good ways of increasing the total return on a bond portfolio". Explain.

(10 points)

Paper II

Part D: Case Study (50 Points)

Read the case carefully and answer the following questions.

1. Evaluate the alternatives available to the company for hedging.

    (12 points)

2. Re-evaluate the options given above if the actual spot rate after 6-m is Rs.71.30/Pound.

    (9 points)

3. If a major order of the company is canceled after three months and it has already taken the positions mentioned above, how can it cover its exposures and show the cash flows for each of the alternatives discussed above? The new rates are given below.

    The 3 months European put of Rs./£ is as follows:

Strike price (Rs./£)	Premium (Rs./£)
72.00	1.20
71.50	1.00
71.00	0.75
70.50	0.60
70.00	0.45

    The other important information is:

	Rs./£
Spot Rate	69.25
3-m Forward Rate	70.25
3-m Futures Contract Rate	70.00
(Standard size = £ 1 – m)	

    (12 points)

4. Explain the meaning of the terms Initial Margin, Maintenance Margin and Variation Margin in futures contracts.

    (8 points)

5. Discuss briefly the main risks of entering into swaps.

    (9 points)

Mr. Shyamsundar Rajaram is the marketing manager of Silver Pharmaceuticals Ltd., a large pharmaceutical company engaged in the manufacture of IV fluids. The majority of the production of the company is exported to the UK, with only about 20% of the revenue being generated in the local markets.

Given the fact that about 80% of the revenue is generated in foreign exchange, Mr.Rajaram would like to ensure that his targets do not fall below expectation because of devaluations and fluctuations in the rupee levels.

In 2000-01, the net sales of Silver Pharmaceuticals Ltd., were Rs.80 crore and are expected to touch Rs.100 crore this year.

Payments are never received in advance and take about 6 months to realize. The company is given tax concessions for earning such a huge amount of foreign exchange. Silver is planning to double its installed capacity and at present is operating at 125% capacity utilization working in three shifts.

Mr. Shyamsundar Rajaram has been seriously thinking about various ways of hedging his company's position in the market (something that was never done by them in the past). It can

either go for a futures contract or else, do nothing like in the previous year and keep the position open.

The following is the estimated scenario for the 6 months forward exchange rate between the Rupee and Sterling Pound:

Expected exchange rate (Rs./£)	Probability
70.00	20%
70.50	25%
71.00	25%
71.50	25%
72.00	5%

The 6 months European put of Rs./£ is as follows:

Strike Price (Rs./£)	Premium (Rs./£)
72.00	2.00
71.50	1.80
71.00	1.50
70.50	1.20
70.00	1.00

There has been huge volatility in the stock markets for the last one year, with the Pound strengthening against the Rupee.

The other important information is:

	Rs./£
Spot Rate	67.75
6-m Forward Rate	70.00
6-m Futures Contract Rate	69.75
(standard size = £1– m)	

Part E: Caselets (50 Points)

Caselet 1

Read the caselet carefully and answer the following questions.

1. What do you understand by scenario analysis?

(6 points)

2. Explain the concept of Monte Carlo simulations with reference to scenario analysis?

(6 points)

At a major US super-regional bank the Risk-Adjusted Return On Capital (RAROC) framework serves as the foundation for planning, performance measurement and decisions on resource allocation. The framework was adopted four years ago. Each business activity is assessed to determine whether it earns an adequate return for the level of risk incurred. This review process has become a key decision-making tool for managing risk-taking activities, as well as ensuring that capital has been profitably deployed throughout the bank.

Each year during the planning process, all business units are ranked by RAROC and their contribution to shareholder value – i.e. the returns above their cost of equity hurdle rate is measured. The equity spread performance measurement approach makes it relatively easy to identify units that create or destroy value in the business portfolio and for the bank to take appropriate action. In one particular year, the strategic planning process revealed that a retail lending business unit would only achieve a 13 percent RAROC for each year over the next three years. This was below the business unit's cost of equity hurdle rate of 15 percent, which had been established by the bank's senior management. Thus, every dollar invested in the business unit was

dissipating shareholder value. To remedy the unit's under achievement, senior bank management initiated a review to determine the best course of action to bring the retail lending unit into profitability.

The review consisted of a comprehensive analysis of the unit's business strategy, risk profile, cost structure or opportunities presented in its business plan. It was found that the risk-adjusted capital, by-product, indicated that the unit was lending primarily to high-risk customers. Although the credit process was effective, market place pricing was very competitive and risk-adjusted returns were marginal. A further internal analysis of the retail lending unit's business plan indicated that its revenue was showing a 6 percent growth rate when those of other sectors of the bank were growing at 10 percent under the same economic conditions and that its expenses were increasing at a rate of 3 percent, while other areas of the bank were holding expense growth flat. It was concluded that the retail lending unit would not be a major contributor of cash flow for the bank in the future.

A review of the unit's customer list indicator that there were minimal cross-selling opportunities between the unit and other areas of the bank, substantiating the belief that the unit had very little overall strategic value to the bank. Market analysis revealed that competition was strong and that the market place – of which the lending unit's share was just 2 percent – was dominated by a few large players. Scenario analysis indicated that, even if the retail lending unit reduced costs, became a low-cost producer and expanded market share, the risk profile of the customers would not allow it to achieve a sustainable contribution to the bank over the long-term. No product expansion or other opportunities to improve profitability were apparent.

The bank's senior management ultimately concluded that the retail lending unit's contribution could not be improved or modified. Discussions were begun on the possible sale, divestiture or even "closing" of the unit and to what extent capital tied-up in the unit could be redeployed into profitable business or used to buy-back the bank's stock.

The bank eventually sold the retail lending unit to a major competitor at a 150 percent premium on book value. A portfolio analysis approach was used to determine how best to reallocate the retail lending unit's capital to other businesses with returns in excess of their cost of equity hurdle rate and with markets with a potential for increasing their share growth. The additional capital gave two other retail units within the bank the opportunity to increase their market share and overall contribution, and the sale of the unit increased the bank's revenue by 3 percent.

Caselet 2

Read the caselet carefully and answer the following questions.

1.   What are the main difficulties being faced by risk managers in handling the turbulence in the markets?

(6 points)

2.   "Stress testing is to be used together with Value at Risk in order to measure the extreme conditions."

(6 points)

3.   "Credit risk is one of the most important types of risk in risk management." Explain what is meant by credit risk.

(6 points)

Let us consider some of the risk management issues that made it difficult for investors to handle the recent turbulence in financial markets. The first is the question of liquidity risk. Many of the risk management models assume that positions can be closed at a low cost, when risk is perceived, and that rebalancing of portfolios can be done dynamically. The sudden drying up of liquidity in international markets, created problems for implementing these risk management strategies. The second issue is regarding the validity of assumptions behind risk management models. Most of the sophisticated models require assumptions about market volatility, correlations, and probability of risky events. These assumptions are made on the basis of historical data, and can therefore, make the model useless during periods of structural shifts and sudden out-of-the-sample risks. The third

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issue is the increasing synchronization of risk management strategies across investors. Sophisticated techniques like portfolio insurance and dynamic hedging are deployed by most international investors. This has resulted in accentuating risks as many portfolios simultaneously rebalance in a similar manner. The fourth issue is the convergence of a variety of risks such as credit risk, market risk and liquidity risk, during periods of heightened volatility, leading to blurring of market segments and the impact of one kind of risk on the other. The fifth is the issue of incentives in the organizations, where fund managers and traders may have a higher incentive to maximize their bonus and short-term gains at the cost of the firm's long-term risk exposure and profits.

Of risk management models being scrutinized in the context of their inability to protect institutional assets from risks, the Value at Risk (VaR) model has attracted extensive debate. The VaR model seeks to provide a summary measure, that indicates how much a firm's equity capital will be lost given a certain level of swing in the prices of the assets in the firm's portfolio. The probability of changes in the prices of all assets in a firm's portfolio is first estimated. With this probability distribution, the probable loss in the value of the portfolio, for a given period, at a certain level of confidence, is estimated. For instance, a VaR of $5 million, 1-day, 99 percent confidence, means that the model indicates that the firm's portfolio will not lose more than $5 million on a single day, in 99 out of 100 days. VaR is dynamically calculated, simulated, and subject to scenario analyses, so that the firm's portfolio can be rebalanced to contain it at levels that are acceptable to its managers. Managers create and rebalance protfolios based on their strategy of how much VaR they would like to have.

If the VaR for a bank is $50mn, 1-day/99 percent confidence, what we are saying is that the probability of losing more than $50mn in a single day, is one in 100 days. But most of the banks experienced that thier losses on many of the days falling during the LTCM crisis, was well above the VaR. This means that the VaR models have grossly understated the likelihood of losses. This happened despite the sophistication of the models, simply because the volatility in the markets, during the crisis, was much higher than what was assumed in the risk models. The probability of being unable to unwind a position in a market that was historically the most liquid, was not factored into these calculations. The changes in the correlations between markets during the crisis, led to assumptions on market correlations becoming erroneous. In any case, the VaR model could only capture market risks, while there was also a huge credit risk component, which the model had not handled.

Another significant problem is the inadequate attention to credit risk. In the LTCM case, it became very clear, that banks and institutions had a very high exposure to a highly leveraged firm, which would quickly become poor quality risk, when its asset portfolio loses value. The same is the case with exposure to other leveraged firms, including investment and commercial banks. Credit risk is the hottest topic in today's markets, and credit derivatives is the product on which many investment bankers are working. The LTCM crisis has led to the formation of the 'Counterparty Risk Management Group' which aims to develop a set of standards for credit risk management.

A World Bank report on risk management summarizes these issues as follows:

"There are two lessons for risk management from the market turbulence of the recent past. First, risk management should promote a conservative and comprehensive approach to risk; a piece meal approach clearly can miss significant risks and interactions among them. Second, in risk management as in other areas, complex formal models can complement, but cannot fully substitute for judgement and experience.

Caselet 3

Read the caselet carefully and answer the following questions.

1. Explain the operation of the London Metal Exchange, the world's foremost exchange for metal futures.

(7 points)

2. Explain how an intermediary can offset its risks in the swap market.

(7 points)

3. Discuss how Lukens Inc. can hedge its positions using commodity futures.

(6 points)

Lukens, Inc., is a producer of carbon, alloy and stainless steel, whose operating earnings are essentially affected by fluctuations in the prices of nickel and natural gas. Prior to 1993, hedging was carried out on an ad hoc and unstructured basis. In 1993, they developed a more formal approach and put together a team to develop and carry out risk management policy and strategies. In December 1993, the team executed its first trade – a purchase of nickel futures on the London Metals Exchange.

In formulating their risk management strategy, besides fluctuations in nickel and natural gas prices, they also looked at other potential sources of risk like changes in foreign currencies and interest rates, and in the price of aluminium and carbon scrap. Having identified their major risk exposures, they next looked at a host of hedging instruments. While deciding upon the he hedging instruments, the two major criteria were – the instrument must trade in a highly liquid market; and secondly there must be a strong correlation between the price of the traded instrument and the price exposure being hedged. Moreover, the associated costs and risks were also considered.

In implementing the risk management policies, they decided upon an active risk management strategy, wherein only a fraction of exposures will be hedged, and this percentage will be subject to a continuous review. Besides, they decided to hedge only significant exposures, essentially nickel and natural gas. But have their policies helped them? Most definitely, yes. Between December 1992 and August 1994, there was a 33 percent rise in the price of nickel. By buying nickel futures on the LME and hedging almost 50 percent of their exposure, the company was able to hold the increase in the overall cost of 19 percent.

But at Union Carbide, risk management is nothing new. The risk management part of the Treasurer's Group works with business management to identify physical and financial risks, to assess its potential impact on the business, and to determine what needs to be done to control these risks.

In the past, Union Carbide was highly leveraged with a debt figure as high as $3 billion. The annual interest expense over that period stood at about $270 million. These numbers are slightly misleading since they are involved in quite a few joint ventures; and in all their joint ventures, they have significant amount of debt. Thus, the interest cost they manage is more than what they actually should. But then, how did they go about managing their interest rate risk?

Since some of their businesses are commodity businesses, which essentially have no interest rate exposure, or perhaps a slight negative exposure to increase in rates, they should be funded with short-term, or floating rate money. But they have also other businesses which are adversely affected by inflation and high interest rates. Therefore, the management decided to take a weighted average of the interest rate exposures of all their different businesses, and arrived at a targeted duration of four years. However, there is no rigidity attached to it. depending upon whether interest rates are going up or down, the duration of the debt can be altered. The hedging instrument mostly commonly used are swaps. They are used to manage the duration of the debt, to adjust fixed vs. floating mix of debt and to control interest costs.

Model Question Paper 2

Suggested Answers
Paper I

Part A: Basic Concepts

1. *(a)* This method aims at matching the gaps in the maturities of the assets and liabilities to avoid liquidity risk in future. By matching the maturity, one can quantify the amount of risk quite accurately. This method is considered as traditional method for quantifying the risk.

2. *(e)* While investing in bonds, an investor is exposed to all the risks given in the question.

3. *(d)* Interest rate risk arises when the income of a company is sensitive to the interest rate fluctuations. Failure on the part of the counterparty in performing the repayment obligation on due date gives rise to credit risk. Liquidity risk refers to the risk of a possible bankruptcy arising due to the inability of the firm to meet its financial obligations. Currency risk refers to the exposure of the firm to adverse movements in the exchange rates.

4. *(e)* Marketability risk is the risk of the assets of a firm not being readily marketable. Market risk is the risk of the value of a firm's investments going down as a result of market movements. Liquidity risk refers to the risk of a possible bankruptcy arising due to the inability of the firm to meet its financial obligations. Systematic risk is the risk, which cannot be overcome by the corporates.

5. *(e)* Risks arising out of foreign exchange exposures are secondary risks as they arise out of the business activities but are not integrally related to them and they are systematic risks as they are market related and not specifically related to the company.

6. *(d)* The risk management function involves a logical sequence of steps: Determining objectives, Identifying risks, Risk evaluation, Development of policy, Development of strategy, Implementation, and Review.

7. *(b)* In a derivative instrument, the initial investment is just the premium to be paid or the margin to be deposited, and it is never more than the value of the underlying asset.

8. *(c)* Anti-dumping duty is levied by the government of a country to protect the domestic industry from the onslaught of imports. It has no direct relation to the weather.

9. *(d)* In order to extend daily VaR to one, the figure should be multiplied by the square root of number of working days in a year.

10. *(c)* A strap consists of a long position in two calls and one put with the same strike price and expiration date.

11. *(a)* Under Bull spread, an option with a lower strike price is bought and an option with a higher strike price is sold.

12. *(c)* The time value is the highest when the strike price is equal to the spot price, as the opportunity is perceived as greater.

13. *(e)* A put and call option is an option that gives the holder the right to buy or sell the underlying asset.

14. *(c)* If a stock split occurs at x for y, for an exchange traded option, then the exercise price is reduced to x/y of the previous value and the number of shares covered by one contract is increased to y/x of its previous value.

15. *(a)* The portfolio manager can buy a put option in DM because after 6 months he requires to sell the DM.

16. *(b)* Lambda is the change in the option premium against a unit change in the price volatility of the underlying asset.

17. *(a)* A chooser option is an option where the investor has the opportunity to choose whether the option is a put or call at a certain point in time during the life of the option.

18. *(a)* The statement in (a) given in the question is the definition of range forward.

19. *(e)* All the statements mentioned are true for cross-currency swaps. Therefore, alternative (e) is true.

20. *(e)* A simple fixed for floating rate swap is known as a plain vanilla swap. Therefore, none of the given alternatives is correct.

21. *(d)* LIBOR + 0.5% – LIBOR + 4.0% = 4.5%.

22. *(c)* Statements (i) and (iii) are true, statement (ii) is false because exchange of principal is notional and statement (iv) is also false because foreign currency interest payments are not hedged.

23. *(d)* In a parallel currency loan, each party lends the same amount to the other party at the same rate of interest and maturity period, but with different currency of loan. Similarly, the economic purpose of a currency swap is to exchange the loans in different currencies. A swap is an exchange of currencies or interest payments and is not a loan.

24. *(c)* In most of the developed countries, the liquidity of the futures markets and the volumes is much higher than in the forward markets, because of organized dealings and the intermediation of the exchange authorities to bring in order and discipline.

25. *(b)* Since futures are exchange-traded products, they are more standardized than forwards. Hence their prices will be different from those of forwards.

26. *(a)* In futures market, scalpers are floor traders who perform the role of market makers.

27. *(c)* Two fixed-floating currency swaps are combined to form a fixed to fixed currency swap, which is known as circus swap. It can be created by combining a currency swap and an interest rate swap with floating rate or both having LIBOR pricing.

28. *(a)* Efficient markets are those in which the counterparties can meet each other and deal directly without the existence of intermediaries, so the cost of dealing is zero. Such markets are existing nowhere in the world.

29. *(a)* It means that the bank is willing to pay LIBOR and receive fixed rate to be determined in the given range of 85/95 basis points.

30. *(e)* If the holder of the option does not exercise the option, and if the call expires, then the option seller gains to the extent of the price of the option. The gain is a short-term gain.

Part B: Problems

1. a According to the Put-Call Parity theorem,

$C + X\, e^{-r(T-t)} = P + S$.

Therefore, $P = C + X\, e^{-r(T-t)} - S$

$$= 12 + 325 \times e^{-0.09 \times 0.25} - 315$$

$$= Rs.14.77$$

b. $\mu = e^{\sigma\sqrt{\Delta t}}$

$$= e^{\sqrt{0.30 \times \sqrt{2.52}}}$$

$$= 1.0606$$

$d = \dfrac{1}{\mu}$

$$= \dfrac{1}{1.0606} = 0.9429$$

$$P = \frac{e^{0.09 \times 0.0385} - 0.9429}{1.0606 - 0.9429}$$

$$= \frac{1.0035 - 0.9429}{1.0606 - 0.9429}$$

$$= 0.5149$$

$$E(S) = P \, S\mu + (1-P) \, Sd$$

$$= 0.5149 \times 315 \times 1.0606 + (1 - 0.5149) \times 315 \times 0.9429$$

$$= Rs.316.10$$

2. **Buying a Straddle:** This strategy involves buying a put option as well as a call option. The call option may be bought with a strike price of Rs.43.30 and the put option at Rs.43.70.

Buying a Straddle

Investment = –0.50 – 0.60 = –Rs.1.10, assuming that both the options are bought at Rs.43.50.

Spot rate	Long call at 43.50	Long put at 43.50	Total pay-off	Total profit
43.00	0	0.50	0.50	–0.60
43.10	0	0.40	0.40	–0.70
43.20	0	0.30	0.30	–0.80
43.30	0	0.20	0.20	–0.90
43.40	0	0.10	0.10	–1.00
43.50	0	0	0	–1.10
43.60	0.10	0	0.10	–1.00
43.70	0.20	0	0.20	–0.90
43.80	0.30	0	0.30	–0.80
43.90	0.40	0	0.40	–0.70
44.00	0.50	0	0.50	–0.60

3. The comparative advantages are:

A : Fixed rate $ at 5.50%

B : Fixed rate £ at 5.50%

C : Floating rate $ at LIBOR + 0.50%

The total advantage is: $(6.75 - 5.50) + (6.25 - 5.50) + (L + 0.25 - L - 0.50)$

$$= 1.25 + 0.75 - 0.25 = 1.75\%$$

If 1.75% is divided equally, each of the parties gets 0.5833%.

Swap between A and C

A borrows fixed rate $ at 5.50%, lends them to B at 5.50% and borrows floating rate $ from him at (LIBOR + 0.25 – 0.5833), that is, (LIBOR – 0.3333)%.

C borrows floating rate $ at LIBOR + 0.50, lends to A at LIBOR – 0.3333, and borrows fixed rate $ from A at 5.50%.

Swap between B and C

B borrows fixed rate £ at 5.50%, lends them to C at 5.50% and borrows fixed rate $ from him at 6.1667%. C borrows fixed rate to from B at 5.50%, lends him fixed rate $ at 6.1667%.

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4. The forward quotation in \$/¥ will be: 0.8177 cents per Yen.

Option	Strike rate (Cents/¥)	Premium (Hundredth of Cent per ¥)
Call (6-m)	0.8177	2.66
Call (6-m)	0.8333	1.79
Put (6-m)	0.7937	1.71
Put (6-m)	0.7843	1.37

Let the payable be \$6,250,000.

If a forward contract is taken, the outflow will be:

¥6,250,000 x $\dfrac{0.8177}{100}$ = \$51,106.25

a. If the call option is bought at ¥/\$ 122.30, the outflow on exercise will be \$51,106.25. The premium is ¥6,250,000 x 0.000266 = \$1662.50. Total outflow = \$52,768.75.

   Effective rate = ¥118.44/\$.

b. Premium paid = ¥6,250,000 x 0.000179 = \$1118.75

   Premium received = ¥6,250,000 x 0.000171 = \$1068.75

   Net premium paid = \$50.00

   Outflow if the put is exercised = 6,250,000 x $\dfrac{0.7937}{100}$ = \$49,606.25

   Net outflow = \$49,656.25

   Outflow if the call is exercised = 6,250,000 x $\dfrac{0.8333}{100}$ = \$52081.25

   Net outflow = \$52131.25

c. Premium received = 6,250,000 x 0.000137 = \$856.25

   Outflow if the put is exercised = 6,250,000 x $\dfrac{0.7843}{100}$ = \$49018.75

   Net outflow = \$48,162.50

5. The treasurer is planning to go long in sterling.

   ∴ He has to protect himself against a fall in interest rates. If he buys futures now and the interest rate decreases during the next 6 months, he can benefit by selling £ futures at a higher price.

   Notional loss due to a full in interest rates if no hedging is undertaken

   = $\dfrac{(2,000,000)(0.11 - 0.08)}{2}$ = £ 30,000.

   To hedge interest rate risk, the treasurer will buy sterling futures.

   If interest rates fall by 1%.

   Change in value/contract = $\left(\dfrac{0.01}{2}\right)$ (500,000) = 2,500.

   So by trading in 4 futures, the gain, (91.83 – 88.77) (4)(2,500) = £30,600.

   This gain is more than the notional loss incurred when it is left unhedged.

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Part C: Applied Theory

1. The tools may be described as under:

   i. **Avoidance**

   The concept of risk is relevant if one is holding an asset/liability which is exposed to risk. Avoidance refers to not holding such an asset/liability as a means of avoiding the risk. Exchange Risk (Transaction/Translation) can be avoided by not holding liabilities/assets denominated in foreign currencies. Business risk is avoided by not doing the business itself. This method can be adopted more as an exception than as a rule since any business activity necessitates holding of assets and liabilities.

   ii. **Loss Control**

   Loss control measures are used in respect of risks which cannot be avoided. These risks might have been assumed either voluntarily or because they could be avoided. The objective of these measures is either to prevent a loss or to reduce the probability of loss. Insurance, for example, is a loss control measure. Introduction to systems and procedures, internal or external audit help in controlling the losses. Raising funds through floating rate interest bearing instruments reduces the losses due to interest rate risk.

   iii. **Separation**

   The scope for loss by concentrating an asset at a single location can be reduced by distributing it to different locations. Assets which are needed for routine consumption such as inventory, stationary can be placed at multiple locations so that the loss, in case of any accident, can be minimized. However, this does increase simultaneously the number of risk centers.

   iv. **Combination**

   This reflects the old adage of not putting all the eggs in one basket. The risk of default is less when financial assets are distributed over a number of issuers instead of locking in the same with a single issuer. It pays to have multiple suppliers of raw material instead of relying on a sole supplier. A well diversified company has a lower risk of experiencing a recession.

   v. **Transfer**

   Risk reduction can be achieved by transfer. The transfer can be of three types. The risk can be transferred by transferring the asset/liability itself. The risk emanating by holding a property or a foreign currency security can be eliminated by transferring it to another. The second type of transfer involves transferring the risk without transferring the asset/liability. The exchange risk involved in holding a foreign currency asset/liability can be transferred to another by entering into a currency swap. Similarly, the interest rate risk can be transferred by entering into an interest rate swap. The third type of transfer involves making a third party pay for the losses without actually transferring the risk. An insurance policy for vehicles covering third party risk is an example of this. When a credit card issuing agency takes a policy to cover the losses incurred on account of misuse of lost cards it is in effect finding someone to finance the losses while it still has the obligation to pay to the Merchant Establishment.

2. A bond swap occurs whenever an investor sells a bond and buys another. Bond swaps may be initiated for many reasons, and there are numerous types of bond swaps. For example, investors may decide to swap bonds in order to increase the current yield, quality or liquidity of their portfolio. Alternatively, they may believe that the existing yields to maturity for two securities are out of line and may thus engage in a yield-spread swap in anticipation of realignment between the two bonds yield. Still other reasons for swapping bonds are tax considerations and expectations regarding future interest rate levels. Because the motives for swaps vary, the potential return and risks from swaps will also differ.

Whatever the kind of bond swapping, the portfolio manager always believes that an overpriced bond is being exchanged for an underpriced bond. Some swaps are based on the belief that the market will correct for its mispricing in a short period of time whereas other types of swaps are based on a belief that corrections either will never take place or will take place over a long period of time.

All the swaps can be divided into:

i.   Risk-Neutral Swaps

ii.   Risk-Altering Swaps.

A risk-neutral swap is expected to increase the total return, as measured by the promised yield to maturity, but one that should not be affected by a general move in interest rates or one that does not significantly affect the price risk, credit risk, or call risk of the portfolio. A substitution swap is a type of risk-neutral swap.

Both types of swaps increase the return on the total portfolio by increasing the YTM (Risk Neutral Swaps) or by reducing (altering) the market risk of the portfolio and/or the credit or call risk (Risk-altering swaps).

Paper II

Part D: Case Study

1. **i.** **Unhedged Position:**

Expected inflow

= (70.00 x 0.20) + (70.50 x 0.25) + (71.00 x 0.25) + (71.50 x 0.25) + (72.00 x .05)

= Rs.70.85/£

ii. **Hedging with Forwards:**

Inflow = Rs.70.00/£

iii. **Hedging with Futures:**

We can assume that the price of 6-m futures at the end of months is equal to the spot rate then, as the price of the futures 6 months hence is not given. If we assume that the spot rate after 6-m is Rs.69.50/£ and as the company has sold futures at Rs.69.75/£, its profit will be Rs.69.75 – 69.50 = Rs.0.25/£ and the effective inflow will be Rs.69.75/£

iv. **Hedging with Options:**

Strike Price	Premium (in Rs.)	Inflow per £
72.00	2.00	70.00
71.50	1.80	69.70
71.00	1.50	69.50
70.50	1.20	69.30
70.00	1.00	69.00

The option with a strike price of Rs.72.00/£ gives the highest minimum inflow, the company should go for it.

2. **i.** **Unhedged position**

Actual inflow = Rs.71.30/£

ii. **Hedging with Forwards**

Inflow = Rs.70.00/£

iii. **Hedging with Futures**

Actual effective inflow = Rs.69.75/£

iv. **Hedging with Options:**

Strike Price	Whether to Exercise	Inflow	Premium (in Rs.)	Effective Inflow
72.00	Yes	72.00	2.00	70.00
71.50	Yes	71.50	1.80	69.70
71.00	No	71.30	1.50	69.80
70.50	No	71.30	1.20	70.10
70.00	No	71.30	1.00	70.30

3.   i.   **Unhedged Position:**

As the position was unhedged, there is no exposure arising to the company.

ii.   **Hedging with Forwards:**

As the company had sold forward, it will have to cancel the forward contract. It has agreed to sell £ at Rs.70.00/£ on a 6-m forward basis. The contract will be canceled by the bank by selling back to the customer at 3-m forward rate.

	Rs.
£ bought from the company under original contract	70.00
£ sold to the company under cancellation	70.25
Net amount payable by the company on cancellation	0.25

iii.   **Hedging with Futures:**

The company can hedge its position by buying 3m futures contracts at Rs. 70.00. It has sold futures at Rs.69.75/£, so the net loss will be Rs.70.00 – Rs. 69.75 = Rs. 0.25/£.

iv.   **Hedging with Options:**

The company can hedge its position by selling put options of the same exercise price has it has bought.

Option Bought Price	Option Sold Price	Premium on Purchase	Premium on Sale	Maximum Loss
72.00	72.00	2.00	1.20	0.80
71.50	71.50	1.80	1.00	0.80
71.00	71.00	1.50	0.75	0.75
70.50	70.50	1.20	0.60	0.60
70.00	70.00	1.00	0.45	0.55

4.   **Initial Margin:** This is just an initial amount that a trader must deposit before trading in any futures contract. In some of the contracts, this margin will be equal to 5% approximately. The initial margin is returned to the party after due completion of all obligations associated with trader's futures position. If a party deposits a security as the margin, then the party earns the interest that accrues to the asset while keeping it as security for margin requirements.

Maintenance Margin: The maintenance margin is generally 75% of initial margin. This margin is strictly maintained so as to ensure that the balance in the margin account will never become negative or zero. The investor can withdraw any amount in excess of the initial margin. When the balance in marginal account falls below the maintenance margin, investor will get a 'margin call' and he is supposed to replenish the margin, bringing the balance back to the initial level.

Variation Margin: The additional or extra funds to be deposited by the trader is referred to as 'variation margin'. If the investor fails to deposit variation margin, the broker closes out the position by selling the contract.

5.   **Interest Rate Risks:** Interest rate risks arise mostly on fixed rate legs of swaps. While the floating rate interest can be periodically adjusted to the prevailing interest rates, the fixed rate remains constant, a change in the level of interest rates in the market not accompanied by a change in the yield of debt instruments of the same time period as the interest rates, will entail interest rate losses to the bank. Unless the swap bank is fully hedged, losses will be incurred.

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Currency Exchange Risks: Currency exchange risks happen when there is an exchange rate commitment given to one party and there is a steep change in the exchange rate between the currencies in the swap. If the swap bank is not able to match the counterparty well in time, it will incur losses due to the exchange rate difference.

Market Risks: Market risks occur when there is difficulty in finding a counterparty to a swap. Usually, longer maturity swaps have less takers and vice versa. Lower the number of takers, higher the risk of losses.

Credit Risks: Credit risks are those risks which the swap bank has to bear in case the counterparty to a swap defaults on payment due to bankruptcy or any other defaults, legal or otherwise. The bank continues to be obliged to pay the other party of the swap, irrespective of the fact whether the former party defaulted or not. Market risks and credit risks together amount to default risks of the bank.

Mismatch Risks: Mismatch risks take place when the swap bank comes across mismatches in the requirements of both counterparties to the swap. Usually, banks have a pool of swaps and have no difficulty in finding matches, but if no party is found, the risk of mismatch losses is there. This risk is further aggravated in case one of the parties defaults.

Basis Risks: Basis risks take place mostly in floating-to-floating rate swaps, when both the sides are pegged to two different indices and both the indices are fluctuating and there is no proper correlation between both.

Spread Risks: Spread risks happen when the spread changes over the time period the parties are matched. The spread risk is not the same as interest rate risk, as spreads may change as a result of change in basis points, while the interest rate may still remain constant.

Settlement Risks: Settlement risks take place when the payments of currency swaps are made at different times of the day mainly because of different settlement hours in capital markets of two countries involved in the currency swap. If a limit on the size of the settlement is placed for each day, this risk is minimized.

Sovereign Risks: Sovereign risks are those risks that can take place if a country changes its rules regarding currency deals. It mostly happens in the underdeveloped or developing countries which tend to have more political instability than the developed world.

Part E: Caselets

Caselet 1

1. While proper use of Delta, Gamma, Theta, Rho and Vega can bring in neutrality of risk in the portfolio, it is not practically possible to balance one's portfolio every now and then due to the time and cost involvements. It is better to keep analyzing the extent of risks rather than trying to eliminate them totally. When the risk becomes unacceptable (based on a predetermined level), an appropriate change in the underlying asset or its derivatives can be made.

In addition, one can resort to scenario analysis, under which, the profitability of one's portfolio can be measured under different levels (scenarios).

Scenario analysis can be done with the help of the following:

i. **Monte-Carlo Simulation:** With Monte-Carlo Simulation various probabilities of outcome can be generated for the future. The scenario can be picturized for possibility of losses based on the simulations of Monte-Carlo.

ii. **Testing Stress:** Testing stress involves the analysis of the portfolio based on past bad experiences or worst possible cases/situations.

iii. **Value at Risk:** With Value at Risk, the confidence level is set which implies that values above the prescribed confidence level entail profits or losses and the same is analyzed.

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2. Monte Carlo also expresses returns as a histogram of hypothetical values. The hypothetical returns are generated by simulations that involve using data of past market prices or rates to execute a large number of computer runs that simulate alternative price behavior patterns. The result is a random distribution of market prices or rates, on which a cut-off point is to be taken which should be assumed as the confidence level. The difference (shortfall) between the cut-off point and the current value of the portfolio is the VaR.

In other words, the projections generated by the Monte Carlo are used to create successive sets of possible future realizations of changes in the rates. The portfolio is revalued for each set of changes. When completed, a set of portfolio revaluations corresponding to the set of possible realizations of rates is available and the 99th percentile is taken as the VaR.

Usually, a minimum of 500 simulations are required for the Monte Carlo method. The number, of course, depends on the size and complexity of the portfolio.

Caselet 2

1. The first is the question of liquidity risk. Many of the risk management models assume that positions can be closed at a low cost, when risk is perceived, and that rebalancing of portfolios can be done dynamically. The sudden drying up of liquidity in international markets, created problems for implementing these risk management strategies. The second issue is regarding the validity of assumptions behind risk management models. Most of the sophisticated models require assumptions about market volatility, correlations, and probability of risky events. These assumptions are made on the basis of historical data, and can therefore, make the model useless during periods of structural shifts and sudden out-of-the-sample risks. The third issue is the increasing synchronization of risk management strategies across investors. Sophisticated techniques like portfolio insurance and dynamic hedging are deployed by most international investors. This has resulted in accentuating risks as many portfolios simultaneously rebalance in a similar manner. The fourth issue is the convergence of a variety of risks such as credit risk, market risk and liquidity risk, during periods of heightened volatility, leading to blurring of market segments and the impact of one kind of risk on the other. The fifth is the issue of incentives in the organizations, where fund managers and traders may have a higher incentive to maximize their bonus and short-term gains at the cost of the firm's long-term risk exposure and profits.

2. Stress testing can be defined as a one time risk measure which is used complementarily with VaR to analyze market risk. Risk is assumed to be stable under statistical measurement, due to the assumption of stability of the market. The assumption of VaR that variables will continue to behave according to the volatility changes in the past may not prove true in case of extreme movements. With the help of stress testing, these unexpected movements can be measured.

3. When there is a counterparty failure in performing the repayment obligation on due date, it gives rise to low quality assets which in turn leads to credit risk. Like the interest rate risk and the liquidity risk, credit risk is also an inherenet feature of any firm that is into the business of lending funds either to individuals or to corporates.

Effective management of credit risk involves the following key principles:

- Evaluation

- Pricing

- Monitoring.

By evaluating and sanctioning the proposal and appropriately pricing it, the credit risk management policy has indeed performed only half his job. While the measurement of the various ratios and other financial analyses is done with great accuracy, their interpretation is mostly not done. There has to be experience to scrutinize all the credit information and interpret the same. However, good the analyses may have been, the bank will be in no position to distinguish a good borrower from a bad borrower, who has no intention of repaying the loan. Despite all the caution, bad loans do creep into the banks. Thus,

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valuation and pricing decisions should be followed up with periodic review of the account and the credit rating of the borrower. Any fall in the rating will increase the credit risk. Credit risks persist from the time the loan is granted throughout its life period and continuous review during this period will help in the early detection of the problem loans.

Caselet 3

1. London Metal Exchange (LME) is the most popular and organized exchange for trading metals. A unique feature of LME is that delivery of metals are on specific settlement dates, instead of specific months.

    The metals traded on LME are at specific price, with a contract size (such as 25 ton for Aluminum, 6 ton for Nickel, etc.), minimum price fluctuation (50 pence per ton for copper, $1 per ton for Zinc, etc.) and quality (such as primary aluminum of minimum 99.7% purity with maximum permissible iron content 0.2% and maximum permissible silicon content 0.11%).

    LME mostly trades on precious metals such as Gold, Silver, Platinum, Palladium, etc., and industrial metals like Aluminum, Copper, Zinc, Lead, Nickel, Tin, etc.

    The LME contracts are traded on specific months as well as on specific dates of contracts. Most of the contracts are on cash date or three months date. Under cash date, the delivery is to be made in three days and in the case of three months date, the delivery is to be made three months after the current date.

    LME only accepts the delivery of metals of LME acceptable grades. Warehouse warrants have been set-up by the exchange and the delivery depends on them. A variance of 2% above or below is permitted for the weight to be delivered on the round tonnage.

2. A bank or a financial institution may have fixed rate assets and floating rate liabilities. For instance, a bank has given loans at a fixed rate of interest for a long-term, but has to pay its depositors periodical interest based on the T-Bill rate or any other benchmark rate. The bank is exposed to interest rate risk because of this non-matching of assets and liabilities. The bank can offset this risk by entering into a fixed to floating rate swap thereby converting the fixed rate asset into a floating rate asset.

3. One means of reducing this risk is through the commodity futures exchange markets.

    Hedging in the futures market involves a two step process. Depending upon the hedger's cash market position, he will either buy or sell futures initially. For example, a firm which owns or plans to purchase or produce a cash commodity will sell futures to hedge this cash position. A long hedge involves a firm purchasing futures to protect itself against a price increase in a commodity prior to purchasing it in either the spot or forward market.

    In the second stage, once the cash market transaction materializes, the futures position is no longer required and hence the hedger will close his futures position, i.e. if he has gone long on a contract, he will sell it.

    Alternatively, if he has initially sold a futures contract, he will buy one. It should be noted that both the opening and closing positions must be for the same commodity, same number of contracts and delivery month.

Model Question Paper 3

Time: 6 Hours   **Total Points: 200**

Paper I

Time: 3 Hours   **Points: 100**

Part A: Basic Concepts (30 Points)

Answer all the questions. Each question carries one point.

1. Which of the following is not considered to be a factor that gives rise to a non-diversifiable risk?

   a. Changes in tax rates.

   b. Entry of new competitors in the market.

   c. Industrial recession.

   d. War and other calamities.

   e. All the above factors rise to a non-diversifiable risk.

2. The risk of the whole market 'Beta' is measured by

   a. 1

   b. 0

   c. – 1

   d. Greater than 1

   e. None of the above.

3. Downside risk on any investment in terms of return would be to receive

   a. The most likely return associated with that investment

   b. An amount equal to the investment

   c. A negative 100% return

   d. An amount equal to the best possible outcome

   e. None of the above.

4. If the outcome of an event leads to loss with no possibility of gain it is called

   a. Pure risk

   b. Speculative risk

   c. Acceptable risk

   d. Dynamic risk

   e. None of the above.

5. According to Traditional Financial Theory

   a. Systematic risk can be diversified away

   b. Presence of unsystematic risk increases cost of capital of a firm

   c. Market does not compensate for bearing unsystematic risk

   d. Unsystematic risk cannot be diversified away

   e. None of the above.

6. By selling commodity futures for its finance product, a firm can

   a. Lock-in its costs

   b. Lock-in its revenues

   c. Reduce its losses

   d. Increase its gains

   e. None of the above.

7. When is a qualified derivative considered as a partial or total hedge?

    a. When there are changes in the fair value of a recognized asset or liability.

    b. When there is a change in the fair value of an unrecognized firm commitment.

    c. When there is no foreign currency exposure of a foreign currency denominated forecasted currency.

    d. When there are no variable cash flows of a forecasted transaction.

    e. Both (a) and (b) above.

8. If a days average temperature is 50^0F, then the Heating Degree Days (HDD) index is

    a. – 15 degrees

    b. 0 degrees

    c. 15 degrees

    d. 80 degrees

    e. None of the above.

9. Which of the following techniques measure VaR as a multiple of standard deviation depending on the required level of confidence?

    a. Historical pattern of observations.

    b. Monte Carlo simulations.

    c. Variance/Covariance models.

    d. Hybrid method.

    e. None of the above.

10. Immunization of portfolio changes in the price of the underlying asset in the next small interval of time is known as

    a. Hedging

    b. Gamma hedging

    c. Delta hedging

    d. Optimal hedging

    e. None of the above.

11. Which of the following parameters of option sensitivities is/are always negative? (Assume the option is a call.)

    i.   Delta

    ii. Rho

    iii. Theta

    iv. Vega or lambda.

    a. Only (i) above.

    b. Only (iii) above.

    c. Both (i) and (ii) above.

    d. Both (i) and (iii) above.

    e. Both (ii) and (iv) above.

12. A multiple put option on the interest rates is called

    a. Floor

    b. Corridor

    c. Collar

    d. Cap

    e. None of the above.

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13. Suppose the put price is 5.67 and the rho of the put option is –12.18. Find the put price when the interest rate reduced by 100 basis points

    a. 5.79
    b. 5.97
    c. 6.27
    d. 6.72
    e. 6.81.

14. Which of the following options will have a low gamma value?

    i. Deep-in-the money call and put.
    ii. Deep-out-of-the money call and put.
    iii. In-the-money call.
    iv. Out-of-the-money put.
    a. Both (i) and (iii) above.
    b. Only (ii) above.
    c. Both (i) and (iv) above.
    d. Both (ii) and (iv) above.
    e. Only (i), (iii) and (iv) above.

15. A call on a given stock, with a zero exercise price and an infinite time to expiration, must have a value

    a. > stock price
    b. ≥ stock price
    c. = stock price
    d. < stock price
    e. ≤ stock price.

16. A bullish put spread consists of

    a. Selling put with higher strike price and buying put with lower strike price
    b. Buying and selling put of near month maturity and distant month maturity respectively
    c. Writing a call option and buy a put option with identical strike prices
    d. Write a put option and buy a call option with identical strike prices
    e. None of the above.

17. Buying a farther call and selling a near call is an example of

    a. Vertical bull spread
    b. Vertical bear spread
    c. Horizontal bull spread
    d. Horizontal bear spread
    e. Bullish butterfly spread.

18. A call option can be viewed as a combination of

    a. A long position in a stock + Some lending at the risk-free rate
    b. A long position in a stock + Some borrowing at the risk-free rate
    c. A short position in a stock + Some borrowing at the risk-free rate
    d. A short position in a stock + Some lending at the risk-free rate
    e. A short position in a stock + Equivalent borrowing at the risk-free rate.

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19. A standard fixed-floating interest rate swap is known as

   a. Plain vanilla swap

   b. Generic swap

   c. Coupon swap

   d. Either (a) or (b) above

   e. Either (a) or (b) or (c) above.

20. As a currency swap does not create foreign currency denominated receivables or payables, these derivatives help us in avoiding _____ risk.

   a. Translation

   b. Transaction

   c. Economic

   d. Both (a) and (b) above

   e. All of the above.

21. The risk to a swap bank from failing to precisely match the provisions of the various swaps in the swap book is called

   a. Transaction risk

   b. Translation risk

   c. Default risk

   d. Mismatch risk

   e. None of the above.

22. A type of swap in which the payments are calculated in a way similar to the structure of mortgage repayment is

   a. Forward swap

   b. Deferred swap

   c. Amortizing swap

   d. Basis swap

   e. Zero-coupon swap.

23. In a swap contract, the ability to reduce the cost of borrowing between the parties involved in the swap transaction depends on the

   a. Credit rating of both parties

   b. Quality spread between both parties

   c. Interest rate prevailing in the market

   d. Both (a) and (b) above

   e. All of (a), (b) and (c) above.

24. In futures market, 90% of contracts are settled through

   a. Cash

   b. Offsetting

   c. Physical delivery

   d. Rolling over to next contract month

   e. None of the above.

25. _____ is an order to buy or sell when the price reaches a specified level.

   a. Market order

   b. Market-if-touched order

   c. Time order

   d. Limit order

   e. Stop-loss order.

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26. Forward rates are used as predictor of future spot rates because
    a. They are costless
    b. They are unbiased predictors of future spot rates
    c. They are always and easily available
    d. All of the above
    e. Both (a) and (c) above.

27. In an efficient market, the expected cost of the forward contract must be
    a. = 0
    b. > 0
    c. ≥ 0
    d. < 0
    e. ≤ 0.

28. Which of the following is/are true?
    a. The owner of a call option benefits from price increases in the underlying asset.
    b. The owner of a put option benefits from price increases.
    c. Value of put option decreases when volatility in price increases
    d. The owner of a put option has limited downside risk when price decreases.
    e. Both (a) and (c) above.

29. Which of the following statements relate to open cover?
    a. It describes the cargo, voyage and cover in general terms.
    b. It takes automatically all shipments that fall within its scope.
    c. It is usually for a period of 12 months and is renewable.
    d. There is a limit to the total number or value of shipments that can be declared under the open cover.
    e. Only (a), (b) and (c) above.

30. Which of the following statement/s is/are "false" in case of critical risks for a firm?
    a. Critical risks are those which do not result in bankruptcy of the firm.
    b. Critical risks are those which result in losses which the firm may easily bear.
    c. Critical risks are those which result in financial distress.
    d. Critical risks are those which result in both bankruptcy and financial distress.
    e. Both (a) and (b) above.

Part B: Problems (50 Points)

Solve all the problems. Points are indicated against each problem.

1. You are working in a bank which is active in maintaining a swap book. You have the following information regarding three of your clients who have indicated the requirements. You would like to ensure that you are left with a spread of at least 15 basis points in each of the deal you take up.

	Funtime Ltd.	Buziness Ltd.	Noview Ltd.
Objective	Fixed Pound	Floating Pound	Floating US $
Fixed US $	6.25%	6.00%	6.75%
Floating US $	Libor + 0.75	Libor + 0.25	Libor + 1.00%
Fixed Pound	8.25%	8.00%	8.90%
Floating Pound	Libor + 0.55	Libor + 0.60	Libor + 0.75%

Examine the feasibility of arranging a swap and show how a swap can be arranged, if feasible.

(12 points)

2. What is the price of a 3-month European put option on a non-divided paying stock when the stock price is Rs.52, the strike price is Rs.50, risk-free interest rate is 12% per annum and the volatility is 30% per annum?

(8 points)

3. Consider the following data relating to an interest rate swap:

Remaining term to maturity	4 yr. 3-m
Fixed rate payment	9%
Floating rate payment	LIBOR
LIBOR applicable for the current half-year	8.5%
Current 3-m LIBOR	7.5%
Current market quote for 4 yr. swap	4 yr. Treasury bill + 30/45
Current 4 yr. Treasury rate	8.25%

Find the value of the swap.

(10 points)

4. The following yields currently exists for the bonds given below:

Bonds	Yield-to-maturity (%)
Long-term GOI bonds	12.5
Long-term AAA Corporate bonds	13.5
Long-term BBB Corporate bonds	14.5

Assume the following to be normal yield spreads:

a. Long-term AAA bonds – Long-term GOI bonds = 150 basis points.

b. Long-term BBB bonds – Long-term AAA bonds = 50 basis points.

Required:

What should be done to profit from this abnormal scenario?

(10 points)

5. A wheat farmer in order to protect himself from price fluctuations sells 15 futures contracts of 5000 bushels each at the rate of Rs.9.00 per bushel. At the time of harvest which is five months from now, the basis is –0.15 and the price of wheat per bushel is Rs.9.50. Did the farmer gain or lose and by how much amount?

(10 points)

Part C: Applied Theory (20 Points)

Answer the following questions. Points are indicated against each question.

1. Since the futures trading in commodities is made online, the automation and online trading of stocks has resulted in expansion of markets, high volumes and increased business. As stock markets play an important role in the economy, what is the role of the futures market?

(10 points)

2. "Managing risks is becoming riskier. With the markets in perpetual motion, the costs of transmitting funds savings to investment have become uncertain. As the South East-Asian meltdown demonstrated, the insulation of past will not protect bottomlines in future. The interest rate volatility and exchange rate volatility may now be experience more frequently than ever." In this context explain briefly the natural and synthetic hedges available for a financial manager.

(10 points)

Paper II

Time: 3 Hours   **Points: 100**

Part D: Case Study (50 Points)

Read the case carefully and answer the following questions.

1. Advise the finance manager how he should hedge his position with the following choices:

    i.   Long futures contract

    ii. Long call option strategy

    iii. Long bull call spread.

    (15 points)

2. Explain the meaning of a bull call spread option.

    (11 points)

3. Discuss briefly the risks of writing options.

    (12 points)

4. Briefly elaborate on the activities of the OCC?

    (12 points)

Superb Petrol Ltd. is a wholesale distributor of petrol and diesel. Its annual turnover is more than Rs.85 crore. It undertakes fixed contracts from transport companies and supplies the required quantity of petrol and diesel as per the requirements for the entire season.

Given the fact that petrol and diesel storage involves huge investments in storage space and construction and maintenance of tanks, most of the transport companies opt to book their minimum expected requirements with Superb and take the delivery for the day or week by simply making a telephone call. Payments are to be made as per the delivery on 15 days credit terms.

On the other side, Superb Petrol Ltd. also does not store huge quantities of fuel, due to space constraints. The ordering department calculates the requirements for the week in advance and places an order with Indian Oil for the same. Superb is supposed to pay on delivery, while extending 15 days credit to its customers.

On 25th January 20x1, Superb receives an order from Aurngabad Rayons Ltd., a large manufacturing company that requires 10 lakh liters of diesel to be supplied on May 15, 20x1. The price of diesel is Rs.12/liter and Superb's commission is Rs.0.50/liter.

Superb's finance manager, a CFA, points out that the prices of diesel are expected to go up from April 20x1 and the price to Aurangabad should be quoted as such. After negotiation, Aurangabad settles for a price of Rs.12.50/liter. Still, the finance manager fears that if the price rise is steep and touches Rs.13/liter as per the market rumors, the deal will end up in a loss.

Diesel futures are presently available at a price which is Rs.11.50, resulting in a basis of 50 cents over the selling price. Each futures contract for petrol products in the BSE covers 1,000 liters. Call options of May 20x1 are available in a range with strike prices between R.11.00 and Rs.14.00, at a premium of Rs.0.25, while call options of June 20x2 are available with strike prices between Rs.11.00 and Rs.14.00, at a premium of Rs.0.10.

Part E: Caselets (50 Points)

Caselet 1

Read the caselet carefully and answer the following questions.

1. Describe the concepts of comparative advantage and absolute advantage.

    (8 points)

2. Explain the terms 'call swaption' and 'put swaption'.

    (9 points)

Rupee derivatives – interest rate swaps and forward rate agreements – are now an integral part of the domestic money and debt markets. However, to begin with, these products can be offered as plain vanilla products only. One of the salient features of generic or plain vanilla swap is that the first leg remains fixed throughout the life of the swap deal but the second leg floats with the chosen reference rate.

A benchmark rate, therefore, plays an important role in the growth and development of the interest rate swap market. The Reserve Bank of India has permitted counterparties to use any domestic interest rate as the benchmark, provided it is market determined, transparent and mutually acceptable. The Mumbai interbank offered rate being compiled by Reuters and the National Stock Exchange has been used as a benchmark in all the interest rate swap deals reported so far.

The initial enthusiasm over swaps shown by corporates, banks and financial institutions seems to have waned. Not many deals have been reported for long. Market participants now realize that one can strike a couple of deals for the sake of publicity, but one cannot have a sustainable interest rate swap market based on a single benchmark, that too when it is as short as an overnight call money rate. Such a benchmark can throw up a few deals based purely on the underlying exposure, but it cannot facilitate growth of a natural interest rate swap market.

And one cannot have interest rate swap deals for longer maturities, of up to seven years, linked to the shortest money market rate. Who will dare to pay or receive a fixed rate for, say, five years and receive or pay in return the overnight Mibor? In fact, a large number of interest rate swaps were for maturities below one year, merely a handful for one year, none for over one year.

To flourish, this market really need's a floating rate benchmark based on term money rates that are reliable and market determined. Such term money market benchmarks will also facilitate growth of the interest rate swap market for standard maturities. Many debt issues in the recent past were linked 91- and 364-day treasury bills, the bank rate and the yield curve on gilts. However, not enough repeat deals took place because of the inherent problems with these benchmarks: cut-off yields being below secondary market yields, lack of transparency, benchmark prone to regulatory risks, and market yields not being directly linked to benchmark.

Ideally, a benchmark rate should evolve from an interbank term money market; that is where money is lent and borrowed for maturities up to 12 months. Unfortunately, this market has not yet developed although it is recognized that its existence is critical for the survival of the rupee derivatives market. Hopefully, a natural term money market will emerge soon with asset-liability management becoming mandatory from the beginning of this financial year.

Banks are required to compile statements of liquidity and interest rate sensitivity on a quarterly basis. These statements will enable a bank treasurer to lend or borrow money for different maturities, including forward-forward, keeping in view the gaps. This may take some time because banks are putting the guidelines in place. The interest rate swap market, however, cannot wait for the development of a natural term money market and immediate steps need to be taken. We need to fine a substitute.

The foreign exchange market offers one the form of a swap rate that is quoted for maturities up to 12 months. The rate is for swapping rupees and dollars for two deliveries, say, spot against one-month forward or three-month forward to six-month forward. This is the rate paid or received by banks. For example, a spot one-month swap rate of 5 percent per annum means that rupees can be exchanged for dollars for one month (starting on the spot date) by receiving the swap rate of 5 percent. This rate is picked up by wire-services after polling different rates put out by banks and brokers.

Caselet 2

Read the caselet carefully and answer the following questions.

1. Explain how options are a better trade-off than the old carry forward system of the Indian stock markets.

(9 points)

2. Briefly evaluate the main option trading strategies.

(8 points)

The Indian capital markets have come a long way. They have witnessed phenomenal growth in the post-liberalization era, although lack of liquidity and inefficient settlement and delivery procedures continue to impede their progress. Nevertheless, the capital markets have exhibited sufficient inherent strength, and overcoming these obstacles will be only a matter of time and effort.

One such effort to improve the depth of the market and the range of hedging instruments available is the active consideration for the introduction of an options market. An option is akin to an insurance policy. Just as an insurance policy protects the buyer against an unforeseen event, an option protects the buyer against any unexpected rise or fall of the price of a stock. Both, therefore, involve payment of a premium as a cost of such protection. Despite this cost in using options as a heading tool as well as an investment strategy, there is an advantage in that the risk is restricted to the premium paid, and the potential gains can be unlimited.

When options replace the existing carry forward system, it will ensure enlightened speculation with certain level of maturity. Towards this direction, the National Stock Exchange has plans to introduce index-based options initially and introduce options for individual stocks subsequently. Although the introduction of an option market will increase the market size and bring in new players with different profiles, the focus here is restricted to the dynamics of an option-based hedging and investment strategy for corporates.

Generally, corporates having investments in stocks will find put options useful as a protection against any sharp decline in the price of stocks. Those who do not have a stock portfolio as such may find a portfolio of call options on the stocks of their choice much less risky than owning the stocks. In fact, a company can buy a call option for a fraction of the price of the stock. In order to gain a clear insight, there is a need to take a closer look at the intricacies involved in the hedging and investment strategies using options.

Hedging Strategies using Options

Suppose a company perceives a bottom for a share which might have been severely oversold due to extreme negative sentiment not supported by fundamentals; whether there is further downslide or not, is not yet certain and there is a good case for a strong rally which the company does not want to miss. The company can buy the share and simultaneously buy an out-of-the-money put option with strike price just below the purchase price of the share. In case the share price continues to slide, the put option will limit the losses. If indeed the stock surges higher, the company will be able to reap profits, reduced by the cost of out-of-the-money put option which in any case would have been cheaper than at-the-money put option.

Assuming that stock prices have gone up and the investments have moved into profits, the focus shifts towards protecting the profits. If there has been a sustained rally in the stock markets now reaching exhaustion and vulnerable to a severe reversal, with the prices still heading higher, at-the-money puts will be the ideal hedging device. (Put options at this stage will continue to remain cheaper than call options since the sentiment is yet to shift to the downside.)

If the market continues to rise, there will be a chance to buy at-the-money puts again (which will involve doubling the investment) in order to secure better selling levels though the premium paid on the earlier option could be wasted. It may be possible to reap profits on both the puts, in case the markets decline sharply well in time before the expiry of both the options.

Once the market has indeed turned and sentiments have turned bearish, volatility and, therefore, the premium on put options will shoot up quickly making at-the-money put options very expensive. If the company has missed hedging opportunities earlier, then out-of-the-money put options could be a cheaper method at this stage and if the market declines substantially, the company will make up for what has been lost due to the lower strike price of the out-of-the-money option.

If the company holds stock as a policy only for short periods, the premium expenditure will obviously be lower in terms of cash outflows but effectively more expensive in the long run since long dated options are cheaper than short dated ones on an annualized basis. One way of obviating this problem is to explore in-the-money options where the buyer does not pay much for the time value though he parts with a higher premium since he buys an option already sitting on profits. In a situation (like borrowing in the ICD market) where the interest rates are very high, this alternative may not be cost-effective.

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Where a company has core long-term investments in stocks, hedging through options may involve higher costs and if the markets are in a limbo, the company may suffer premium erosion without any tangible benefit. Out-of-the-money put options which are much cheaper than at-the-money options can be an ideal solution to such situations. No doubt, an out-of-the-money option does deprive the buyer the full benefits of an anticipated move but he is more than compensated by the extent of decline which normally happens in a long-term reversal.

The key to successful option buying strategies is to pick low volatility situations and not buying after the volatility moves up as is often the case when the market starts a strong uptrend or a decline. There is a misconception even among professionals that options can be purchased at any point and their utility is the same at all times. If an option is purchased and the stock prices do not move at all or move in a different direction than anticipated, the premium paid will be a net loss. Therefore, it is important to form an opinion of the expected behavior of the stock price and also the volatility that is likely to accompany price movements.

A hedging strategy involving purchase of options should, therefore, take into account various considerations, such as

- How long the shares/call options are expected to be held?

- What is the market direction as well as the expected volatility of the price action?

- Whether the premium payable upfront can be sustained by the cash flows of the company?

- What type of option (at-the-money, out-of-the-money or in-the-money) is suitable in the present context?

Caselet 3

Read the caselet carefully and answer the following questions.

1. Explain how trading in derivatives for hedging may not benefit mutual funds as expected.

(8 points)

2. Explain the concept of Calendar Spread.

(8 points)

On December 8, 1999, the Securities and Exchange Board of India (SEBI) amended, *inter alia*, Regulation 45 of its Mutual Funds Regulations clearly stating, "the mutual funds shall enter into derivatives transactions in a recognized stock exchange for the purpose of hedging and portfolio balancing, in accordance with the guidelines issued by the Board". The guidelines issued by SEBI set out, among other things, that "the mutual funds shall be required to fully cover their positions in the derivatives market by holding underlying securities/cash or cash equivalents/options and/or obligation for acquiring underlying assets to honor the obligations contracted in the derivatives market" and further that "the offer document of a scheme envisaging derivatives trading shall state unambiguously and clearly the losses that may be suffered by the investors as a consequence of such investments".

Hedging underlying securities is by no means a simplistic proposition as is generally thought of. It is indeed a complex process, given the vagaries and volatility of the market. Selling in the derivatives market against the holdings of underlying securities in anticipation of a fall in prices will result in the not unlikely gains being lost, should the market register a rise instead of a fall as the gains in the cash segment would be counter-balanced by the losses in the derivatives market. Similarly, buying in the derivatives market against the cash flow in future, in anticipation of a rise in prices will lead to a situation wherein the likely gains being denied, should the market choose to fall instead of rise, as again the gains in the cash segment would be eroded by the losses in the derivatives market.

Having recourse to the derivatives market as a hedging mechanism should, therefore, be left to the judgment of fund managers and there should be no statutory compulsion for any mutual fund to enter into derivatives transactions against underlying securities or cash as the amended regulations of SEBI require.

It is also pertinent to note in this connection that hedging through the media of an index contract is an imperfect hedge. A perfect hedge would require the prices of a basket of shares held or proposed to be bought to move in unison with the stock index. As such a movement normally does not take place, the beta factor, measuring the variation between the prices of concerned shares and the stock index values, is worked out and purchase or sale of the number of futures contracts adjusted accordingly to provide for a perfect hedge.

This assumes that the beta factor of the past will continue to operate in the future too – an assumption which may not always prove to be correct. Besides, the investor's inability to buy or sell the required number of shares (when it is not an integer number), transaction costs and lack of absolute correlation between the spot and futures values of the index, margin deposits, price limits, etc. detract the futures contract from acting as a perfect hedge.

Hedging through options is a relatively costlier proposition because of the premium the purchaser of the call or the put has to pay. In the case of a call, the premium is higher for lower strike prices, while the premium is higher for higher strike prices in respect of a put. The premium amount would be detracting the instrument from acting as a perfect hedge.

Mutual funds regulations of SEBI also stipulate that "every mutual fund shall buy and sell securities on the basis of deliveries and shall in all case of purchases, take delivery of relative securities and in all cases of sales, deliver the securities and shall in no cases put itself in a position whereby it has to make short sale or carry forward transaction or engage in badla finance".

Prohibiting a mutual fund from effecting a short sale or a long purchase is an understandable proposition but not permitting a mutual fund to operate in the modified carry forward system by selling against an underlying security in anticipation of a rise in price goes against the principle of hedging which SEBI is now permitting mutual funds with regard to futures and options. It is not realized that badla is a more efficacious device as a hedge instrument than options and futures. The question of any lack of correlation between the futures and spot prices detracting the instrument from acting as a perfect hedge does not just exist, as the quotation in respect of all the three types of transactions, namely, for delivery, offsetting and carry forward, is one and the same. There is also no question of payment of any premium amount, as the market is equally balanced between the buyer and the seller.

Not permitting mutual funds to engage in badla finance is again not fair. Badla financing in the modified carry forward system, with all the built-in checks and balances – trade guarantee funds, investor protection funds, badla shares being kept either in demat form or in safe custody in the clearing house, etc. – coupled with strict monitoring and surveillance systems. SEBI and stock exchanges have evolved, is a very safe avenue of investment. By keeping away from badla financing, mutual funds, commercial banks and others are denying themselves a lucrative avenue of business, safe and sound. The involvement of these institutions in badla financing, cushioned as they are with large funds, will also help in sobering down the badla rates which in turn will help bolster buoyancy in the market.

The confusion between speculation and badla financing also needs to be cleared. While trading in modified carry forward system can be speculative in nature as it permits contracts to be settled not only by offsetting contracts but also to be carried forward from one settlement cycle to another, there is no speculation whatsoever in badla financing. One enters the badla market purely as a financing venture and needs to be so only if the returns are considered adequate and not otherwise.

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Model Question Paper 3

Suggested Answers
Paper I

Part A: Basic Concepts

1. *(b)* Entry of new competitors in the market does not increase or decrease the market risk or non-diversifiable risk.

2. *(a)* β of the market is equal to 1.

3. *(c)* Or in other words, to erode the investment to 0.

4. *(a)* Pure risks are those in which the outcome tends to be a loss with no possibility of a gain. Speculative risks are those in which there is a possibility of profit or loss. Acceptable risks are those where the loss is minimal and is acceptable to the firm. Dynamic risks are various risks that depend on changes in the economic, political, social, and other scenarios.

5. *(c)* Unsystematic risk is the individual company related risk and is not compensated for by the market as it is not resulting from market-wide happenings.

6. *(b)* By locking-in the revenues, the firm ensures that any price changes in the future do not affect its revenues.

7. *(e)* A qualified derivative is considered as a partial or total hedge when there are changes in the fair value of a recognized asset or liability or when there is a change in the fair value of an unrecognized firm commitment.

8. *(c)* Based on 65° Fahrenheit, the Heating Day Temperature is calculated as (i) 0, if the day's temperature is more than 65°, or (ii) 65° – the actual temperature if the temperature is less than 65°. Therefore, HDD = 65° – 50° = 15°

9. *(c)* Variance/covariance models measure VaR as a multiple of standard deviation depending on the required level of confidence. Historical pattern of observations and Monte Carlo Simulations express returns as a histogram of hypothetical values. Hybrid models combine Historical simulation as well as the RiskMetric approach.

10. *(e)* Theta is the change of the option premiums due to change in the time to maturity.

11. *(b)* For a call option, Theta is always negative because as the time to expiration decreases, the value of the options also decreases. Though the time cannot be negative, theta assumes negative value since the options lose value as time passes. Hence only statement (iii) is true.

12. *(a)* A floor protects from falling interest rates.

13. *(a)* As the interest changes by 1% (100 bps) the price of the option will change by 0.1218. Given that the price of the put option is 5.67, if the interest rate increases, by 1%, the option will be worth 5.67 – 0.1218 = 5.55. And if the interest rate reduces by 1%, the option will be worth 5.67 + 0.1218 = 5.79.

14. *(b)* Gamma of deep-out-of-the-money options (both call and put) are always lower and are less sensitive to the change in the stock prices.

15. *(b)* As the exercise price is zero and the time to expiration is infinite, the call will be worth the same or more than the underlying stock price. This is an imaginary situation as the exercise price cannot be zero nor can the time to expiration be infinite.

16. *(a)* Under Bull spread, an option with a lower strike price is bought and an option with a higher strike price is sold.

17. *(c)* In Horizontal Bull spread, a farther call is bought and a near call is sold. Under Vertical Bull spread, an option with a lower strike price is bought and an option with a higher strike price is sold. Under a Vertical bear spread, an option with a lower strike price is sold and an option with a higher strike price is bought. In horizontal bear spread, a near call is bought and a farther call is sold.

18. *(b)* A call option (long call) refers to the purchase of a call. The investor is bullish on the underlying asset and intends to buy it.

19. *(e)* A standard fixed-floating interest rate swap is known as a plain vanilla swap. It is also known as a generic swap or a coupon swap.

20. *(d)* Since a currency swap does not create foreign currency denominated receivables or payables, it helps in avoiding the translation and transaction risks.

21. *(d)* Mismatch risks take place when the swap bank comes across mismatches in the requirements of both counterparties to the swap. Usually banks have a pool of swaps and have no difficulty in finding matches, but if no party is found, the risk of mismatch losses exist.

22. *(c)* Amortizing swaps are useful if a swap is undertaken to manage the risk arising from mortgage loans. They are particularly useful for managing the associated interest rate risk. A forward swap is one in which the commencement date is set at a future date, and it helps in locking the swap rates and use them later as and when needed. Deferred swap allows the fixed rate payer to enter into a swap at any time up to a specified future date. Basis swaps are used to hedge basis risks.

23. *(d)* In a swap contract, the ability to reduce the cost of borrowing between the parties involved in the swap transaction depends on the credit rating of both the parties as well as the quality spread between them.

24. *(b)* Offsetting involves selling an identical futures contract (with same commodity and delivery month) to reverse the earlier position so that the net position becomes zero. Most of the futures contracts can be completed through offsetting or reversing a trade.

25. *(d)* A limit order is an order that tells the broker to execute a transaction only at a specified price or at one that is more favorable to the client. If the price is not reached, transaction is not made.

26. *(b)* Forward rates are used as predictors of future spot rates.

27. *(a)* Efficient markets are those in which the counterparties can meet each other and deal directly without the existence of intermediaries, so the cost of dealing is zero. Such markets are existing nowhere in the world.

28. *(a)* The call option buyer is usually bullish about the price of the underlying asset. Therefore, he benefits from price increase.

29. *(e)* An open cover describes the cargo, voyage and cover in general terms and automatically takes care of all shipments, which fall within its scope. It is usually for a period of 12 months and is renewable annually. There is no limit to the total number or value of shipments that can be declared under the open cover.

30. *(e)* Critical risks are those that are severe and may affect the very existence of the company.

Part B: Problems

1. Looking at the comparative advantages of the three companies, we can say that:

   Funtime Ltd. borrows floating dollar at Libor + 0.75%.

   Buziness Ltd. borrows fixed pound at 8.00%.

   Noview Ltd. borrows floating pound at Libor + 0.75%.

   The total gain generated by the three is

   [(Libor + 1.00) – (Libor + 0.75)] + [(Libor + 0.60) – (Libor + 0.75)] + (8.25 – 8.00) = 0.35%

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As the total gain is less than the spread required by the bank (0.15 x 3 = 0.45%), it is not possible to arrange a swap between all the three parties. Therefore, it should be verified whether a swap can be arranged between any two of them, leaving out the third. The swap will be feasible provided it generates a gain of more than the spread wanted by the bank, that is 0.15 x 2 = 0.30%.

The total gain generated can be calculated as follows:

- Funtime Ltd. and Noview Ltd.:
  [(Libor + 1.00) − (Libor + 0.75)] + (8.25 − 8.90) = − 0.40

- Funtime Ltd. and Buziness Ltd.:
  [(Libor + 0.60) − (Libor + 0.55)] + (8.25 − 8.00) = 0.30%

- Buziness Ltd. and Noview Ltd.:
  [(Libor + 0.60) − (Libor + 0.75)] + [(Libor + 1.00) − (Libor + 0.25)] = 0.60%

It can be seen that the total gain is maximum when a swap is arranged between Buziness Ltd. and Noview Ltd. As the gain is 0.60%, there is still a gain of 0.30% remaining for distribution to the companies, after the bank charges its spread of 0.30%. The swap can be arranged as follows, if the net gain is distributed equally to the two companies:

- Buziness Ltd. borrows floating dollar from the market at Libor + 0.25, lends them to the bank at Libor + 0.25, and borrows floating pound from the bank at Libor + 0.45.

- Noview Ltd. borrows floating point from the market at Libor + 0.75, lends them to the bank at Libor + 0.75 and borrows floating dollar from the bank at Libor + 0.85.

  The gain to the bank = −(Libor + 0.25) + (Libor + 0.45) − (Libor + 0.75) + (Libor + 0.85) = 0.30%

2. $C = S_o\, N\,(d_1) - Xe^{-rt}\, N(d_2)$

$$d_1 = \frac{\ln(S/X) + (r + \sigma^2/2)t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$d_1 = \frac{\ln\left(\frac{52}{50}\right) + \left(0.12 + \frac{0.30^2}{2}\right)0.25}{0.30\sqrt{0.25}}$$

$$= \frac{0.0392 + 0.0413}{0.15} = 0.5367$$

$N(d_1) = N(0.53) + 0.67\,[N(0.54) - N(0.53)]$

$= 0.7019 + 0.67\,(0.7054 - 0.7019)$

$= 0.7019 + 0.0022 = 0.7042$

$d_2 = 0.5367 - 0.30 \times \sqrt{0.25}$

$= 0.3867$

$N(d_2) = N(0.38) + 0.67\,[N(0.39) - N(0.38)]$

$= 0.6480 + 0.67(0.6517 - 0.6480) = 0.6505$

$C = 52 \times 0.7042 - 50 \times e^{-0.12 \times 0.25} \times 0.6505$

$= 36.61 - 31.55 = Rs.5.05$

According to put-call parity theorem,

$C + Xe^{-rt} = P + S$

$5.05 + 50 \times e^{-0.12 \times 0.25} = P + 52$

$P = 5.05 + 48.52 - 52 = Rs.1.57$

3. Value of the fixed leg:

Let the notional principal be $100,000

3 months	4500
9 months	4500
15 months	4500
21 months	4500
27 months	4500
33 months	4500
39 months	4500
45 months	4500
51 months	104500

Present value of the above cash flows can be calculated at 8.55% by a fixed rate receiver.

The present value of the cash flows at the end of three months will be $105,998.

$$\text{Value as on today} = \frac{105998}{1+\frac{0.0855}{4}} = 103,780$$

$$\text{Value of the floating leg} = \frac{1,00,000 \times \left(1+\frac{0.085}{2}\right)}{\left(\frac{1+0.075}{4}\right)} = 102,331$$

Value of the swap = 103,780 – 102,331 = $1,449

Note: If it is assumed that, instead of a fixed rate receiver, the swap is being valued from the point of view of a fixed ratepayer, the fixed leg should be discounted at 8.70%. Its value will then be $102,331 – $103,250 = $919.

4. a. In (a), the current yield spread between AAA corporates and long-term GOI bonds is 100 basis points. For the normal yield spread to exist, the current yield spread must increase. This can happen if the AAA rated bonds fall in price or if the long-term GOI bonds increase in price. Therefore, the investor should purchase long-term GOI bonds.

   b. In (b), the current yield spread is 100% basis points. In order for the current yield to narrow to the normal yield spread of 50 basis points, the long-term BBB bonds must increase in price and/or the AAA bonds must fall in price. Therefore, the investor should purchase the BBB bonds and sell short the AAA bonds.

5. The cash inflow on selling 15 contracts of wheat bushels at 9.00 per bushel is

   Rs.9.00 x 5,000 x 15 = Rs.6,75,000

   At the time of harvest the farmer sells the wheat at Rs.9.50 per bushel. The cash inflow will be

   Rs.9.50 x 5,000 x 15 = Rs.7,12,500

   Since he has to close his position, he buys 15 contracts at Rs.9.65[*] per bushel. The cash outflow will be

   Rs.9.65 x 5,000 x 15 = Rs.7,23,750

   *(The futures price of Rs.9.65 is obtained as follows. We know that Basis = Current cash price – Futures price

   –0.15 = 9.50 – Futures price

   Futures price = 9.50 + 0.15 = Rs.9.65)

   The loss to the farmer from the futures transactions is

   Rs.6,75,000 – Rs.7,23,750 = (–)Rs.48,750

However, the gain from selling futures contract and from selling the wheat in the spot market is Rs.7,12,500 – Rs.6,75,000 = Rs.37,500. Therefore, the net loss to the wheat farmer is the difference between a loss of Rs.48,750 and a gain of Rs.37,500 which is Rs.11,250.

Part C: Applied Theory

1. The role of futures market in an economy can be looked at from speculators and hedgers point of view and that of from price discovery.

   Speculators: Speculators are those traders who enter into futures contracts only to book profits by entering into and exiting the markets at appropriate time. Their only aim is to book profits. Since their motive is to book profits they obviously should enter into a contract at a lower price and sell it when the price reaches a higher level, which is referred to as taking a long. In this case, the price differential is their profit. Or else they enter into a contract by selling an asset at the existing price and buying at a latter date when the price is at a lower level than the selling price. To enter into both types of these contracts they have to assume a certain degree of risk as the future is uncertain. If the future unfolds in contrast to their expectations, they incur a loss. The amount of loss in the case of a long position is equivalent to the difference between the buying price and a lower selling price and since the selling price can fall to a minimum of zero, the loss will be equivalent to the buying price. But in case of a short position the upside risk potential is unlimited as the price of an asset theoretically can reach any level. In other words, only certain types of traders are capable of taking this risk and the cost of it to the society will be much higher in their absence. Also, speculation has its drawbacks, one expects to control them with a proper regulatory mechanism in place.

   If speculators are on one side of the coin, the hedgers are on the other side. They employ the commodities in the daily course of their business and therefore their primary aim is to lock-in a certain price by entering into futures contract now. That is to achieve an immunity against price fluctuations by shifting the price risk to others who generally happen to be the speculators. It should be, however, noted that futures contract does not assure you a complete hedge in case of quantity risk.

   The second aspect of a futures market is that of price discovery. In futures trading all the traders assemble at a place usually referred to as a pit in an exchange and are required to make an offer to all other traders present by openly shouting the bid and asked prices. This results in a situation wherein the participants discover the true equilibrium price. This is because only the true price will reflect the relative costs of production and consumption depending on which a stage of optimum allocation of resources is achieved in an economy.

2. A natural hedge is the hedge which occurs automatically by way of the exposures in various currencies during the normal operations of the company. An exposure in one currency may offset the risk due to the exposure in another currency when the movement in one currency is negatively correlated with another one. A company has to deliberately undertake a transaction which offsets the risk of the company's exposure in a particular currency. There are various ways in which a synthetic hedge may be developed to suit almost any kind of foreign exchange exposure of the company. Some of the examples by which a synthetic hedge can be developed are

   a. Options

   b. Futures

   c. Swaps

   d. Forwards.

Paper II

Part D: Case Study

1.   i.   **Long Futures Contract:**

There are two basic possibilities here:

a.   The price may remain constant at Rs.12/liter.

b.   The price may rise to Rs.13/liter.

Let us analyze the situation in a tabular form:

January 25, 20x1

Go long on 1000 May 20x1 petrol product futures at Rs.11.50/liter.

Possible situations on May 15, 20x1:

a.   Price increases to Rs.13/liter

Loss on forward sales = (12.50 – 13.00)	–0.50
Profit on futures = (12.50 – 11.50)	1.00
Net Profit	0.50
Add: Commission from Indian Oil	0.50
Total Profit	1.00

b.   Price remains constant at Rs.12/liter

Gain on forward sales = (12.50 – 12.00)	0.50
Loss on futures = (11.50 – 11.50)	0.00
Net Profit	0.50
Add: Commission from Indian Oil	0.50
Total Profit	1.00

ii.   **Long Call Options Strategy:**

Here also, both the above mentioned situations will be examined. Let us assume that he buys a call option with strike Rs.11.50 and a premium of Rs.0.25.

January 25, 20x1

Buy 1000 May 20x1 call options of Rs.11.50/liter, at a premium of Rs.0.25.

Possible situations on May 15, 20x1:

a.   Price increases to Rs.13/liter

Loss on forward sales = (12.50 – 13.00)	–0.50
Profit on call option = (12.50 – 11.50 – 0.25)	0.75
Net Profit	0.25
Add: Commission from Indian Oil	0.50
Total Profit	0.75

b.   Price remains constant at Rs.12/liter

Gain on forward sales = (12.50 – 12.00)	0.50
Loss on call options (only loss of premium)	–0.25
Net Profit	0.25
Add: Commission from Indian Oil	0.50
Total Profit	0.75

iii. **Long Bull Call Spread:**

While hedging with options is quite simple, in order to reduce the premium costs, one can go for a long bull call spread. Suppose if our finance manager purchases the call option of May 20x1 with strike price Rs.11.50 at a premium of Rs.0.25 and simultaneously sells the call option of June 20x2 at a strike price of Rs.11.50 at a premium of Rs.0.10, his net option premium will be Rs.0.15 and the resulting profit or loss will be as follows for the two situations depicted above.

January 25, 20x1

Buy 1000 May 20x1 call options of Rs.11.50/liter, at a premium of Rs.0.25 and sell 1000 June 20x2 call options of Rs.11.50/liter at a premium of Rs.0.10.

Possible situations on May 15, 20x1:

a. Price increases to Rs.13/liter

Loss on forward sales = (12.50 – 13.00)	–0.50
Profit on call option = (12.50 – 11.50 – 0.15)	0.85
Net Profit	0.35
Add: Commission from Indian Oil	0.50
Total Profit	0.85

b. Price remains constant at Rs.12/liter

Gain on forward sales = (12.50 – 12.00)	0.50
Loss on call options (only loss of premium)	–0.15
Net Profit	0.35
Add: Commission from Indian Oil	0.50
Total Profit	0.85

2. **Bullish Vertical Spreads:** As the name suggests, this strategy is employed to exploit a moderately bullish belief about the market or about a stock.

   The strategy can be executed either using calls or using puts. A bullish vertical spread with calls will involve buying an in-the-money call and selling an out-of-the-money call of the same term to expiration.

   The use of this strategy lowers the initial cash outlay than what would have been incurred in the event of purchasing only in-the-money call.

3. The risks of writing options can be summarized as follows:

   The writer of an option faces the risk of being assigned an exercise. The implications of this risk for call writers and put writers are as follows: (i) The call writer who has written a call on a stock which he does not own (naked call writer) will end up incurring losses proportional to the increase in the price of the asset above the exercise price because he has to buy the asset from the market at the higher price and deliver it at the lower (exercise) price. (ii) The put writer must have adequate financial capacity and liquidity to buy the stock at the exercise price. This risk of being assigned an exercise is more significant for the writer of an American option because he can be assigned an exercise at any time during the life of the option.

   The writer of the covered call foregoes the opportunity to benefit from an increase in the value of the underlying asset above the option premium, but continues to bear the risk of a decline in the value of the underlying interest.

   Transactions involving buying or writing of multiple options (like straddles and strangles) and transactions involving buying/writing options in combination with Short/Long positions in the underlying stocks present additional risks to the investor. The investor attempting such transactions must understand that there is a possibility of incurring losses on both sides of the combination transaction and an increased risk exposure can result when one side of the trade is exercised or liquidated while the other side remains outstanding.

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4. After the deal for an option contract is struck on the trading floor of the exchange, the OCC steps in acting as a writer as far as the buyer is concerned and the buyer as far as the seller is concerned. Thus, at this juncture, the link between the buyer and the seller is severed. At the end of every trading day, the OCC examines the contract notes submitted to it by its members. The paperwork submitted by both the parties should match. If they agree they are called as matched trade, if not out trade. The process of matching trades and tracking payments is called as clearing. In case of out trades, the exchange tries to reconcile the differences by contacting the related traders.

The OCC maintains all these data in a computer system. It also maintains a record of the outstanding position of all the investors involved in options trading. Thus, whenever it receives an exercise notice from its members it checks the uncanceled short position of other members in the same series and assigns it to one of them in a random fashion.

After receiving the short notice, the trader with the short position will:

i. Oblige the option holder, or

ii. Default.

When the Writer Obliges

This is quite a straightforward issue. The procedure is as follows. When the buyer of a call option decides to exercise his right, he informs his broker. The broker then delivers an exercise notice form to the OCC with necessary details. When the OCC receives the exercise notice form from the broker, it posts the same to one of the brokers whose account shows short uncanceled position in the same series. This is done on a random basis. The broker house then reassigns the notice to one of its clients, and delivers the share certificates already deposited with it.

When the Writer Defaults

In case the short trader fails to oblige, the OCC performs the writer's part of the contract as usual and then initiates proceedings against the writer for default. We will also see, how the OCC takes precautions to avoid such situations.

In addition to the above, the OCC makes it possible for buyers and writers to close their positions at any time during the expiration period. When an option is sold, the clearing corporation makes the entry for sale of the option in the account of the holder maintained by it. At the same time, it enters a long position in the account of the writer of the option chosen randomly. The entry made will cancel out the existing entry and the offsetting position of the two is reduced. From this, we observe that whenever a buyer or a writer enters into an offsetting contract, he is relieved from his obligation to pay or to deliver the stock.

Part E: Caselets

Caselet 1

1. Assume that two countries A and B produce two goods X and Y. Country A has more than sufficient natural resources to produce good X compared to country B. Country B has more than sufficient natural resources to produce good Y. A and B can minimize their efforts and cost in producing a good if they can exclusively concentrate on one particular product in which they are enjoying a better position than the other. In this case, A is said to have an absolute advantage over B in producing X and B has an absolute advantage over A in producing Y. If they mutually agree to produce only X and only Y respectively, then there will be a mutual benefit to each of them and their overall cost will also be minimized. But consider a situation where A has an absolute advantage in both, but B's position is relatively better in producing Y than X. Then B is said to have a comparative advantage in producing product Y.

A similar argument can be extended to swap agreements where the counterparties involved use the principle of comparative advantage to reduce their cost of funding. One party may enjoy a higher credit rating that enables it to raise funds cheaper than another party, which has a lower credit rating. The principle of comparative advantage can be used in such a way that both the parties are benefitted by entering into a swap arrangement among them to reduce their net cost of funding.

2. **Cal Swaption**

A call swaption gives its buyer the right to enter into a swap as a fixed rate payer. The writer of the call swaptions will be floating rate payer if the option is exercised.

Assume that your firm wishes to enter into a fixed-floating rate swap because you expect the rates to rise and hence you want to pay a fixed rate and receive a floating rate. But there is a speculation that the rates may start falling after a certain period and hence you may buy a call swaption so that depending on the rate movement in the future you can enter into a swap deal or allow your option to expire.

Put Swaption

Here the buyer gets the right to enter into a swap as a floating rate payer. The writer becomes the fixed rate payer when the option is exercised.

Caselet 2

1. When options replace the existing carry forward system, it will ensure enlightened speculation with certain level of maturity. Towards this direction, the National Stock Exchange has plans to introduce index-based options initially and introduce options for individual stocks subsequently. Although the introduction of an option market will increase the market size and bring in new players with different profiles, the focus here is restricted to the dynamics of an option-based hedging and investment strategy for corporates.

   Generally, corporates having investments in stocks will find put options useful as a protection against any sharp decline in the price of stocks. Those who do not have a stock portfolio as such may find a portfolio of call options on the stocks of their choice much less risky than owning the stocks. In fact, a company can buy a call option for a fraction of the price of the stock. In order to gain a clear insight, there is a need to take a closer look at the intricacies involved in the hedging and investment strategies using options.

2. i. **Transaction Costs:** In fact, most of the strategies result in substantial brokerage commissions because brokerage has to be paid on multiple legs. For example, while executing a long straddle strategy commissions have to be paid on buying a call and buying a put. In fact, many clients do complain that the brokerage houses have pushed these strategies on them to generate additional commissions.

   ii. **Bid-Ask Spreads:** There are bid-ask spreads for each option and the consideration of spread is important because an investor buys an option at the higher asked price and sells an option at the lower bid price. Therefore, bid-ask spread is a cost of trading which has to be reckoned while calculating the pay-off associated with a complex strategy.

   iii. **Dividends:** Options are not dividend protected and we have ignored the possibility of dividends being declared on the underlying stock prior to the expiration date.

   iv. **Margin Requirements:** We have also ignored the margin requirements applicable to writing of options and we have assumed that investors receive the full amount of written options.

   v. **Early Exercise:** The most important point we have ignored is the possibility of early exercise. We have wished away this possibility by assuming that the options are of the European type, but the fact remains that most of the equity options that are traded are of the American type. A written American put or a written American call that is in-the-money can be exercised early (prior to the date of expiration). Therefore, the investor executing a complex investment strategy like a bearish vertical spread using calls faces a higher risk than what we have assumed.

   vi. **Timing of Cash Flows:** We have also ignored the timing of the different cash flows which, of course, is not very significant, when the initial cash flow and the expiration day cash flows occur within a period of one year.

Caselet 3

1. Hedging underlying securities is by no means a simplistic proposition as is generally thought of. It is indeed a complex process, given the vagaries and volatility of the market. Selling in the derivatives market against the holdings of underlying securities in anticipation of a fall in prices will result in the not unlikely gains being lost, should the market register a rise instead of a fall as the gains in the cash segment would be counter-balanced by the losses in the derivatives market. Similarly, buying in the derivatives market against the cash flow in future, in anticipation of a rise in prices will lead to situation wherein the likely gains being denied, should the market choose to fall instead of rise, as again the gains in the cash segment would be eroded by the losses in the derivatives market.

2. **Calendar Spread:** A calendar spread is almost similar to a butterfly spread. It is created by selling a call option with a certain strike price and purchasing another call option with longer maturity but the same strike price. Despite the initial investment, the long maturity option can be sold when the short maturity option expires, thus resulting in a profit.

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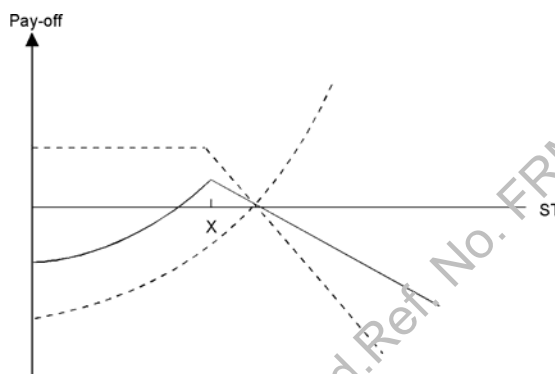
Model Question Paper 4

Time: 6 Hours   **Total Points: 200**

Paper I

Time: 3 Hours   **Total Points: 100**

Part A: Basic Concepts (30 Points)

Answer all the questions. Each question carries one point.

1. Immunization refers to elimination of
   a. Price and default risk
   b. Reinvestment risk and price risk
   c. Default and reinvestment risk
   d. Maturity and default risk
   e. Maturity and reinvestment risk.

2. Which of the following statement/s is/are true about the interest rate risk?
   a. Fluctuations in the coupon interest rates occur from one bond issue to the next.
   b. Systematic fluctuations occur because of changes in the market prices of bonds as their prices move inversely to the prevailing market interest rates.
   c. The variability of return that investors experience is a result of fluctuations in market interest rates.
   d. Both (a) and (c) above.
   e. All of (a), (b) and (c) above.

3. Of the following, systematic risk encompasses
   a. Business risk
   b. Financial risk
   c. Interest rate risk
   d. Inflation risk
   e. Both (c) and (d) above.

4. Costs of insurance policies can be termed as
   a. Risk handling costs
   b. Actual costs
   c. Social costs
   d. Loss financing costs
   e. Both (a) and (d) above.

5. Sourcing of raw materials from a number of suppliers instead of from a single supplier can be called_____ technique of risk management.
   a. Risk transfer
   b. Combination
   c. Risk diversification
   d. Separation
   e. Loss control.

6. A buyer of forward contract will make profit if
   a. Future price is lower than the forward price
   b. Future price is higher than the forward price
   c. Future price is equal to the forward price
   d. Both (a) and (c) above
   e. Both (b) and (c) above.

7. When is the hedging relationship between an interest bearing financial instrument and an interest rate swap effective?

   a. When the principal amount and the notional amount of the swap do not match.

   b. If the fair value of the swap is zero in the beginning of the transaction.

   c. If the net settlements under the swap are not computed on each settlement date in the same way as they are calculated on an interest-bearing instrument.

   d. There is prepayment facility in the financial instrument.

   e. The maturity date of the instrument and the expiration date of the swap do not match.

8. The value of weather index for a given period is arrived at by

   a. CDD x $100

   b. HDD x $100

   c. (HDD – CDD) x $100

   d. (CDD – HDD) x $100

   e. (CDD or HDD) Cumulative x $100.

9. Which of the following is not an advantage of VaR?

   a. VaR can be used in ALM to estimate changes in the net interest income.

   b. VaR can be used to measure the risk of foreign exchange exposure.

   c. VaR helps in identifying the effects caused by substantial future movements to the value of portfolio.

   d. VaR uses many models with a wide variety of assumptions and methods of calculation.

   e. None of the above.

10. Which of the following is/are true about delta of a call option?

    i. The difference between the delta of a call and a put is one.

    ii. The difference between the delta of a call and a put is –1.

    iii. The delta of the call option is always positive.

    iv. The delta of the call option is greater than one.

    a. Only (i) above.

    b. Both (i) and (iii) above.

    c. Both (iii) and (iv) above.

    d. Only (i), (iii) and (iv) above.

    e. Only (ii), (iii) and (iv) above.

11. Binomial option pricing model can be used in which of the following cases?

    a. American put options only.

    b. Options on dividend paying stocks only.

    c. Options on non-dividend paying stocks only.

    d. Both (a) and (b) above.

    e. Both (a) and (c) above.

12. Higher the volatility of an asset, higher would be the price of

    a. A futures price

    b. A forward price

    c. A call option

    d. A put option

    e. All of the above.

13. Gamma of an option is given by

    a. Change of theta of the option with respect to time

    b. Change of theta of the option with respect to interest rate

    c. Change of delta of the option with respect to change in price of the underlying asset

    d. Change of the option price with respect to change in delta

    e. Change of the option price with respect to change in time.

14. Which of the following correctly describes the put-call parity relationship?

    K is the exercise price

    C is the value of the call option

    P is the value of the put option

    r is the risk-free interest rate and

    t is the time to maturity of the option.

    a. $P = C + Ke^{-rt} - S$.

    b. $C = P + Ke^{-rt} - S$.

    c. $C = P + Ke^{-rt} + S$.

    d. $P = C + S + Ke^{-rt}$.

    e. $P = C - S - Ke^{-rt}$.

15. Consider 2 call options with the same time to expiration that are written on the same underlying stock. Call 1 trades at $7 and has an exercise price of $100. Call 2 has an exercise price of $95. What is the maximum price that call 2 can have?

    a. $2.

    b. S7.

    c. $10.

    d. $12.

    e. $14.

16. Which of the following factors will have the same impact on call premium and put premium when they are increased/decreased?

    i. Current asset price

    ii. Volatility

    iii. Time to expiration.

    a. Only (i) above.

    b. Only (ii) above.

    c. Both (i) and (ii) above.

    d. Both (ii) and (iii) above.

    e. All of (i), (ii) and (iii) above.

17. In case of a bearish call spread

    a. The maximum loss will be the difference in the premia

    b. The maximum gain will be the difference in the premia

    c. The maximum gain will be the difference in the premia plus difference in the strike prices

    d. The maximum loss will be the difference in the strike prices

    e. The maximum loss will be the difference between the spot price and the higher strike price.

18. When interest rates increase
    a. Call price increases
    b. Call price decreases
    c. Put price decreases
    d. Both (a) and (c) above
    e. Both (b) and (c) above.

19. Which of the following is true about basis swap?
    a. It involves exchange of principal amount.
    b. It does not have an expiry date.
    c. It provides option to fixed rate receiver to terminate the swap.
    d. It involves exchange of fixed and floating rate of interest.
    e. It involves exchange of 2 floating rates.

20. Value of the swap is zero in a
    a. Basis swap
    b. Par swap
    c. Putable swap
    d. Callable swap
    e. None of the above.

21. The theoretical principal underlying the swap is called the
    a. Basis amount
    b. Swap differential
    c. Notional principal
    d. Arbitrage principal
    e. None of the above.

22. A swap quote of LIBOR/fixed 5 year swap at 85/95 over 5 year treasury by a bank means that
    a. Bank is willing to pay LIBOR and receive fixed rate to be determined in the given range
    b. Bank is willing to receive LIBOR and pay fixed rate to be determined in the given range
    c. Bank is willing to pay 5 year treasury rate + 85 bp and receive LIBOR
    d. Bank is willing to receive 5 year treasury rate + 85 bp and pay LIBOR
    e. None of the above.

23. The par swap rate means
    a. Fixed rate at which the swap has zero present value
    b. Rate at which both floating and fixed rate are same
    c. Fixed rate is more than the floating rate
    d. Floating rate is more than the fixed rate swap
    e. None of the above.

24. The price of currency futures is determined by using _____ theory.
    a. Comparative advantage
    b. Expectation
    c. Covered interest arbitrage
    d. Liquidity premium
    e. None of the above.

25. The difference between spot price and futures price is known as

    a. Swap points

    b. Basis

    c. Hedge ratio

    d. Variation margin

    e. None of the above.

26. Lambda of an option is the rate of change in the value of option with respect to change in

    a. Time

    b. The volatility of the underlying asset

    c. The spot rate of the underlying currency

    d. The delta of the option

    e. None of the above.

27. A call on a given stock, with a zero exercise price and an infinite time to expiration, must have a value

    a. > stock price

    b. ≥ stock price

    c. = stock price

    d. < stock price

    e. ≤ stock price.

28. A drop in the stock price due to a dividend will have

    a. An adverse effect on the price of a call and a put

    b. A favorable effect on the price of a call and a put

    c. An adverse effect on the price of a call and a favorable effect on the price of a put

    d. An adverse effect on the price of a put and a favorable effect on the price of a call

    e. An adverse/favorable effect on call or put depending on the extent of the fall in stock price.

29. Which of the following is/are included in the express warranty in a marine insurance?

    a. That its machinery is in proper working order.

    b. That it is not overloaded.

    c. That the ship is seaworthy on a particular day.

    d. Both (a) and (c) above.

    e. All of (a), (b) and (c) above.

30. Which of the following features relate to the Factory Mutual Insurance company?

    a. It is owned by the policyholders who pay premium at the beginning of their insurance and receive dividend at the end.

    b. It is opposite to advance premium mutuals.

    c. It is concerned with the coverage of insurance by providing loss prevention services with regular inspection of insured premises.

    d. It continues even without successive premium payments by the insured.

    e. Both (c) and (d) above.

Part B: Problems (50 Points)

Solve all the problems. Points are indicated against each problem.

1. Consider the following hypothetical information on three-month options on the US dollar against the rupee:

Strike Price	Premium (Paise/Dollar)	
(Rs.)	Call	Put
43.00	55	10
43.25	25	25
43.40	5	60

A speculator expects that the Rs./$ rate which is now 43.25, may move to 40.00 or 46.00 in the next three months and wants to speculate on it for an amount of $100,000. He thinks taking a combination of bullish spread and bearish spread is superior to a straddle or a strangle. Do you agree with him? Give your answer based on a comparison of the strategies with respect to:

a. Net premium inflow/outflow.

b. Break even prices.

c. Profit potential.

(4 + 4 + 4 = 12 points)

2. A company decided to take a three-year floating rate loan of $200 million to finance an acquisition. The loan is indexed to 6-month LIBOR with a spread of 0.125%. The current level of six-month LIBOR is 7.625%. The company bought a three-year interest rate collar with strike rates of 7.625% and 10.125% respectively for a net premium of 2.5%.

The 6-month LIBOR rate expected to prevail in future can be estimated from the following equation:

LIBOR = 7.93 + 0.11X

where X is the number of months lapsed.

Calculate the effective interest rate on the loan to the company.

(10 points)

3. The following information relates to three companies, which, not finding the interest rates offered for their borrowings in the market to their liking, have approached the ABC Bank Ltd.

Company	Objective	Fixed rate funds (5)	364-day T-bill rated based funds (%)	PLR based funds (%)
Alpha	Fixed Rate Funds	14	T-bill rate + 4	PLR+6
Beta	T-bill rate based funds	12	T-bill rate + 3	PLR +7
Gamma	PLR based funds	15	T-bill rate + 5	PLR + 8

The amount required by the companies is Rs.10 core each for five years on bullet repayment basis. The bank wants to arrange a swap between the three in such a way that it retains 25% of the total gain from the swap and shares the rest equally among the three companies. Show how the above swap can be arranged.

(12 points)

4. Consider a four-month European call option on the pound sterling. The current spot rate of the pound against the rupee is 70.30 and the volatility of the Rs./£ rate is 20%. The risk-free interest rate in the UK and India are 5% and 10% respectively. The strike price of the option is Rs.70.50/£. Is it worthwhile to buy the option at a premium of Rs.2?

(6 points)

5. The details of a declaration policy of the fire insurance are as follows:

   i.   Insured amount is Rs.2 crore

   ii.   Provisional premium is Rs.40,000

   iii.   Declaration is on monthly basis

   iv.   Period of insurance is 12 months starting from April 1, 1999.

   v.   Declarations made were:

April,1999	Rs.199.8 lakh
May,1999	Rs.199.2 lakh
June, 1999	Rs.198.8 lakh
July, 1999	Rs.199 lakh

You are required to

a.   Calculate the actual payment by the insurance company if the last declaration made should have been Rs.199.5 lakh and property worth Rs.40,000 was damaged by fire during July, 1999.

b.   Independent of (a) above, if the insured desires to cancel the insurance policy from August, 1999, calculate the amount refunded by the insurance company. Assume the premium retained at the short period rate is 50% of the premium on the average declaration amount.

<div align="right">(5 + 5 = 10 points)</div>

Part C: Applied Theory (20 Points)

Answer the following questions. Points are indicated against each question.

1. "Interest rate caps, floors and collors are special types of borrowing and lending options". Describe in detail.

<div align="right">(10 points)</div>

2. What are the prerequisites for hedge according? What are the difficulties involved in fair value accounting and deferral accounting? Do you think prohibiting firms from using derivatives, as speculative instruments would solve the problem of hedge accounting to some extent?

<div align="right">(10 points)</div>

Paper II

Time: 3 Hours   **Total Points: 100**

Part D: Case Study (50 Points)

Read the case carefully and answer the following questions.

1. Construct the profit diagrams associated with the following investment strategies and comment on the maximum profit/loss in each one of them.

    a. Selling a March 120 call.
    b. Buying a December 140 call.
    c. Selling a June 160 put.
    d. Buying a March 150 put.

    (20 points)

2. Are the June 20x2 put premiums in line with what should have been the put premium using the put-call parity relationship? If the quoted put premiums are different what strategy would be recommended for exploiting the anomaly? State your assumptions if any.

    (10 points)

3. The management of the mutual fund would like to go for a butterfly spread, by purchasing one June 140 call and one June 160 call and simultaneously selling two June 150 calls. Also you are required to construct a profit table for expiration day market prices of Rs.100, Rs.120, Rs.140, Rs.160, Rs.180 and Rs.200.

    (10 points)

4. Explain the meaning of a condor spread with a simple figure.

    (5 points)

5. Explain the concept of gamma of an option.

    (5 points)

Recently, SEBI has allowed mutual funds to trade into derivatives subject that the same is done for hedging and portfolio balancing and not for speculative purposes. The management of ABC Mutual Fund Ltd. is very excited about this development and thinks that this will be a very good way to hedge the fluctuactions in the market which in the past have subjected their portfolio to heavy losses. But as this is a new development and no one can surely guarantee success as markets in India are more sentiment based than technically organized, the management of the fund would like to go slow and experiment first.

They have narrowed down to one share of XYZ Electronic Ltd. from the 'A' group of the BSE. The stock currently trades at Rs.150 and had paid no dividend in the current year. The beta of the stock is 1.4. It has a volatility of 25%.

The following are the option premiums on XYZ Electronic Ltd. and different strike prices as on November 30, 20x1:

Stock Price Rs.150	Calls (Rs.)			Puts (Rs.)		
Strike Price (Rs.)	Dec.31 20x1	Mar.31 20x2	Jun.30 20x2	Dec.31 20x1	Mar.31 20x2	June 30 20x2
120	31	42	51	–	–	–
130	25	30	34	–	–	–
140	18	22	28	1	4	–
150	6	11	16	4	7	–
160	4	8	12	9	14	21
170	1	5	9	–	19	24

The blank spaces denote no offer or trading in the option.

Part E: Caselets (50 Points)

Caselet 1

Read the caselet carefully and answer the following questions.

1. Briefly describe the main factors affecting the price of an option.

(8 points)

2. Discuss the operation of COFEI (Coffee Futures) in India.

(8 points)

India's financial markets are about to see something truly new: options trading. For all these years, the Indian 'spot market' for equity has operated as a futures market, so the understanding and institution into futures is widespread. Hence when futures trading appeared, it was easy for India's traders to switch from trading futures on stocks to futures on index. In contrast, options are interesting, and new, in important ways. One common idea that has been often expressed is that 'selling options is very dangerous'.

In order to think about this question, let us start with futures. Futures positions have 'unbounded pay offs'. Which means that a buyer of a futures can have profits ranging from – 100 percent to infinity. The same is the case with the futures seller.

In the case of options, there is one remarkable and new case: the option buyer can only have profits ranging from 0 to infinity. Once an option has been fully paid for, the worst loss which can take place is that the option can prove to be worthless. Things cannot get worse than that.

In contrast, the option seller is exactly like the futures buyer or seller in terms of the losses. The option seller can have losses as bad as a futures buyer or a futures seller.

Hence, the resolution to the question 'Is options selling profoundly different?' is as follows. There are two groups of positions. One group of positions are those which (in principle) can have extremely large losses. These are:

*   Selling,

*   Selling futures, and

*   Buying futures.

The second group of positions contains only one member: it is the buy position on options. Buying options is unique in that large losses cannot take place.

Now, in India, we have plenty of experience with futures, with both buy or sell positions with futures. If we are willing to accept buy or sell positions on futures, where very large losses can take place, then we should equally be willing to accept sell positions of options.

There have been proposals that only large institutions should be allowed to 'write options' (i.e., sell options). This is as justified as a view that only large institutions should be allowed to buy or sell futures, i.e., to trade on the existing Indian spot market for equity. If India's retail market participants can buy or sell futures (i.e., trade on the equity spot market), then they should surely be allowed to sell options.

Caselet 2

Read the caselet carefully and answer the following questions.

1. Define the concepts 'at-the-money', 'in-the-money' and 'out-of-the-money' in options terminology.

(8 points)

2. 'A combination is an option trading strategy that involves taking a position in both calls and puts on the same stocks.' Explain straddle combination.

(8 points)

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Option strategies form a hedging perspective of protecting investments in stocks, involve purchase of put options. However, options can also be used purely as an investment avenue with emphasis almost exclusively on the return on investment (ROI) – in terms of amount paid as premium. In effect, a company with a bullish view on a stock, can buy a call option on the stock at a fraction of the price of the stock and enjoy much greater returns on the investment (in premium expenditure) than what would have been possible on an investment in buying the underlying stock.

When a company believes that a major bear market has come to a probable end though the exact bottom is uncertain, at-the-money call option would be the ideal choice. If a major rally develops as anticipated, the company would stand to gain in multiples of the amount invested (as premium paid) in the call options. If the stock continues to decline contrary to expectations, there will be a chance to buy another at-the-money call option at such cheaper levels, thus building a portfolio of call options acquired at various

levels. Only when the decline in stock prices persists and the strike prices of both the call options stands to lose the premium paid but no more.

After the rally develops as expected, the focus shifts towards – protecting the profits, simultaneously enjoying maximum part of the rally and positioning for any new decline.

The company would estimate, based on fundamental and technical forecasts, a tentative price target for the rally from where the stock may be expected to sharply reverse course. An out-of-the money call option with strike price around the projected top will be very cheap when the rally is well established. Once the stock price indeed reaches the price target the at-the-money option may reach the price target, the at-the-money option may be sold for a handsome profit and the cheap out-of-the money call will continue to position the company for any further unexpected rally in the stock price.

The utility of options does not stop with bull markets alone and works just as well in catching price declines. After the call options are encashed upon a conviction that the stock has no further room to go up, the company may purchase an out-of-the-money put option, which once again is cheaper than an at-the-money put option. If the decline is severe, this put option will move in-the-money fairly quickly, enabling the company to make money in a bear market as well. However, if the decline turns out to be shallow and is only a minor correction followed by a resumption of uptrend, the company has only lost a small amount paid as premium in a strategy much less risky than short selling the share.

Here again, formation of an opinion of the expected trend is very important as it will determine the strike price of the option, duration, etc. The key to a successful option buying strategy is to pick a low volatility situation when the premium is low instead of panic-buying after the volatility has picked up and the premia have suddenly become higher. There is no perfect options strategy that yields the highest profits and is suited to all types of market situation. Each strategy is a compromise fine-tuning the risk-reward profile depending upon the objectives of the investor. Again, there is no escape from understanding the markets and formulating a reasonable opinion of where the prices are headed for and what kind of volatility is to be expected.

Caselet 3

Read the caselet carefully and answer the following questions.

1. Explain the concept of arbitrage with stock index futures.

(10 points)

2. What is portfolio insurance? How does it work?

(8 points)

Trading in index futures is not just to hedge market risk; it can well be a source of profit through arbitrage. There are arbitrage opportunities in index futures, just as in stocks. In fact, index arbitrage is big business in the more mature markets.

Considering the investors' awareness levels, the low liquidity in the Indian futures market, the high lending and borrowing rates, the daily margin requirements and other market imperfections, it appears that index arbitrage opportunities are hard to come by, at least for now, in India. But given the increase in index futures trading since it began in June, and the declining transaction costs, it is just a question of time before the profit-making opportunities in index arbitrage are realized.

In the stock market, an arbitrage opportunity arises when the same scrip trades at different prices in different markets. In such a situation, investors buy the stock in one market at a lower price and sell it in the other for more, cashing in on the difference, net of the transaction cost. However, such an opportunity vanishes quickly as investors rush in to take advantage of this price difference. Thus, the arbitrage process helps correct the discrepancies in pricing.

The same principle can be applied to index futures. Being a derivative product, index futures derive their value from the stocks that constitute the index (either the Sensex or the Nifty). At the same time, the index futures value is linked to the stock index value through the opportunity cost of funds required to play in the market.

Thus, if the stock index value is say, 1200 and the opportunity cost of funds in 10 percent per annum, the theoretical value of a three-month futures index contract would be 1230 (1200 plus 10 percent for three months). The index number, in a sense, represents the monetary value, as it is a relative measure of the underlying value of the scrips that make up the index. This is equivalent to investing Rs.1200 in the underlying scrips at the market rate of interest of 10 percent for three months.

Thus, for instance, based on the Nifty index value of 1333.80 on July 28, and an opportunity cost of 10 percent (simple interest), the theoretical futures index for August 31 contract (34 days) should logically work out to 1346.20. But, often, the theoretical futures value differs from the actual one. The actual futures value at the close of July 28 was 1363 – a difference of 16.80 points between the theoretical and actual values. This difference compared to the stock index value creates an arbitrage opportunity for investors.

How can one take advantage of this difference in value? As the true value of the futures index is estimated at 1346.20, the investor can expect the actual value (1363) to decline to that level. Consequently, the investor would logically go short on the futures index and long on the stock index.

Thus, the investor would first sell the index futures at 1363. He would then borrow money at the market rate of interest (say, 10 percent, the same rate used for calculating the theoretical futures index) and buy the underlying scrips whose representative value is captured by an index number of 1333.80. On the settlement day, the investor would sell the stock index and settle the loan. He would then stand for delivery of the futures index to cover the short position.

Both the stock and the futures, index had the same value on the settlement day. And, irrespective of the closing stock index value on the settlement day, the difference of 16.80 points between the theoretical and the actual value would be the profit for the investor.

Thus, if the stock index value on the settlement day is, say, 1370 (more than 1363, for which it was earlier sold) the investor would have to pay 7 points (1370 – 1363) to cover his short position. Against this, the underlying scrips would have appreciated from the value at which he acquired them, which is 1333.80. He can now sell the stocks at the going value, captured in the index number of 1370. With the proceeds, he can repay the loan with interest, which would work out to Rs.1346.20. He is, thus, a net gainer of 16.80 points. This, incidentally, is the difference between the theoretical and the actual index futures value (1363 – 1346.20) on the contract date.

On the other hand, if the actual index futures value on the settlement day is 1355 (less than the 1363 for which it was sold earlier), the investor would receive 8 points to cover his short position. He would then sell the stock index at 1355 and settle the loan with interest for Rs.1346.20. The net inflow works out to 16.80 which, again, is the difference between the theoretical and the actual futures values.

The same arbitrage opportunity would be available if the index future quotes below the theoretical value. Suppose, in the above instance, the actual futures index quoted at 1340, instead of the theoretical 1346.20, the profit opportunity is the difference, which is 6.20 points. The investor would then go short on the stock index and long on the futures index. This is opposite to what the investor did when the actual futures index quoted above the theoretical index value.

In this case, the investor would go short on the stock index at 1333.80 and invest the proceeds at 9.50 percent. He would then take a long position on the futures index at 1340. On the settlement day, the investor would stand for delivery of the index futures contact. He would then use the money got on maturity of the deposit to buy back the stock index to cover this short position. And irrespective of what may be the stock index/futures index value on settlement day, the net profit (after adjusting for interest earned) would be 6.20 points – the difference between the theoretical and the actual index future value.

Model Question Paper 4

Suggested Answers
Paper I

Part A: Basic Concepts

1. *(b)* Immunization refers to a strategy in which cash-matches over the next few years and duration-matches the rest. It eliminated reinvestment risk and price risk.

2. *(e)* Interest rate risk is the risk of an adverse effect of interest rate movements on a firm's profits or balance sheet. It is the variability of returns that investors experience as a result of fluctuations in interest rates. Interest rate exists even for investors who invest in bonds.

3. *(e)* Systematic risk is that risk which cannot be mitigated by the corporates. It equally affects all the securities in the market. Since here inflation risk and interest rate risk are not firm specific, they comprise the systematic risk. Financial risk and Business risk are firm specific.

4. *(e)* Costs of insurance policies are termed as risk handling costs and loss handling costs.

5. *(d)* Under combination strategy of risk management, raw materials can be sourced from a number of suppliers instead of from a single supplier.

6. *(b)* An exporter who enters into a forward contract will make a profit if future price is higher than the forward price.

7. *(b)* The hedging relationship between an interest bearing financial instrument and interest rate swap is effective if the fair value of the swap is zero in the beginning of the transaction.

8. *(e)* The weather index is the total of the CDD or HDD for the given period multiplied by US$100.

9. *(d)* The use of various models with a wide variety of assumptions is in fact a disadvantage of VaR as it makes it more complicated and the results may vary considerably based on different methods and assumptions.

10. *(a)* Delta is the ratio of change in the price of a derivative with the price of the underlying asset. Delta of a call option is 1 and delta of a put option is between -1 and 0. Therefore, difference between call and put options is one.

11. *(e)* The binomial pricing model can be used to estimate the fair value of call or put option. It is assumed that the underlying stock does not pay any dividend during the life of the option. This model can be modified to price American options.

12. *(c)* The volatility of a stock price represents the uncertainty attached to its future movement. The call option holder gains from the price increase but has fixed downside risk in the case of price decline, so the higher the volatility, higher the premium on the call option.

13. *(c)* The rate of change for delta with respect to the underlying asset's price.

14. *(a)* Put-call parity is given by $c + Ke^{-r(T-t)} = P + S$. This can also be written as $P = c + Xe^{-r(T-t)} - S$.

15. *(d)* $7 + $5 = $12. As the strike price is lower by $5, the premium can go up to a maximum increase of $5.

16. *(d)* The longer the "time to expiration", the higher the option price (call or put). Value of both call and put increases as volatility increases. The value of the call option increases with increase in the stock price and it decreases with a decrease in the stock price. The value of the put option decreases with increase in the stock price, and it increases whenever stock price declines. Hence statements (ii) and (iii) are true.

17. *(b)* This strategy is used to exploit moderately bearish beliefs about the underlying asset with the help of calls. It involves selling a call with lower strike price and buying a call with higher strike price. Both the calls should have the same maturity. Naturally, the call with lower strike will have a higher premium and the call with higher strike will have a lower premium. The profit is the difference in the premiums.

18. *(d)* Both statements under (a) and (c) are true because cost price is directly proportional to interest rate and put price is inversely proportional to the interest rate.

19. *(e)* With a basis swap, each party pays a floating rate of interest, and each is tied to different floating rates. The basis swap sets a spread between two indices for the life of the transaction. Basis swaps are used by banks to hedge the mismatch between the index of their assets and the index of their liabilities, and by swap dealers to create structures for companies to hedge indices other than Libor. Therefore (e) is true.

20. *(b)* It is the fixed rate at which the present value of the swap is zero.

21. *(c)* The theoretical principal underlying the swap is called the notional principal.

22. *(c)* Bank is willing to pay 5 yr. Treasury rate + 85 bp receive Libor.

23. *(a)* Par swap rate is the fixed rate in an interest rate swap that causes the swap to have a value of zero.

24. *(c)* Price of currency futures is determined by the covered interest arbitrage.

25. *(b)* The difference between spot price and futures price is known as basis.

26. *(b)* Lambda is the change in the option premium against a unit change in the price volatility of the underlying asset.

27. *(b)* Such a call's value is equal to the stock price but, this is an imaginary situation which is never possible in real life situations.

28. *(c)* Drop in the price of a stock due to dividend will have an adverse effect on the price of a call option and a favorable effect on the price of a put option.

29. *(c)* In the express warranty of a marine insurance it is specified that the ship is sea-worthy on a particular day.

30. *(c)* Factory Mutual Insurance company is concerned with the coverage of insurance by providing loss prevention services with regular inspection of insured premises.

Part B: Problems

1.

	Net premium inflow/outflow	Break even prices	Profit potential
Combination of Bull spread + Bear spread	$-5+55-55+5=0$	All prices are breakeven	No pay-off
Straddle	$-25-25=-50$	$43.25 + 0.50 = 43.75$	at $46 = 2.75 - 0.50 = 2.25$
		$43.25 - 0.50 = 42.75$	at $40 = 3.25 - 0.5 = 2.75$
Strangle	$-5 - 10 = -15$	$43.40 + 0.15 = 43.55$	at $46 = 2.60 - 0.15 = 2.45$
		$43.00 - 0.15 = 42.85$	at $40 = 3.00 - 0.15 = 2.85$

Profit potential in combination of bull spread and bear spread is not superior to either straddle or strangle.

2.

Time period (in months)	Six-month Libor Rate: 7.93 + 0.11X	Actual rates applicable Libor + 0.125%	Rates under the collar
6	7.625	7.750	7.750
12	8.590	8.715	8.715
18	9.250	9.375	9.375
24	9.910	10.035	10.035
30	10.570	10.695	10.125
36	11.230	11.355	10.125

Note: Since applicable rate of interest for the 30 months and 36 months exceed 10.125%, the rate of interest for the company would be 10.125%.

The effective rate of interest under collar would be

$$\left[\left(1+\frac{0.07750}{2}\right)\left(1+\frac{0.08715}{2}\right)\left(1+\frac{0.09375}{2}\right)\left(1+\frac{0.10035}{2}\right)\left(1+\frac{0.10125}{2}\right)\right.$$
$$\left.\left(1+\frac{0.10125}{2}\right)\right]^{1/3} -1 = 9.53\%$$

3. According to the comparative advantage, the applicable rate of interest to the three companies:

i. α company   PLR + 6%

   β company   12%

   γ company   T-bill rate + 5%

The objective of the companies:

ii. α company   14%

   β company   T-bill rate + 3%

   γ company   PLR + 8%

Total gain from the swap is

[14 + T-bill rate + 3% + PLR + 8%] – [12 + T-bill rate + 5% + PLR + 6%] = 2%

Out of the total gain of 200 basis points ABC bank retains 25%, i.e. 0.50%. Remaining 1.50% will be shared by the three companies equally.

The swap can be arranged as follows:

a.   β company borrows from market fixed 12% and lends to ABC Bank at 12% and borrows from Bank at T-bill rate + 2.5%.

b.   α company borrows from market at PLR + 6% and lends to ABC Bank at PLR + 6% and borrows from Bank at T-bill rate + 5%.

c.   γ company borrows from market at T-bill rate + 5% and lends to ABC Bank at T-bill + 5% and borrows from Bank at PLR + 7.5%. The swap can be depicted diagrammatically as shown below.

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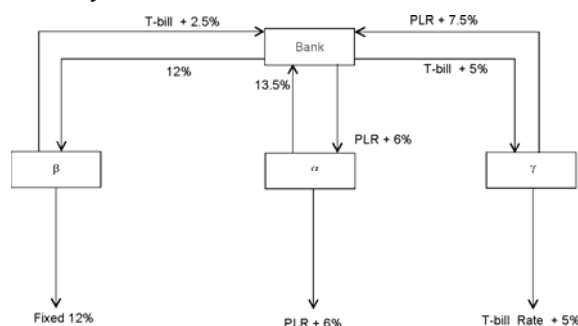
4.
   Spot price (S)   = 70.30

   Volatility (σ)   = 20%

   Strike price (X)   = 70.50

   T   = 0.333

   r   = 10%

   r_f = 5%

   $$d_1 = \frac{\ln(S/X) + (r - r_f + \frac{\sigma^2}{2})(T - t)}{\sigma\sqrt{T - t}}$$

   $$d_2 = d_1 - \sigma\sqrt{T - t}$$

   Substituting the values for obtaining d_1

   $$d_1 = \frac{\ln\left(\frac{70.3}{70.5}\right) + \left(0.1 - 0.05 + \frac{0.2^2}{2}\right) \times \frac{1}{3}}{0.2\sqrt{\frac{1}{3}}}$$

   $$= 0.1775$$

   $d_2 \quad = d_1 - \sigma\sqrt{T - t} = 0.1775 - 0.20\sqrt{1/3}$

   $\quad\quad = 0.06203$

   $N(d_1) \quad = 0.5675 + 0.75(0.5714 - 0.5675)$

   $\quad\quad = 0.5704$

   $N(d_2) \quad = 0.5239 + 0.20(0.5279 - 0.5239)$

   $\quad\quad = 0.5247$

   Call price $\quad = SN(d_1) - Xe^{-r(T-t)} N(d_2)$

   Call price $\quad = 70.30 \times 0.5704 - 70.50 \times 0.5247 \times e^{-0.10} \times \frac{1}{3}$

   $\quad\quad = Rs.4.32$

   Since theoretical option price i.e., Rs.4.32 is greater than the market price i.e. 2, therefore, it is worthwhile to buy the option.

5. a. As the declaration prior to the loss is undervalued, the loss recoverable is

   $$\frac{Rs.199 \text{ lakh}}{Rs.199.5 \text{ lakh}} \times 40,000 = Rs.39,000$$

   b. Since the cancellation is at the insured's instance, the adjustment will be at short period rates.

   $$\text{Average declaration} = \frac{199.8 + 199.2 + 198.8 + 199}{4}$$

   $$= Rs.199.2 \text{ lakh}$$

Premium that can be refunded is the lower of

i.   50% of average declaration x $\dfrac{40,000}{200}$

$$= 0.5 \text{ x } \dfrac{199.2 \text{ lakh}}{200 \text{ lakh}} \text{ x Rs.40,000}$$

$$= \text{Rs.19,920}$$

ii.   35% of Rs.40,000 (Provisional premium)

$$= \dfrac{35}{100} \text{ x Rs.40,000} = \text{Rs.14,000}$$

As 35% of the provisional premium is less than the 50% of the annual premium, the insurance company will refund Rs.14,000.

Part C: Applied Theory

1.   **Caps, Floors and Collars**

An interest rate cap and floor are special types of borrowings and lending options, which are meant for long-term hedging.

Caps (Interest Rate Caps)

A cap is a series of interest rate options, which guarantees a fixed rate payable on a borrowing over a specific time period at specific future dates. If interest rates rise above the agreed cap rate then the seller pays the difference between the cap rate and the interest rate to the purchaser. A cap is usually bought to hedge against a rise in interest rates and yet is not a part of the loan agreement and may be bought from a completely different bank/writer. In a cap, usually an upfront fee is to be paid to the bank/writer. The cap guarantees that the rate charged on a loan at any given time will never exceed the current existing rates or the cap rate. The cap working is depicted in the following graph:

Interest Rate Cap
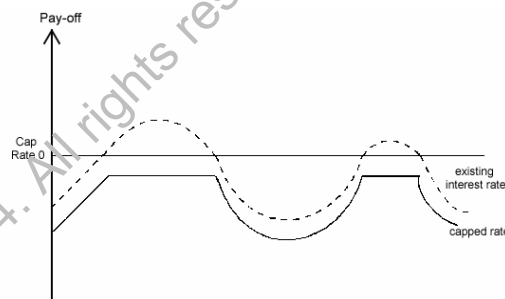
Floors (interest Rate Floors)

A floor is an agreement where the seller agrees to compensate the buyer if interest rates fall below the agreed upon floor rate. It is similar to a cap, but ensures that if the interest rate falls below a certain agreed floor limit, the floor limit interest rate will be paid.

Interest Rate Floor
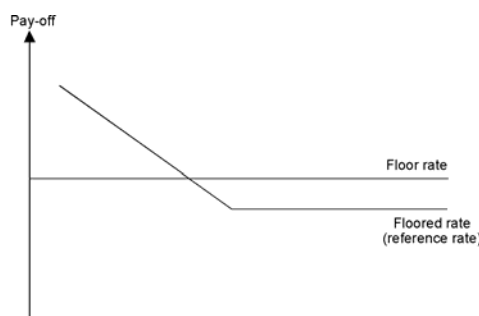
Collars

A collar is a combination of a cap and a floor where you sell a floor at a lower strike rate and buy a cap at a higher strike rate. Thus, they provide protection against a rise in interest rates and some benefit from a fall in interest rates.

The pay-off profile of a cap and a collar are given below:

Interest Rate Cap
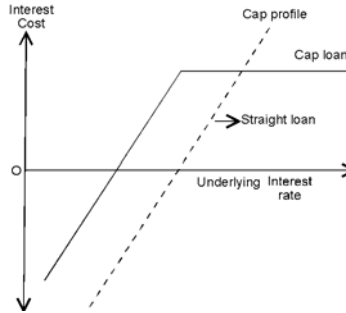
Interest Rate Collar
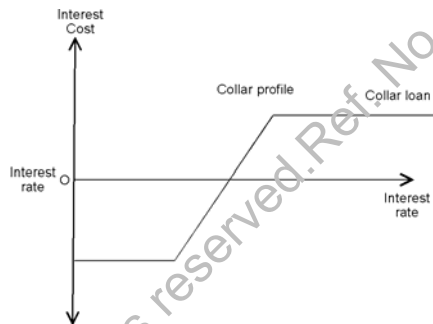
2. For undertaking hedge accounting the firm should at the inception

   i. Designate the hedge relationship.

   ii. Document such relationship.

   iii. Identify hedge item, hedge instrument and risks being hedged.

   iv. Expect hedge to be highly effective.

   v. Lay down reasonable basis for assessment effectiveness.

Difficulties faced in fair value accounting are:

- To arrive at the fair value of a transaction.

- Interfirm comparison becomes difficult when only some firms adopt fair value accounting.

- When different assets are valued differently inter period comparison of the balance sheet becomes difficult.

- If a hedge is terminated recorded cost is different from initial cost.

Problems faced in deferral accounting are:

The increased level of an institution's risk of loss would not be reflected immediately in the financial statements.

Prohibition of use of derivatives as speculative instruments would not solve the problem of hedge accounting. The hedge accounting is for derivatives and hence it should not be different for different products. If accounting is product specific and if there is inconsistency within the product transactions may not be classified into proper categories which will give rise to problems in accounting.

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Paper II

Part D: Case Study

1. a. **Selling a March 120 call.**

Short Call: Pay-off
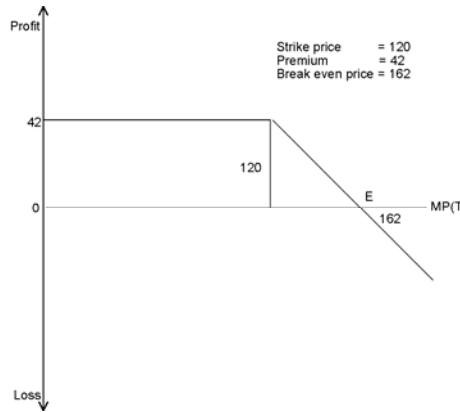
If the stock price is Rs.120 or less, the entire option expires worthless and the entire premium received is the profit of ABC Mutual Fund Ltd. In this case, the maximum profit is Rs.42 (the premium received). The break even price is the strike price plus premium received. If the expiration date price substantially exceeds Rs.162, then the call buyer will exercise the call which in turn produces loss to ABC because they have to buy the stock at higher price and sell it at Rs.120.

Long Call: Pay-off
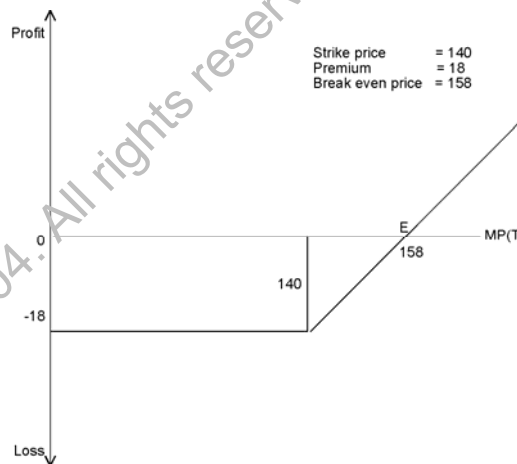
b. **Buying a December 140 Call**

For the range of stock prices below Rs.140, the maximum loss of ABC Mutual Fund Ltd. is restricted to the option premium of Rs.18. The break even point is equal to the exercise price plus the premium paid for the call which is Rs.158 here. The profit is unbound beyond the stock price of Rs.158.

c. **Selling a June 160 Put**

If the expiration price of XYZ Electronics is Rs.160 or higher, the put expires and ABC Mutual Fund Ltd. keeps the maximum premium of Rs.21. On the other hand, if the expiration price is less than Rs.160, ABC's income is eroded and at the price of Rs.139, it breaks even. At lower prices, it starts losing and the maximum loss is bounded at Rs.139 when the market price at expiration = 0.

Short Put Pay-off
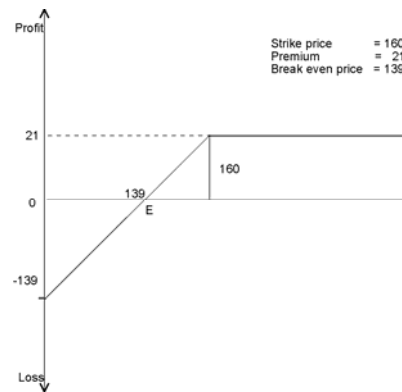
d. **Buying a March 150 Put**

Long Put Pay-off
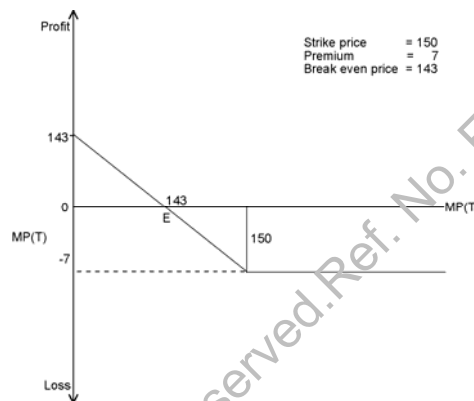
The maximum profit associated with this strategy is Rs.143 which occurs when the market price of XYZ Electronics Ltd. declines to zero. The break even price in this case is Rs.143. The maximum loss of ABC Mutual Fund Ltd. is Rs.7 (the premium) because if the market price at expiration time is equal to or greater than Rs.150, ABC need not exercise the option and stands to lose only the premium of Rs.7.

2. Put-call parity means the value of the call with a certain exercise price and exercise date should be equal to the value of a put plus the value of one share.

On June 30, 20x2, put premium for the strike price of Rs.160 is Rs.21 and the value of the put plus one share is Rs.121 (Rs.100 + Rs.21), but the call value (value of call plus the exercise price) is Rs.172 (Rs.160 + Rs.12). Similarly, the value of one put plus one share for the strike price of Rs.170 is Rs.124 (Rs.100 + Rs.24), but the call value is Rs.179 (Rs.170 + Rs.9).

Hence, the value of the put premium in both cases are underpriced in relation to the call premiums.

In order to benefit from such anomalies, for the strike price of Rs.160, one can go on shorting the put and stock and buying the call, to lock in a profit.

This strategy involves an initial investment as follows:

= Rs.100 + Rs.21 – Rs.12 = Rs.109

The net profit is Rs.63 (172 – 109)

Similarly in the case of the strike price of Rs.170, the initial investment will be:

= Rs.100 + Rs.24 – Rs.9 = Rs.115

The net profit is Rs.64 (179 – 115)

This is subject to the following assumptions:

i.   There are no transaction costs.

ii.   All net trading profits are subject to the same tax rates.

iii.   It is possible to borrow and lend at risk-free rates of interest.

3. The following is the pay-off position of the initial investment:

Buy June 140 call   −Rs.28

Buy June 160 call   −Rs.12

Sell two June 150 calls   + Rs.32

Initial Investment   −Rs.8

Profit Table: Cash Flow at Time

Market Price	Buy June 140	Sell two June 150	Buy June 160	Net Cash Flow (addition of buy, sell, buy)	Profit
100	0	0	0	0	−8
120	0	0	0	0	−8
140	0	0	0	0	−8
160	20	−20	0	0	−8
180	40	−60	20	0	−8
200	60	−100	40	0	−8

4. A condor spread strategy is similar to a butterfly spread involving 4 options of the same type but with a small difference. In a butterfly spread, three different strike prices are involved; but in a condor, four different strike prices are involved. In a condor spread, two options are bought at the extreme strike prices and two are sold at two intermediate strike prices. Let us see the example of a condor spread with calls.

Assume that there are 4 call options on a stock with strike prices $45, $50, $57 and $62 priced at $9, $6 $2 and $1 respectively. In a condor spread, you buy those at $45 and $62 and you sell those at $50 and $57. If the stock price at expiration turns out to be $45 or below, no call option will be exercised and the loss is limited to the cost of the spread, i.e. $2. If the stock price at expiration is $50, the long call with strike price $45 will be exercised and the pay-off will be $3. The short call with strike price $50 will be exercised against you when the stock price at expiration is above $50. If the stock price at expiration is above $62 the profit on the long calls will be offset against the loss on the short calls. Thus, the condor spread has limited loss and a limited profit. The pay-off of a condor spread is given below. It can be easily shown that the pay-off of a short position is the mirror image of the long position.
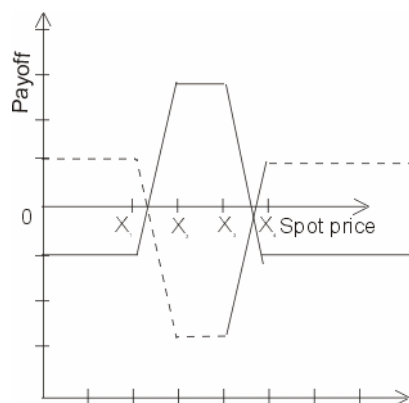
5. The gamma of any option is the rate of the change of the option's delta with respect to the price of the underlying stock. Gamma of any option indicates the sensitivity of delta with respect to the change in the stock prices. The gamma of a put and call will always be equal. Gamma is second order derivative of option premium with respect to the stock prices. It is the rate of change of delta to the changes in the option prices. Higher gamma reflects greater sensitivity of option's delta with respect to the stock price. Gamma of deep-out-of-the-money options (both call and put) will always be lower and less sensitive to the change in the stock prices. The following figure depicts how gamma varies with the stock price and gamma essentially measures the slope of the graph.
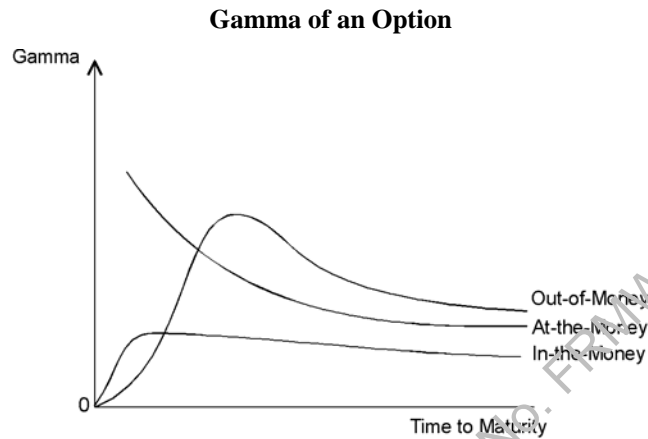
Gamma of an Option

For an European call or a put option on a non-dividend paying stock, the gamma can be calculated by the following formula:

Gamma of a call or a put = $N'(d_1) + S\sigma\sqrt{T-t}$

Gamma also varies with the time remaining until expiration. For an option that is near-the-money gamma increases as expiration approaches. The greater value of gamma reflects the greater sensitivity of delta with respect to stock prices, when the expiration is approaching the near-the-money option. For an option that is deep-out-of-the-money, the gamma will fall as expiration comes nearer.

Part E: Caselets

Caselet 1

1. The value of an option depends on six factors:

C_0 or P_0 = f(S_0, E, σ^2, t, r_f, d)

Where,

f	=	Function
C_0	=	Value of call option
P_0	=	Value of put option
E	=	Exercise price
S_0	=	Price of underlying stock
σ^2	=	Price volatility of underlying stock
t	=	Time to expiration
r_f	=	Risk-free interest rate
d	=	Cash dividend.

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i.   The spot price or current price of the underlying asset.

ii.   The exercise price or strike price of the option.

iii. The time-to-maturity or time-to-expiration.

iv.   Volatility of the underlying asset or volatility in the price of underlying asset.

v.   The risk-free rate of interest.

vi.   Dividends expected during the life of the option, in case of dividend paying stocks.

2.   Trading in COFEI was by an "open outcry" system with post trade operations fully computerized prior to September 2000. But now online trading has been introduced. There are two major varieties of coffee viz. plantation A and Robusta cherry AB. These two are traded as alternate month contracts i.e. Jan. 2000, March 2000, May 2000, etc., COFEI permits trading in nine contracts simultaneously covering 18 months forward.

Some of the unique features of COFEI are

i.   COFEI acts as a counterparty to both buyers and sellers and thus guarantees performance.

ii.   The clearing house is a part of COFEI itself and not a separate entity.

iii. All clearing members are shareholders of COFEI.

iv.   Daily marking to market of all trades enables COFEI to function with minimum risk.

v.   All deliveries relating to trade at COFEI are effected from Certified Warehouses recognized and approved by COFEI.

vi.   Certified Warehouse system guarantees quality and quantity of coffee delivered.

Caselet 2

1.   **At-the-money Option**

An option whose strike price is equal to the underlying asset price.

In-the-money Option

An option that has positive intrinsic value based on the stock price and strike price. Calls are in-the-money when the strike price is less than the stock price; Puts are in-the-money when the stock price is less than the strike price.

Out-of-the-money Option

An option that has no value. In the case of a call option, the option whose exercise price is greater than the market price of the underlying asset. In the case of a put option, the option whose exercise price is less than the market price of the underlying asset.

2.   A straddle involves a call and a put option with the same exercise price and the same expiration date. A straddle buyer buys a call and a put option and the seller sells a call and a put option at the same exercise price and the same expiration date. The maximum loss associated with the long straddle position is the cost of the two options (the premium paid for buying the options). Profit potential is unlimited when the prices of the underlying asset rise significantly and limited when it falls significantly.

Caselet 3

1.   Arbitraging is a simultaneous purchase and sale of similar assets in different markets to take advantage of price discrepancy.

Arbitrageurs are the third group of participants in these markets. The act of arbitraging involves locking-in riskless profits by entering into different transactions in two or more markets simultaneously.

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Consider an IBM stock traded on the NYSE and on LSE. Suppose the stock price is $155 in New York and 88 pounds in London and the exchange rate is $1.75 per pound. An arbitrageur could simultaneously buy 100 shares in LSE and sell in NYSE and make a risk-free profit of

100 x [155 – $(1.75 x 88)] = $100

Transaction costs would reduce the profit of the arbitrageur to the minimum. As you buy the stock on the London Exchange the demand will increase. Similarly, the price at NYSE will fall as they sell the stock, reducing the arbitraging opportunities. In short, arbitrage opportunities cannot last for very long periods of time in a stock, but the very existence of arbitrageurs implies that there are opportunities in the markets for sometime.

2. Portfolio insurance is one of the ways of hedging a futures contract. It is a dynamic hedging strategy which uses stock index futures and which implies buying and selling securities periodically to achieve the desired results of not incurring a loss greater than a predetermined value or to maintain a desired minimum limit on the portfolio value. The working of the portfolio insurance is akin to buying an index put option.

Portfolio insurance can also be done by selling and buying stocks directly or by using listed index options.

Model Question Paper 5

Time: 6 Hours   **Total Points: 200**

Paper I

Time: 3 Hours   **Points: 100**

Part A: Basic Concepts (30 Points)

Answer all the questions. Each question carries one point.

1. The off-balance sheet items such as guarantees, letters of credit, underwriting commitments, etc., give rise to _____ risk.

   a. Currency
   b. Credit
   c. Contingency
   d. Liquidity
   e. Interest rate.

2. Risk(s) affecting all the securities in the market is/are

   a. Risk due to variability in returns due to changed investors' expectations
   b. Financial risk
   c. Inflation risk
   d. Business risk
   e. Both (a) and (c) above.

3. Coefficient of determination is used to calculate

   a. Beta
   b. Systematic risk of a security
   c. Unsystematic risk of a security
   d. Undiversified risk of a security
   e. Both (b) and (d) above.

4. What are residual uncertainty risks?

   a. Increased precautions and limits on the risk activities.
   b. The risks that remain still uncovered, after majority of the risks are eliminated.
   c. Risks of re-occurrence of eliminated risks.
   d. They refer to contractual risk transfers.
   e. All of the above.

5. Which of the following techniques of measuring risk distinguish between the downside movements and the upside movements?

   a. Variance.
   b. Standard deviation.
   c. Range.
   d. Value at Risk.
   e. None of the above.

6. What are critical risks for a firm?

   a. Those which result in bankruptcy of the firm.

   b. Those which may result in losses which the firm may easily bear in the normal course of business.

   c. Those which result in financial distress.

   d. Those which result in both bankruptcy and financial distress.

   e. None of the above.

7. An "out-of-money" swaption is valued at

   a. Zero

   b. Variable rate (prime + 1/2%)

   c. Nominal rate

   d. Fixed swap rate

   e. Prime rate.

8. Which of the following asset type is not supported by Credit Manager Software?

   a. Letter of credit.

   b. Swaps.

   c. Credit derivatives.

   d. Forwards.

   e. None of the above.

9. Pricing of weather related options are done by

   a. Simple probability distribution pricing

   b. Gauss' distribution pricing

   c. Binominal pricing

   d. Both (a) and (b) above

   e. All of the above.

10. Which of the following statements is false?

    a. The value of the call option decreases with increase in the stock price.

    b. The value of the put option decreases with increase in the stock price.

    c. The value of call option increases with decline in strike price.

    d. The smaller the "time to expiration", the higher the option price.

    e. Both (a) and (d) above.

11. A synthetic short position in futures can be created by

    a. Long put option + Long call option

    b. Long put option + Short call option

    c. Long call option + Short call option

    d. Long call option + Short put option

    e. None of the above.

12. What does the following quote imply? C ($110, $95, 0.5) = $18.57

    a. A call option with a strike price 95 and spot price 110 has 1/2 a year to maturity and is trading at a premium of $18.57.

    b. A call option with a spot price of the underlying asset $95 strike price 110 and has 6 months to maturity with a price of 18.57.

    c. A call option with an exercise price at $95 and is trading at $110 and it has 6 months to maturity with a price of $18.57.

    d. A call option with an exercise price at $95 and a current value of $110 and has 1/2 a month to maturity with a price of $18.57.

    e. None of the above.

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13. When a trader sells a call, if the call expires without being exercised, the gain is a

    a. Long-term gain if the position is held for more than a year

    b. Short-term gain always

    c. Short-term gain only when it is held for less than a year

    d. Equals the price of the option

    e. Both (b) and (d) above.

14. If an option is in the money, the initial margin requirement is

    a. 100% of the proceeds from selling the option

    b. 80% of the proceeds from selling the option

    c. 100% of the proceeds from selling the option + 20% of the value of the underlying stock

    d. 80% of the proceeds from selling the option + 25% of the value of the underlying stock

    e. 90% of the proceeds from selling the option + 10% of the value of the underlying asset.

15. Other factors determining the price of an option remaining constant, which of the following is/are true?

    i. An increase in assets' current price increase the call premium of the option.

    ii. An increase in strike price increases the call premium.

    iii. An increase in time to expiration increases the call premium.

    a. Only (i) is true.

    b. (i) and (ii) are true.

    c. (ii) and (iii) are true.

    d. (i) and (iii) are true.

    e. All of (i), (ii) and (iii) are true.

16. Which of the following is/are true in the case of a call option?

    i. The loss of intrinsic value from a downside price movements is strictly limited to the holders of the option.

    ii. The loss of intrinsic value from downside price movement is unlimited, to the holder of the option.

    iii. There is no limit to the upside potential if there is a downside price movement, to the holder of the option.

    IV. An option cannot take a value beyond its intrinsic value.

    a. Both (i) and (iii) above.

    b. Both (ii) and (iii) above.

    c. Both (ii) and (iv) above.

    d. (ii), (iii) and (iv) above.

    e. (i), (iii) and (iv) above.

17. Which of the following is not a property of Black-Scholes Formula?

    a. When the stock price 'S' becomes very large, the call option is exercised.

    b. When the stock price becomes very large, price of a European put option 'p' approaches zero.

    c. As σ tends to zero, the put price is max $(Xe^{-r(T-t)} - S, sigma)$.

    d. As σ tends to zero, the call price is max $(Xe^{-r(T-t)} - S, sigma)$.

    e. None of the above.

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18. The compound option

    a. Will be exercised on the first exercise date always

    b. Will be exercised on the second exercise date always

    c. Will be exercised on the first exercise date only if the value of the option on that date is greater than the first strike price

    d. Will be exercised on the first exercise date only if the value of the option on that is greater than the second strike price

    e. None of the price.

19. Which of the following is/are true?

    a. If you pay fixed in a callable swap, you are short in the option.

    b. If you received fixed in a callable swap, you are long in the option.

    c. If you pay floating in a putable swap, you are short in the option.

    d. If you receive floating in callable swap, you are long in the option.

    e. If you receive floating in a putable swap, you are short in the option.

20. Which of the following statements is true in respect of quality spread and swap spread?

    a. Quality spread will be always more than the swap spread.

    b. Quality spread will be always less than the swap spread.

    c. Quality spread depends on the credit rating of entity planning to borrow in the market and swap spread depends on the transaction cost of the market maker on the swap market.

    d. Quality spread depends on the liquidity in the market and swap spread depends on credit rating.

    e. There is no difference between quality spread and swap spread.

21. Which of the following is/are example(s) used for basis swap(s)?

    a. A promises to pay B 3-month LIBOR in return for 3-month treasury bill rate.

    b. A promises to pay B 3-month LIBOR in return for 6-month LIBOR.

    c. A promises to pay B 3-month LIBOR + 1 in return for 6-month LIBOR.

    d. Both (a) and (b) above.

    e. All of the above.

22. An X x Y cancelable swap is a

    a. X year swap that can be terminated Y years hence

    b. X year swap that can be terminated X – Y years hence

    c. X year swap that can be terminated X + Y years hence

    d. Y year swap that can be terminated X years hence

    e. Y year swap that can be terminated Y – X years hence.

23. In the context of swap, warehousing is

    a. A mechanism in which the swap dealer enters into a swap with one party without having a counterparty for the transaction

    b. A mechanism of hedging the risk emanating from swap transaction

    c. A method used to price a swap

    d. A method of hedging interest rate risk with interest rate swap

    e. A method of hedging Asset Liability Management risk with interest rate swap.

24. A manufacturer borrowed $15 million at 6% for four years. The principal amount which is drawn in three equal installments, needs to be paid in five annual installments starting from end of first year as follows:

End of 1 year	1 million
End of 2 year	2 million
End of 3 year	3 million
End of 4 year	4 million
End of 5 year	5 million

The manufacturer wants to enter into fixed to floating swap. Which of the following will match the cash flows of the manufacturer?

a. Accreting swap.

b. Amortizing swap.

c. Roller coaster swap.

d. Forward swap.

e. None of the above.

25. In the case of Futures contract, the risk of default is faced by

a. Buyer of the contract

b. Seller of the contract

c. Clearing agency

d. Both (a) and (b) above

e. All of (a), (b) and (c) above.

26. The number of futures contracts which have been traded already but pending for delivery is called

a. Open interest

b. Close interest

c. Volume

d. Due volume

e. None of the above.

27. Which of the following statements is true, if the underlying asset has a strong positive correlation with interest rates?

a. When interest rate rises, long futures position gains.

b. When interest rate falls, long futures position gains.

c. When interest rate is steady, short futures position gains.

d. When interest rate falls, short futures position falls.

e. None of the above.

28. Which of the following statements is true? It is desirable to

a. Increase liabilities in hard currencies

b. Decrease liabilities in soft currencies

c. Increase assets in hard currencies and decrease liabilities in soft currencies

d. Decrease liabilities in hard currencies and increase assets in soft currencies

e. Decrease assets in hard currencies.

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29. A synthetic short position in futures can be created by

   a. Long put option + Long call option

   b. Long put option + Short call option

   c. Long call option + Short call option

   d. Long call option + Short put option

   e. None of the above.

30. Surrender value of an insurance policy is the amount which the insurer is willing to pay to the insured

   a. To settle a claim

   b. If the policy is discontinued

   c. To settle the policy on maturity

   d. After the first five years of the policy

   e. To shift to another policy.

Part B: Problems (50 Points)

Solve all the problems. Points are indicated against each problem.

1. A speculator expects steep movements in the exchange rate of dollar against the Rupee from the current level of Rs.44.50 in the next three months. He is not sure of the direction in which the price change may take place. He wants to adopt a strategy suitable for his view. The following is the information relating to three month options on the dollar:

Call options		Put options	
Strike price (Rs./$)	Premium (Paise)	Strike price (Rs./$)	Premium (Paise)
44.25	55	44.25	5
44.50	25	44.50	10
44.75	5	44.75	60

The speculator believes that increase in the exchange rate is as likely as its decreases. You are required to

   a. State the strategies the speculator may adopt.

   b. Calculate the maximum loss the speculator may incur if his expectations do not come true, for each of the strategies mentioned in (a) above.

   c. Calculate the break even price(s) for each of the strategies mentioned in (a) above.

   d. Indicate the maximum profit that can be earned from each of the strategies mentioned in (a) above.

(2 + 2 + 4 + 4 = 12 points)

2. Consider the following information relating to the borrowing requirements of three companies and the interest rates payable by them in different markets:

	ATL	BLL	CPL
Objective	Fixed £	Floating £	Floating $
Fixed $	6.00%	5.75%	6.50%
Floating $	Libor + 0.50%	Libor + 0.10%	Libor + 0.30%
Fixed £	8.00%	7.75%	7.50%
Floating £	Libor + 0.30%	Libor + 0.50%	Libor + 0.75%

Show how the three companies can reduce their borrowing costs and achieve their objectives by doing a swap. Assume that the gains from the swap are shared equally.

(12 points)

3. Four-month options on a stock whose current market price is Rs.30 are being traded at an exercise price of Rs.29. The volatility of the stock price is 25% per annum. A dividend of Re.0.50 is expected from the stock in two months from now. The risk-free rate of interest is 10%. What is the price of the option if it is a European call.

(10 points)

4. A highly diversified portfolio is currently worth Rs.10 lakh and has a beta of 1.0. The BSE Sensex is currently at 4000. Show how a (hypothetical) put option on the BSE Sensex with a strike price of 3800 can be used to provide portfolio insurance. Assume that each option is for 10 times the value of the index.

(8 points)

5. The current market price of a stock is Rs.19. Three month European call and put options are trading on the stock at an exercise price of Rs.20 and a premium of Rs.3. The risk-free interest rate is 10%. The stock is expected to pay a dividend of Rs.1.00 in one month from now. Is there any scope for arbitrage profits in this situation? Explain how it can be exploited.

(4 + 4 = 8 points)

Part C: Applied Theory (20 Points)

Answer the following questions. Points are indicated against each question.

1. "There are a number of instruments and tools available for management of risk and each instrument has to be used for hedging a particular risk." What are the guidelines for risk management that are to be borne in mind?

(10 points)

2. "Recently, SEBI has authorized mutual funds to trade on derivatives, subject to appropriate disclosures". Enumerate the latest developments in the Indian derivative markets.

(10 points)

Paper II

Time: 3 Hours   **Points: 100**

Part D: Case Study (50 Points)

Read the case carefully and answer the following questions.

1.   With the given information, analyze and compute the net arbitrage profit or loss of Mr. Ashok Patel.

(10 points)

2.   What are synthetic foreign currency contracts?

(15 points)

3.   Explain the meaning of TED spread.

(10 points)

4.   Discuss briefly the salient features of index futures.

(15 points)

Mr. Ashok Patel is a money manager with a medium sized money management company in the US, Echelin Inc. He is in-charge of the fixed securities division. Given the fact that Mr. Ashok is an Indian, he would like to invest in India and try to earn some net arbitrage profits which are higher than the returns on fixed deposits in the US.

Mr. Ashok knows that the current rate on fixed deposits in India, which are fully secured is 10% p.a. and the same is only 4.75% p.a. in the U.S. The rate of exchange as on August 8, 20x1 is Rs.46.45/$. He is planning for an investment of about 4 months (120 days) maturing on December 6, 20x1 and would like to allocate an amount of $2,000,000.00 for the investment.

His calculations show that the exchange rate is quite stable now and is expected to touch Rs.47.00/$ by December 6, 20x1 and under no circumstance is bound to cross this rate. On December 6, 20x1, the rate happens to be Rs.46.98/$.

Part E: Caselets (50 Points)

Caselet 1

Read the caselet carefully and answer the following questions.

1.   What benefits do you think the trading of futures will bring to the Indian markets?

(7 points)

2.   Discuss briefly the main difference between exchange traded derivatives and over the counter traded derivatives.

(7 points)

The proven benefits of derivatives worldwide notwithstanding, many doubts surround the introduction of derivatives trading in Indian market. First among them is that the Indian market is not yet in a position to embrace derivatives. The reality is that the Indian stock market has undergone many qualitative changes over the last decade. The developments that took place have brought the Indian market on par with the developed markets abroad. Improved trading and settlement systems, demat, risk containment measures at the bourses, state-of-the art technology being used et al, are the factors that drastically transformed the face of Indian markets. It is worth noting that all the shares that form part of both Sensex and Nifty are now in demat form. Having studied the state of the securities market, the LC Gupta Committee had recommended phased introduction of derivative instruments. The recommended sequence is index futures, index options and options on stocks.

While the market may not satisfy all the prerequisites for derivatives trading, it is also necessary to look at the opportunitity cost of not putting a derivatives market in place. Derivatives based on Indian securities or indices could develop outside, to help the players who are denied that opportunity in the Indian markets.

To a large extent, misconceptions about derivatives are a fallout of the derivative horror stories such as Bearings and LTCM. Media has often portrayed derivatives as demons and disaster vehicles. A recent report of NSE likens derivatives disasters to sporadic aircraft crashes which catch more attention than the fact that many aircraft fly safely everyday. The report says, "We do not abandon flying just because it has a remote possibility of crash. We build-up systems to avoid recurrence of such crash".

While derivatives are contracts that derive their existence from the underlying assets, because of the ease of trade, they have the potential to reach huge proportions. Since derivatives also suffer from risks, as do the underlying securities, derivatives need to be handled cautiously on account of sheer size. These characteristics make derivatives double-edged swords. This drives home the importance of adequate regulation that takes care of the concerns associated with derivatives trading.

Studies of the derivatives disasters have shown that, the disasters emanated from the way they were used rather than from derivatives per se. While most of the derivatives disasters were fallout of lack of sufficient internal controls, the recent LTCM fiasco was on account of hedge funds' managers' greed for high returns. The case of Barings and Daiwa banks were associated with the failure of internal controls. The OTC type of deals tend to be opaque and devoid of safety mechanism like margining and proper regulatory framework. On the contrary, exchange-traded derivatives market offers a transparent and regulated form of trading as compared to the OTC markets.

Caselet 2

Read the caselet carefully and answer the following questions.

1. Explain in simple words the concept of Value at Risk.

(7 points)

2. What are the main disadvantages of Value at Risk?

(8 points)

Finance is essentially about the valuation of uncertain cash flows in the future. Dealing with this uncertainty, and the relationship between risk and return, is the basic challenge faced by everyone in finance, whether in banking or fund management or securities.

Traders and firms need to be extremely careful when dealing with risk. Some amount of risk is inescapable, for otherwise the average returns would be extremely low. Some kinds of risk do not yield higher returns, and are just not worth bearing. Risk and return have to be thought out at the portfolio level, whereas many people are instinctively used to looking at individual securities.

The risk of overall portfolio has to be calibrated to suit the risk tolerance of the principals, and maximize the average returns that can be attained by these levels of risk. This is not a simple challenge.

Traditionally, coping with risk has been done by pure intuition. This is becoming increasingly hard given the complexity of the modern financial system, and the competitive pressures generated by 'quantitative' firms. There is considerable body of per-scientific "flok medicine" which is widely used in finance. This has generated many disasters, some of which have made front page news.

One of the most difficult facets of risk in the financial sector is the relationship between shareholders and managers. The owners of a finance company need to define a "risk policy" which the managers that they hire should obey.

If risk and return lie at the heart of finance, then shareholders need to locate the firm on the risk-return trade-off, and ensure that managers cater to the choices of the shareholders. The definition of risk policies in this context requires an explicit specification of risk. This gives an impetus for a more explicit treatment of risk using modern financial economics.

In recent years, the notion of "Value at Risk" (VaR) has come into prominence as a tool towards the risk measurement. In order to measure the risk of a portfolio in terms of its VaR, we need to specify two things: (a) a horizon and (b) a probability level.

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Hence, there is no such thing as a single VaR, instead there is a different VaR for different time horizons and for different probability levels. The VaR at a 99 percent level on a one-day horizon is the one-day loss that will only be exceeded on 1 percent of the days. Similarly, the VaR at a 95 percent level on a one-week horizon is the one-week loss that will only be exceeded on 5 percent of the time period.

If we assume there are 250 trading days a year, a 1 percent VaR on a one-day horizon is the loss that will be exceeded for two to three days a year. If Nick Leeson's supervisors had known the one-day VaR of his positions, they would have allowed these positions.

Thus, the notion of VaR reduces the total risk of an entire portfolio – and not an instrument – into a numerical measure of the losses that will be experienced on bad days on the portfolio. VaR has one great advantage; managers can understand and comprehend it. The chairman of a company can discuss the drafting of a risk policy in terms of VaR, even if he is not familiar with advanced financial economics.

To be sure, the implementation of systems to measure VaR requires advanced financial economics. But the beauty of VaR is that the output that comes out of its implementation is comprehensible. When we deal with complex combinations of spot equity, index futures, index options, forward positions on the currency market, etc., the creation of a VaR system is technically demanding. Yet, any manager would know that something is amiss when the 95 percent VaR on a one-day horizon of position exceeds the net worth of the company.

VaR is measured at a portfolio level. It is not about any one instrument, it is about the total risk of a portfolio. It is not particularly meaningful to ask: "What is the VaR of the September Nifty futures". The idea of VaR correctly focuses upon the bottom line: The risk of the portfolio as a whole.

VaR is closely connected with initial margin requirements of clearing corporations. The initial margin is supposed to be large enough to cope with one-day losses on most days. At the Chicago Mercantile Exchange, initial margin is normally set at a 95 percent VaR on a one-day horizon. Once again, portfolio analysis is important: It is not possible to assign an initial margin to each futures contract and obtain the total risk of the portfolio by summing up.

A portfolio "buy August futures and buy September futures" is very different from a portfolio "buy August futures and sell September futures". The first position is speculation on both prices rising. The second position is hedged, it has no price exposure, and has a much lower VaR.

Regulators have long been interested in risk measurement with the objective of limiting the leveraged positions that are adopted. The leverage of banks is limited by the Basle norms. These norms are naive in that they do not use portfolio analysis. VaR ideas would yield better prudential regulations for banks.

In the securities industry, VaR is starting to be adopted by many regulators. In India, the LC Gupta Committee on exchange-traded derivatives has refrained from micro-managing markets as far as specifying margins are concerned; instead the committee recommends that SEBI should ensure that the collateral pledged with the clearing corporations always exceeds the 99 percent VaR on a one day horizon (this is more stringent than requirements in the US, which typically target the 95 percent VaR on a one-day horizon).

Caselet 3

Read the caselet carefully and answer the following questions.

1. Briefly elaborate on the concept of Executive Equity Swaps.

    (8 points)

2. Discuss the working of this kind of Swap.

    (6 points)

3. Discuss the main limitations of the swap markets.

    (7 points)

Equity swaps first appeared in the 1980s as equity index swaps. The basic form of an equity swap can be used by persons outside or inside a firm. Let us consider a simpler application of an equity swap. Suppose a pension fund has $1 million to invest in equity for three years. Instead of investing directly in equity, the pension fund may decide to invest in fixed rate debt and enter into an equity swap to reap the benefit of equity investment indirectly, without actually investing in equity.

To do this, the pension fund can purchase a $1 million face value, three-year corporate debt with a coupon rate of 9 percent and currently priced at par. At the same time, the pension fund enters into an equity swap with an equity swap dealer. The swap might call for the pension fund to pay the swap dealer 8.5 percent annually in exchange for the return on the S&P 500. Both payments are calculated on the basis of a notional principal amount of $1 million. Importantly, the swap dealer pays the pension fund when the equity return (S&P 500) is positive but the pension fund pays the swap dealer when the equity return is negative (this latter payment is in addition to the 8.5 percent it pays the swap dealer).

It is obvious that this strategy results in a return to the pension fund equal to S&P 500 return plus 50 basis points. It is also obvious that the net effect is to create the equivalent of an equity position for the fund. Equity swaps can also be used to exchange index to index returns, e.g. a swap may provide for the exchange of higher of two indices such as S&P 500 or the Nikkei 225 index. Swaps such as those described above have been in use for quite some time. But the executive equity swap is the latest innovation of financial engineers.

Here is how the executive equity swap works – an officer or director of a company (let us call him Ashok) enters into a bilateral agreement with an investment or commercial bank. In this agreement, Ashok agrees to swap the total returns from his stock (dividends and capital appreciation) in return for a fixed or floating return pegged to a benchmark rate like LIBOR or a broad-based market index, less annual commission/fee. In addition, the bank makes good any negative return on the stock due to depreciation of the stock price. The agreement may provide for either periodic settlement or terminal settlement. The stock is deposited with the investment or commercial bank, which assumes the role of a dealer. The underlying assets are notional as is the case with any other form of swap, therefore, executive equity swaps do not result in the sale of shares. As a consequence, capital gains taxes are delayed.
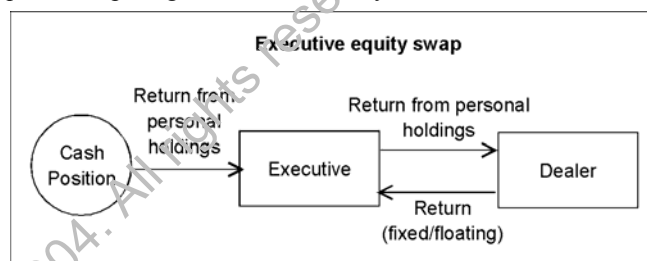
The significant feature of the executive equity swap is that, for the term of the contract the executive is immune from price risk. If the price falls, the diminished wealth is replenished by the bank. If the price appreciates, it is passed onto the bank. The net effect is that Ashok has swapped a concentrated stock position for an alternative investment.

The other motivating factor can be tax arbitrage. Since there is no true sale of stock, Ashok avoids the immediate capital gains tax on appreciated shares and thus defers tax liabilities. The time value of delaying the tax liability, which can be further magnified, because often, short-term gains that would have been taxed as ordinary income are converted into long-term gains taxed at the much lower long-term rate.

To illustrate the economic importance of this, suppose Ashok who purchased the firm's stock for Rs.69 which is now trading for Rs.75 might decide to sell. If one lakh shares are sold immediately, Ashok would be facing a Rs.2.4 lakh (Rs.6 lakh times the current short-term capital gains rate of 40 percent, assuming he is in the tax bracket of 40 percent) tax bill today. In contrast, if he enters into an equity swap, locking in the Rs.6 per share gain, he would pay Rs.1.2 lakh (Rs.6 lakh times the current long-term capital gains tax rate of 20 percent) in taxes at the maturity of the swap. The present value of the tax bill would be further reduced by one-fourth (i.e. Rs.0.745 lakh) with the swap, assuming an annual discount rate of 10 percent and a swap term of 5 years (Rs.1,20,000 x (1.1^{-5})).

The dealer's motivation is typically the commission, fees or spread earned from the deal. The risk of the resulting transaction is then assessed in a portfolio context (the bank can have a portfolio of such deals which result in diversification of risk).

From an agency perspective, executive stock options are regarded as tools to minimize the agency costs. The managers having a stake in the business they manage, find themselves in the shoes of owners, and, therefore, less likely to take decisions which conflict with those of stockholders' interests.

But the ingenuity of financial engineers, however, seems to affect the efficacy of stock options for the executive equity swaps allow managers to reimpose agency costs on the firm by reducing the correlation of their personal wealth with shareholder wealth, which enhances the potential for self-serving decision-making. This is due to the fact that, cash flow rights are swapped but ownership rights are not. An executive can sell the cash flows associated with the stock while retaining ownership and voting rights.

Model Question Paper 5

Suggested Answers
Paper I

Part A: Basic Concepts

1. *(c)* The off-balance sheet items such as guarantees, letters of credit, underwriting commitments, etc., give rise to contingency risk.

2. *(e)* Financial risk and Business risk are firm specific. They do not affect all the securities in the market. Inflation risk and risk due to variability in returns due to changed investors' expectations affect all the securities equally because they are not firm specific.

3. *(e)* Co-efficient of determination is used to calculate systematic risk of a security as well as the undiversified risk.

4. *(b)* Residual uncertainty risks are risks, which remain still uncovered, after majority of the risks are eliminated.

5. *(d)* Value at Risk distinguishes between the downside movements and the upside movements.

6. *(a)* Critical risks are those, which result in bankruptcy of a firm.

7. *(a)* An out-of-money swaption is valued at zero.

8. *(e)* Credit Manager Software supports all the mentioned instruments.

9. *(d)* The following two methods are generally used to price weather related options: (i) Simple Probability Distribution Pricing, and (ii) Gauss' Distribution Pricing.

10. *(d)* Higher the time to expiration, the value of call and put option increases.

11. *(b)* A short call option when combined with a long position in the asset (here currency), it results in a synthetic short put option. Therefore, long put option + short call option i.e., it results in the pay-off of a put option writer.

12. *(a)* $C(S, X, T) = P$. It means that the call option has an exercise price of X, stock price of S and 'T' months to maturity, which is trading at a premium of P.

13. *(e)* If the holder of the option does not exercise the option, and if the call expires, then the option seller gains to the extent of the price of the option. The gain is a short-term gain.

14. *(c)* If the option is in-the-money, margin = premium x 100 + 0.2 x market price (assuming there are 100 shares in the lot).

15. *(a)* The value of the call option increases with increase in the stock price and it decreases with a decrease in the stock price. The value of the put option decreases with increase in the stock price, and it increases whenever stock price declines. The value of the call option increases with decline in strike price and it decreases with increase in strike price. The longer the "time to expiration", the higher the option price.

16. *(a)* In the case of a call option, the holder can exercise the option only if the market price is more than the exercise price. If the option is exercised, the profit made by the option holder is unlimited. If the option is not exercised, his loss is limited to the premium.

17. *(d)* When tends to zero, the put price is the max $Xe^{-r(T-t)} - S$ and not the call price.

18. *(c)* Compound options are basically options on options. Few examples of compound options are captions, floors, and swaptions. They can be exercised only on the first exercise date and the value of the option on that date should be greater than the first strike price.

19. *(c)* A callable swap gives the holder the right to terminate the swap at any time before its maturity. A putable swap gives the seller of the swap to terminate the swap at any time before its maturity. In a callable swap, the fixed rate payer is long, and in a putable swap, the floating rate payer is short.

20. *(c)* Quality spread is the difference between borrowing power of two parties in the market. This mostly arises because of the difference in the credit ratings of the two firms. The average of bid and ask rates exchanged for floating is referred to as the swap rate. The average excess of the fixed rate in a swap agreement over the corresponding risk-free rate is known as swap spread. It depends on the supply and demand for fixed and floating rates in the market.

21. *(e)* Basis swaps are used to hedge basis risks. Basis risk is the risk arising from uncertainty about the basis (futures price – current price) at a future time. All the given alternatives are examples of basis swaps.

22. *(d)* Under a cancelable swap, one party to the swap (or sometimes both) has the right to cancel a swap under certain circumstances. It allows customers to fix the net interest expense of their floating rate loans at a fixed rate below that which is currently available for a standard interest rate swap. In an X x Y cancelable swap, a Y-year swap is cancelable after X years.

23. *(a)* Most of the times, it takes time to match the swap offer of one company with the requirements of the other. Many financial institutions (swap dealers) benefit from this situation by entering into a swap with the offering company and hedging the interest risk till counterparty is found. This is known as Warehousing

24. *(a)* Accreting swaps can be used to convert floating rate payments into fixed rate payments if the principal amount increases every time additional loan is availed. Generally loans on some huge infrastructure projects are given in installments and the interest payments are made in the increasing loan amounts. Since here the principal is repaid in increasing installments, it is an accreting swap.

25. *(c)* In the case of futures contracts, the risk of default is faced by the clearing house.

26. *(a)* Open interest represents the number of outstanding futures i.e. the number of futures contracts that have to be settled on or before the maturity date.

27. *(b)* Hedging with interest rate futures can be of two types: (i) a rise in the interest rate can be executed by selling or going short in interest rate futures. (ii) a fall in the interest rates can be executed by buying or going long in interest rate futures.

28. *(c)* Hard currency is one, which is appreciating, and a soft currency is one, which is depreciating. Therefore, assets should be increased in hard currencies and liabilities should be decreased in soft currencies.

29. *(b)* A short call option when combined with a long position in the asset (here currency), it results in a synthetic short put option. Therefore, long put option + short call option i.e., it results in the pay-off of a put option writer.

30. *(b)* Surrender value is paid when the policy is discontinued.

Part B: Problems

1. a   The strategies are straddle and strangle

   b.   Straddle: Total premium paid = 0.25 + 0.10 = Re.0.35 per dollar

         Strangle: Total premium paid = 0.05 + 0.05 = Re.0.10 per dollar

   c.   Straddle: Break even price:

         i.   Strike price – Premium = 44.50 – 0.35 = 44.15

         ii.   Strike price + Premium = 44.50 + 0.35 = 44.85

Strangle: Break even price

i.   Higher strike price + Premium = 44.75 + 0.10 = 44.85

ii.   Lower strike price – Premium == 44.25 – 0.10 = 44.15

d.   Straddle:

i.   Unlimited profit on upward movement

ii.   Limited to 44.50 – 0.35 = 44.15 per dollar on downward movement

Strangle:

i.   Same as straddle on upward movement

ii.   Limited to 44.15 on downward movement.

Note: A long butterfly strategy is also suitable, but it needs more funds.

2.   The borrowings are to be made as follows:

Floating $ = BLL

Fixed £   = CPL

Floating £   = ATL

Total saving   = (L + 0.30 – L – 0.10) + (8.00 – 7.50) + (L + 0.50 – L – 0.30)

= 0.20 + 0.50 + 0.20 = 0.90%

The swaps can be arranged as follows:

i.   ATL borrows floating £ at L + 0.30%, lends them to BLL at L + 0.20 and borrows floating $ from BLL at L + 0.10%.

ii.   ATL borrows floating $ from BLL at L + 0.10%, lends them to CPL at L + 0.10% and borrows fixed £ from CPL at 7.60%.

iii.   BLL borrows floating $ at L + 0.10%, lends them to ATL at L + 0.10% and borrows floating £ from ATL at L + 0.20%.

iv.   CPL borrows fixed £ at 7.50%, lends them to ATL at 7.60% and borrows floating $ from ATL at L + 0.10%.

Cost to ATL: –(L + 0.30) + (L + 0.20) – (L + 0.10) + (L + 0.10) – (7.60)

= – 0.10 – 7.60 = –7.70

Saving   = 8.00 – 7.70 = 0.30%

Cost to BLL: –(L + 0.10) + (L + 0.10) – (L + 0.20) = –(L + 0.20)

Saving   = (L + 0.50) – (L + 0.20) = 0.30%

Cost to CPL: –7.50 + 7.60 – (L + 0.10) = + 0.10 – (L + 0.10) = – L

Saving   = (L + 0.30) – L = 0.30%.

3.   The dividend should be discounted for two months, as it is due in two months.

Present value of the dividend $= 0.50 \times e^{-0.10} \times \dfrac{2}{12} = 0.49$

Adjusted stock price = 30 – 0.49   = 29.51

$C \quad = S_0 N(d_1) - N(d_2)$

$$d_1 = \frac{\ln\left(\dfrac{S_0}{E}\right) + \left(r + \dfrac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

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$$d_2 = d_1 - \sigma\sqrt{t}$$

$$d_1 = \frac{\ln\left(\dfrac{29.52}{29}\right) + \left(0.10 + \dfrac{0.25 \times 0.25}{2}\right)\dfrac{4}{12}}{0.25 \times \sqrt{\dfrac{4}{12}}} = \frac{0.0178 + 0.0438}{0.1443} = 0.4269$$

$N(d_1) = 0.6628 + 0.69\,(0.6664 - 0.6628) = 0.6653$

$d_2 = 0.4269 - 0.25 \times \sqrt{\dfrac{4}{12}} = 0.2826$

$N(d_2) = 0.6103 + 0.26\,(0.6141 - 0.6103) = 0.6113$

$C = 29.51 \times 0.6653 - \dfrac{29}{e^{0.10 \times \frac{4}{12}}} \times 0.6113$

$= 19.63 - 17.15 = 2.48$

The price of a European call $=$ Rs.2.48.

4. The portfolio is now worth 250 times the index. It is necessary to buy 25 put options on the sensex with a strike price of 3800 to issue the portfolio against loss in value below 3800.

If the sensex falls to 3700,

Loss on the portfolio $= \dfrac{10,00,000}{4,000}\,(4,000 - 3,700) = 75,000$

Gain on the option $= 100 \times 10 \times 25 = 25,000$

Loss $= 75,000 - 25,000 = 50,000$

Thus, a put option on the index immunizes the portfolio against all losses below 3,800.

5. Value of call $=$ Rs.3.00

Value of put should be: $C + D + E \times e^{-rt} - S$

$= 3.00 + 1.00 \times \times e^{-0.10 \times \frac{4}{12}} + 20 \times e^{-0.10 \times 0.25} - 19$

$= 3 + 0.99 + 20 \times 0.9753 - 19 = 4.50$

The price of the put should have been Rs.4.50, while it is only Rs.3.00. So arbitrage profits can be made by shorting a put, shorting one stock and buying a call.

Part C: Applied Theory

1. **Guidelines for Risk Management:** There are a number of instruments and tools available for management of risk. While going through the risk management process in general, and deciding the instrument to be used for hedging a particular risk, the following guidelines need to be kept in mind:

- **Common goal of risk management and financial management:** The overall goal of financial management is to create shareholder wealth. Shareholder's wealth is created by undertaking projects which generate a positive Net Present Value. Thus, the final goal of risk management should be to make sure that funds for such investments are available at the appropriate time.

- **Proper mix of risk management techniques:** No risk management can be complete or fool proof in itself. A firm has to ensure that it employs the most optimum mix of risk control, risk prevention, risk transfer and risk retention, as also that of various internal and external hedging techniques.

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- **Proactive risk management:** There are a number of uncertainties involved in the financial and commodities markets. Continuous change in interest rates, exchange rates, commodity prices, economic variables and external environment is a reality. Though it is not possible to accurately predict the movement of these variables, the risk manager needs to make an attempt to forecast the same. These forecasts should be used for management of risks. Risk management cannot be done after the happening of an event, it has to be done in its anticipation.

- **Flexibility:** The risk management strategies should not be too rigid. They should be flexible enough to allow the risk manager to make the most appropriate decision according to the circumstances.

- **Bringing risk to the optimal level**: The process of risk management should aim at maintenance of risk at the level which is optimal according to the risk bearing capacity of the firm. While a firm should not be exposed to risks which may result in its liquidation, the aim of risk management is not to completely eliminate risks.

- **Risk substitution:** A firm needs to be aware of the fact that generally risk management techniques do not eliminate the risk completely, but substitute it by another kind of risk. For example, when a company deals in futures contracts, the risk is not completely eliminated, but is replaced by basis risk. So essentially, a firm trying to manage its risks is only exchanging certain unacceptable risks for other risks which are more acceptable to it. A firm needs to remember this fact while managing its risks.

2. Latest Developments in India.

Recently, SEBI has authorized mutual funds to trade on derivatives, subject to appropriate disclosures. The guidelines permit derivative trading for hedging and portfolio balancing.

The positions of the mutual funds in the derivative markets will have to be fully protected (covered) by holding underlying securities/cash and cash equivalents/options and/or obligations to require the underlying assets to honor the obligations contracted in the derivatives market.

Since derivatives can be used by the mutual funds as a risk management tool, up to 100% of scheme's net assets, in the debt component, can be used for derivative trading.

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Paper II

Part D: Case Study

1. With the given information, analyze and compute the net arbitrage profit or loss of Mr. Ashok Patel.

	Cash Flows
August 8, 20x1	
1. Borrow $2,000,000 at 4.75% p.a. for 120 days	$2,000,000.00
2. Convert the borrowing of $ into Rs. at the given rate of Rs.46.45/$.	Rs.92,900,000.00
3. Invest the proceeds in Rs. F.D. in India	
4. Sell Rs. forward on a maturity on December 6, 2001. The amount of the forward should be the interest and the principal in Rs.	
December 6, 20x1	
5. On maturity receive the interest and principal from the Indian bank. The total amount is Rs.92,900,000.00 (principal) Rs.3,054,240.00 (interest)	Rs.95,954,240.00
6. Convert the Rs. back to US at the current rate which happens to be Rs.46.98/$	$2,042,448.70
7. Repay the US loan together with interest @4.75% p.a. for 120 days. The total amount payable is Rs.2,000,000.00 (principal) Rs.32,232.88 (interest)	$2,032,232.88
8. Net arbitrage profit (6 - 7)	$10,215.82

This net arbitrage profit is without considering the exchange rate commissions payable.

2. Let us take a simple example to understand this.

Assume that there are market expectations that the Australian dollar may depreciate in comparison to the Swiss Franc. A money manager can sell Australian dollar futures while simultaneously buying Swiss Franc futures, thus assuring a future exchange rate between the two said currencies. This can be depicted easily through a simple equation:

$F_{t,T}$ (SFr/AUD) = $F_{t,T}$ ($/SFr)/ $F_{t,T}$ ($/AUD)

The money manager will see real benefits only in the following situations:

i. Both the Australian Dollar and the Swiss Franc depreciate in relation to the US Dollar, but the Australian Dollar depreciates more.

ii. Both the Australian Dollar and the Swiss Franc appreciate in relation to the US Dollar, but the Swiss Franc appreciates more.

iii. The Swiss Franc appreciates and the Australian Dollar depreciates, both in relation to the US Dollar.

Obviously in the first two cases, the money manager will lose on one of the transactions and gain in the other, but he can expect a net gain in the deal.

3. TED Spread is the difference between the price of a 3-month T-bill futures contract and a 3-month Eurodollar time deposit futures contract, both expiring on the same day. Given the fact that the T-bills are less risky than Eurodollars, the TED spread varies considerably over the life of the futures contracts. The T-bills being guaranteed by the US government are less risky than the guarantee given by the commercial banks issuing the Eurodollar time deposits.

4. i. The most important feature of the index futures contracts is that these contracts are cash settled; there is usually no delivery of the underlying stocks or stock certificates, as matching the physical stocks as per the index may be quite difficult and costlier than settling the contract by cash.

    ii. An investor can either buy or sell an index futures contract. When an investor goes long in the index futures contract, he will receive a cash settlement on the expiration date, if the closing price exceeds the contract price. On the other hand, if the closing price is less than the contract price, the investor will be required to pay the difference.

    For example, if the investor has bought the S&P 500 Index Futures at 350 and on the expiration day the value of the contract is 360, the investor will receive $5,000 [(360 – 350) x 500]. On the other hand, if the index closes at 340, on the expiration date the buyer will be required to pay the difference of $5,000.

    An investor going short on the index futures contract stands to gain (lose) if, on the expiration day, the value of the index is less (more) than the contracted value. In our example, the investor going short on S&P 500 index futures at 350 will receive a sum of $5,000, if the index closes at 340 on the expiration day and will be required to pay $5,000, if the index closes at 360.

    iii. Since index futures contracts are listed and traded on futures exchanges, the investor can offset his position on any day prior to the expiration day. For example, an investor who has gone long on an index futures contract can offset his position by going short on the contract and vice versa.

    iv. The performance of all index futures contracts are guaranteed by the exchanges clearing house. As in case of options exchanges, the clearing house becomes the counterparty to both the buyer and the seller.

    v. The index futures carries the margin requirements which are applicable to both the buyer and the seller. The purpose of maintaining margin money is to minimize the risk of default by either party. The payment of margin ensures that the risk is limited to the previous day's price movement on each outstanding position. Margin money is a kind of security deposit or insurance against a possible future loss of value. The margin can be maintained either in the form of risk-free short dated government securities or in the form of cash. There can be different types of margins like initial margin, variation margin, maintenance margin and additional margin.

    The basic purpose of initial margin is to cover the greatest possible loss in one day. Both buyer and seller have to deposit margins. Generally, the initial margin is deposited before the opening of the day of the futures transaction. The measurement of this margin is based on the variance observed in daily price of the underlying index over a specified historical period (say immediately preceding 1 year). This margin is fixed in such a way that it can cover price movements more than 99% of the time. Generally, three times the standard deviation (sigma) is used for calculation of initial margin. This method is also known as Value at Risk (VaR). All daily losses should be compensated by depositing additional funds and such amount is known as variation margin. This is required to be paid at the close of business on the following day. Profits on the contract are credited to the client's variation margin account. Some stock exchanges require maintenance margin, which is set at a level slightly lower than the initial margin. Whenever the variation in settlement price brings the margin amount below the maintenance margin, the customer must replenish the margin amount to the level of initial margin. For example, if initial margin is fixed at Rs.500 and maintenance margin is at Rs.400, then the trader is permitted to trade till such time that the balance in this initial margin is above Rs.400. If it drops below Rs.400, say it drops to Rs.350, then a margin of Rs.150 (and not Rs.50) is to be paid to restore the levels to initial margin. In case of excessive volatility, additional margin may be imposed by the exchange.

    Additional margin is imposed only when the exchange fears that the market has become too volatile and may result in some critical situation, like payment crisis. This is a protective measure available to the exchange to prevent any breakdown.

There is another form of margin known as cross margin in which the margin amount is calculated after considering the combined positions in futures, options, cash markets, etc. Hence, the total margin requirement may come down due to cross hedges.

Part E: Caselets

Caselet 1

1.   i.   Stock index futures will require lower capital adequacy and margin requirements as compared to margins on carry forward of individual scrips.

    ii.   The brokerage costs on index futures will be much lower.

    iii.   Savings in cost is possible through reduced bid-ask spreads where stocks are traded in packaged forms.

    iv.   The impact cost will be much lower in case of stock index futures as opposed to dealing in individual scrips.

    v.   The market is conditioned to think in terms of the index and therefore would prefer to trade in stock index futures. Further, the chances of manipulation are much lesser.

2.   An important difference between exchange-traded and OTC derivatives is the credit risk. In the OTC markets, one party is exposed to the risk that his counterparty may default on the contract. In case of default, there will be a need to replace the counterparty which is also known as replacement risk. This risk becomes insignificant in case of exchange traded derivatives since every contract between the two parties, say A and B, is substituted with two contracts one between A and the exchange and the other between the exchange and B. Thus, in the market for exchange traded derivatives credit risk is taken by the exchange which acts as clearing house for all the trades. When a future contract is traded on the exchange, the exchange will become seller to the buyer and buyer to the seller. Hence, a party who is entering into the contract need not worry about the creditworthiness of the counterparty. The exchange protects itself by asking parties to deposit certain amount as margin on a day-to-day basis with the exchange which is usually enough to cover the price movement of the underlying assets on any given day. On any particular day if the exchange feels that the volatility is likely to be high on the underlying asset, the exchange may request the parties to deposit additional margins during the trading day. Due to the above mechanics, losses to the exchange and to the counterparties who enter into the contract are minimized.

Caselet 2

1.   Value at Risk is a statistical measure of the maximum potential loss from uncertain events in the normal business over a particular time horizon. It is measured in units of currency through a probability level. It is the loss measurement consistent with a confidence limit such as 99%, on a probability distribution (usually a normal distribution), implying that this is the measurement of a loss which has a chance of only 1% of being exceeded.

In simple words, if a trader mis-hedges a deal, it is a must to know the chances of loss before they occur. VaR is one such technique that allows the management to do so.

The calculation of VaR always requires the application of statistical theory. Usually, 95%, 97.5% and 99% confidence levels are used in measuring VaR. The following are the steps to be undertaken while measuring VaR:

    i.   Decide the confidence level to be followed in order to calculate the loss that has the property that it will not exceed the chosen level.

    ii.   Develop a probability statement of potential value changes in the portfolio.

    iii.   Consider the market driven factors.

    iv.   Decide on the time horizon.

    v.   Calculate the loss within the given parameters.

VaR being simply a distribution of probable outcomes of future losses that may occur on a portfolio, the actual result will not be known until it takes place. Till then, it is a random variable whose outcome has been estimated.

2. While VaR has proved to be a superior method of measuring risk, it has some limitations:

   i.   It cannot measure risk accurately in extreme market conditions, because it is difficult to model risk under such conditions. Suppose that the correlation between the US$ and the French Franc falls from 90% to 30%, VaR analysis will not immediately recognize this. It will perhaps take 50 or more days before sufficient daily price data is collected to reveal that the correlation has shifted.

   ii.   It focuses on a single arbitrary point. Also, it relies on simplified assumptions which may not be applicable to complex situations like options pricing.

   iii. It uses many models with a wide variety of assumptions and methods of calculation, producing different results under different models.

   iv.   It is basically a statistical measure and not a managerial one.

   v.   There is no theory to show that VaR is the appropriate measure upon which to build optimal decision rules.

   vi.   It cannot capture model risks, thus requiring the use of model reserves also.

   vii. Volatility also keeps varying with time and is not stable.

   viii. Prices may not respond in a linear fashion to changes in the market variables, resulting in erroneous measurement by VaR.

   ix.   The distributions may not be normal distributions in all the given circumstances.

   x.   Correlations may not be stable in all the given circusmtances.

   xi.   Riskmetrics™ is not able to fully capture spread risks, option risks and yield curve changes, resulting in inaccuracy in the risk measurement.

   xii. It is based on the past data which may not always prove true in future.

   xiii. Intra-day positions are not considered in VaR, which usually takes only the closing position into consideration.

         Given these limitations, VaR is often supplemented by Stress Testing.

Caselet 3

1. Equity swaps first appeared in the 1980s as equity index swaps. The basic form of an equity swap can be used by persons outside or inside a firm. Let us consider a simpler application of an equity swap. Suppose a pension fund has $1 million to invest in equity for three years. Instead of investing directly in equity, the pension fund may decide to invest in fixed rate debt and enter into an equity swap to reap the benefit of equity investment indirectly, without actually investing in equity.

   To do this, the pension fund can purchase a $1 million face value three-year corporate debt with a coupon rate of 9 percent and currently priced at par. At the same time, the pension fund enters into an equity swap with an equity swap dealer. The swap might call for the pension fund to pay the swap dealer 8.5 percent annually in exchange for the return on the S&P 500. Both payments are calculated on the basis of a notional principal amount of $1 million. Importantly, the swap dealer pays the pension fund when the equity return (S&P 500) is positive but the pension fund pays the swap dealer when the equity return is negative (this latter payment is in addition to the 8.5 percent it pays the swap dealer).

2. Here is how the executive equity swap works – an officer or director of a company (let us call him Ashok) enters into a bilateral agreement with an investment or commercial bank. In this agreement, Ashok agrees to swap the total returns from his stock (dividends and capital appreciation) in return for a fixed or floating return pegged to a benchmark rate like LIBOR or a broad-based market index, less annual commission/fee. In addition, the bank makes good any negative return on the stock due to depreciation of the stock price. The agreement may provide for either periodic settlement or terminal settlement. (See: Executive Equity Swap) The stock is deposited with the investment or commercial bank, which assumes the role of a dealer. The underlying assets are notional as is the case with any other form of swap, therefore, executive equity swaps do not result in the sale of shares. As a consequence, capital gains taxes are delayed.

3. The swap market has some limitations:

   i. It is difficult to identify a counterparty to take the opposite side of the transaction once a party has approached the swap dealer with his/her requirements.

   ii. The swap deal cannot be terminated without the agreement of the parties involved in the transaction.

   iii. Existence of inherent default risk.

   iv. Under-developed secondary markets for swaps, mainly as a result of very slow development of standardized documentation. This clearly shows that swaps are not easily tradable.

   v. The theory of comparative advantage of one party in a market as compared to the other market is one of the benchmarks for deciding on a swap. It should be noted that the comparative advantage enjoyed by one party in the floating rate market as compared to the fixed rate markets is mostly because the floating rates are for a short-term period of about six months (usually tied to LIBOR) and can be changed in case the credit rating of the party changes, while the fixed rates are for usually longer periods of time (2 to 5 years) and as such, cannot be changed with the changes in the party's credit rating. So, in short, the comparative advantage theorem is illusionary.

   vi. The swap market is not exchange controlled and it is an over-the-counter market. This calls for an extra caution on the part of the parties involved to look into the creditworthiness of the counterparties before entering into an agreement.

   The above limitations make the swap market transactions restricted to the firms and financial institutions.

Appendix
Table for N(x) When x $\leq$ 0

This table shows values of N(x) for x $\leq$ 0. The table should be used with interpolation. For example,

$$N(-0.1234) = N(-0.12) - 0.34[N(-0.12) - N(-0.13)]$$
$$= 0.4522 - 0.34 \times (0.4522 - 0.4483)$$
$$= 0.4509$$

x	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−3.0	0.0014	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
−3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
−3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
−3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
−3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
−4.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table for N(x) When x ≥ 0

This table shows values of N(x) for x ≥ 0. The table should be used with interpolation. For example,

$$N(0.6278) = N(0.62) + 0.78[N(0.63) - N(0.62)]$$
$$= 0.7324 + 0.78 \times (0.7357 - 0.7324)$$
$$= 0.7350$$

x	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9986	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.7	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.8	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000