

Question Paper
Derivatives: Analysis & Valuation (CFA630): October 2008
Section A : Basic Concepts (30 Marks)

- This section consists of questions with serial number 1 - 30.
- Answer all questions.
- Each question carries one mark.
- Maximum time for answering Section A is 30 Minutes.

1. The value of a forward contract at its initiation is

[<Answer>](#)

- (a) Present value of forward price at risk less interest rate less spot price
- (b) Spot price minus forward price
- (c) Bid-ask spread
- (d) Forward price
- (e) Zero.

2. The quotation for a forward rate agreement is as follows:

[<Answer>](#)

US \$ 6/9 months 5.25%/5.50% p.a.

The quotation means that the interest rate on

- (a) A 3 month US \$ deposit after six months is 5.50%
- (b) A 3 month US \$ deposit after six months is 5.25%
- (c) A 6 month US \$ deposit made after nine months is 5.25%
- (d) A 9 month US \$ deposit made today is 5.50%
- (e) A 9 month US \$ borrowing after six months is 5.50%.

3. Which of the following statements are **true** about backwardation with regard to the futures market?

[<Answer>](#)

- I. It is the condition where cash prices are higher than futures prices.
 - II. Under such a condition, basis is negative.
 - III. This is the sort of market featured by progressively rising futures prices as the futures contracts are of longer maturity.
 - IV. This condition prevails only if the futures prices are determined by factors other than cost-of-carry.
- (a) Both (I) and (II) above
 - (b) Both (I) and (IV) above
 - (c) (I), (II) and (III) above
 - (d) (II), (III) and (IV) above
 - (e) All (I), (II), (III) and (IV) above.

4. The price of an option increases if

[<Answer>](#)

- (a) The strike price increases for a call option
- (b) The strike price increases for both call and put options
- (c) The strike price decreases for a call option
- (d) The strike price decreases for a put option
- (e) The strike price decreases for both call and put options.

5. If the standard deviation of change in spot rupee-dollar exchange rate is 15% and standard deviation of change in rupee-dollar futures contract is 5.5%. The coefficient of correlation between the returns from spot and futures is 0.95. The minimum variance hedge-ratio for hedging through futures contract should be

[<Answer>](#)

- (a) 0.37
- (b) 0.50
- (c) 1.25
- (d) 1.50
- (e) 2.59.

6. A short hedge occurs when [<Answer>](#)
- Hedging is done for a period of 3 to 6 months
 - 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
 - A firm that has purchased a commodity sells futures to hedge the cash position
 - Hedgers seek to eliminate or control the risk exposure associated with the quantity that will be bought or sold at some future date
 - Hedgers seek to eliminate or control the risk exposure that arises due to adverse changes in prices.
7. Which of the following strategies **most** closely resembles the outright purchase of stock? [<Answer>](#)
- Buy a call, write a call with a higher strike price
 - Buy a call, write a put at a same strike price
 - Buy a put, write a put with a higher strike price
 - Write a call, write a put at a same strike price
 - Write a call, buy a put at a same strike price.
8. Nifty Futures are traded on NSE. This instrument is based on the value of S & P CNX Nifty Index. Minimum change in the value of the index is 0.05. Lot size of each futures contract is 50. The tick size of such a contract is [<Answer>](#)
- Rs.25.00
 - Rs.12.50
 - Rs.10.00
 - Rs.5.00
 - Rs.2.50.
9. Mr. Alex, who has a short position in T-bond futures, plans to deliver a Treasury bond that has a coupon of 9.75% payable semi-annually on May 15 and November 15 and a conversion factor of 1.1803. If the futures settlement price on September 15, 2008 is 103-16, the invoice price is approximately [<Answer>](#)
- \$100,000
 - \$103,500
 - \$112,568
 - \$125,456
 - \$132,753.
10. The following data pertains to the structure of an asset-backed securities transaction: [<Answer>](#)
- | Particulars | Rs. (in million) |
|-----------------------|------------------|
| Senior tranche | 250 |
| Subordinate tranche A | 50 |
| Subordinate tranche B | 25 |
- The value of the collateral for the structure is 350 million. Subordinate tranche B is the first loss tranche. The amount of the loss for the tranche B, if losses due to the default over the life of the structure total to Rs.20 million, is
- Rs.20 million
 - Rs.10 million
 - Rs.5 million
 - Rs.1 million
 - Nil.
11. Recent reversal in the trend of Rs./US\$ exchange rates, i.e., weakening of US\$, has exposed Indian exporters, invoicing their receivables in US\$, to foreign currency risk. Under such a scenario, the use of which of the following types of options, though expensive, will enable the Indian exporters to lock in the most favorable exchange rate? [<Answer>](#)
- Asian Options
 - Barrier Options
 - Exchange Options
 - Forward Start Options
 - Lookback Options.

12. Mr. Neel, an equity investor has made investment in the equity shares of Cisco Ltd. The gamma of his holdings is 200. The delta and gamma of the call option on the equity shares of the company are 0.20 and 0.125 respectively. The position in call option, Mr. Neel should take, to create a gamma neutral portfolio is [<Answer>](#)
- Short 2000
 - Short 1600
 - Long 800
 - Long 2000
 - Long 1600.
13. The shares of Multimedia Ltd., are quoted at Rs.367. Put option with a strike price of Rs.380 is trading at a premium of Rs.20. The time value of such put option is [<Answer>](#)
- Nil
 - Rs.7
 - Rs.11
 - Rs.13
 - Rs.20.
14. Credit enhancement encompasses a variety of provisions that may be used to reduce the credit risk of an obligation. Which of the following is **not** a credit enhancement technique? [<Answer>](#)
- Third Party Loan Guarantees
 - Special Purpose Vehicle
 - Collateralization
 - Letters of Credit
 - Forfaiting.
15. Mr. Robert, a trader has gone long on a Treasury Bond futures. The rationale behind investment in Treasury Bond futures, is that Mr. Robert expects [<Answer>](#)
- Short-term interest rates to decline
 - Long-term interest rates to decline
 - Long-term interest rates to rise
 - The yield curve to become more downward sloping
 - The yield curve to become more upward sloping.
16. Mr. Pratham purchased a knock-out put option on the stock of Excel Ind. at a strike price (X) of Rs.250 and knock out boundary of Rs.260. Which of the following statements is/are **true** with respect to this transaction? [<Answer>](#)
- If the stock price (S_t) remains below Rs.260 during the life of the option, pay-off will be equal to $\text{Max}(0, X - S_t)$.
 - If the stock price rises above Rs.260 during the life of the option, the put is cancelled and he receives a fixed rebate (R) irrespective of the stock price on the expiration date.
 - The option will come in to existence only when the stock price reaches Rs.260.
- Only (I) above
 - Only (II) above
 - Both (I) and (II) above
 - Both (I) and (III) above
 - Both (II) and (III) above.
17. A reverse time spread using calls involves [<Answer>](#)
- Sell a short period of time call and write another call with the same exercise price but which has a longer time period till expiry
 - Sell a long period of time call and write another call with shorter time period till expiry
 - Purchase a call expiring in a short period of time and write another call with the same exercise price, but which has a longer time period until expiration
 - Purchase a long period of time call and write another call with shorter time period till expiry
 - Purchase and sell a call of the same exercise price with the same time to expiry.

18. In a single period binomial option-pricing model, the underlying stock of GV Power is currently selling for Rs.180 and will rise or fall by 20% over the next period. A call option with an exercise price of Rs.220 would have a premium of [<Answer>](#)
- Rs.40
 - Rs.15
 - Rs.8
 - Rs.5
 - Nil.
19. On July 10, 2008, Mr. David goes long on a gold futures contract. Size of the contract is 100 ounces, initial margin is \$22,500 per contract and maintenance margin is \$21,000 per contract. On July 15, 2008, opening margin balance was \$21,450, and futures closes at \$905. If the previous day's close was \$917.25, the margin call will be [<Answer>](#)
- Nil
 - \$775
 - \$1525
 - \$2275
 - \$3125.
20. Which of the following statements is/are **true** with respect to the variations that exist for swaps? [<Answer>](#)
- Coupon swaps are those swaps where fixed rate obligations are exchanged for floating rate obligations over a specified period of time on a notional principal.
 - Weather swaps are standardized financial contracts that allow two parties to exchange specific weather risk exposures over a period of time.
 - In currency swaps, termination of contract can be done if one party defaults the other party and claim damages.
 - An equity swap is similar to an interest rate swap, having a fixed period, a fixed rate payer and a floating rate payer.
- Only (II) above
 - Both (I) and (II) above
 - Both (II) and (III) above
 - (I), (III) and (IV) above
 - All (I), (II), (III) and (IV) above.
21. A lender bought an interest rate floor on a five-year bullet repayment loan at 8.50%. The rate of interest on this loan, in the years 1 through 5, turned out to be 9.25%, 8.75%, 8.35%, 7.75% and 8.25% respectively. The effective rate of interest received by him will be approximately [<Answer>](#)
- 9.25%
 - 9.00%
 - 8.85%
 - 8.70%
 - 8.50%.
22. Which of the following statements is/are **true** with respect to the 'smile effect' in option pricing models? [<Answer>](#)
- Implied volatility of options out-of-the-money is greater than those at-the-money.
 - Implied volatility of options deeply in-the-money is greater than those at-the-money.
 - Implied volatility of options deeply in-the-money is smaller than those at-the-money.
 - Implied volatility of options deeply in-the-money is smaller than those out-the-money.
- Only (I) above
 - Only (II) above
 - Only (III) above
 - Both (I) and (II) above
 - Both (II) and (IV) above.

23. Mr. Ranveer bought 5000 equity shares of Ace Development at Rs.165 per share. He simultaneously bought put options on the above stock at an exercise price of Rs.175 priced at Rs.7. The minimum profit per share that is locked by him by undertaking above transactions is [<Answer>](#)
- Rs.2
 - Rs.3
 - Rs.5
 - Rs.7
 - Rs.10.
24. The biggest single disadvantage of writing covered calls is [<Answer>](#)
- Infinite risk
 - Opportunity losses if exercise occurs
 - Added commissions
 - Necessity to post margin
 - More regulatory hassles.
25. Mr. Saha has taken long position in the stock of Max India Ltd. for Rs.3,00,000. The beta of the stock is 1.5. To hedge its position against the market movement, what would be the appropriate action? [<Answer>](#)
- Long on index futures for Rs.4,50,000
 - Long on index futures for Rs.3,00,000
 - Short on index futures for Rs.4,50,000
 - Short on index futures for Rs.3,00,000
 - Short on index futures for Rs.2,00,000.
26. Which of the following statements about Vega is **not true**? [<Answer>](#)
- It is the first derivative of an option price with respect to volatility of underlying stock
 - It tends to be zero for deep-out-of-the-money option
 - It will be the highest for near the money option
 - Negative value indicates loss in theoretical value
 - It declines as expiration approaches.
27. Mr. Sumit has written SAIL NOV 150 call option priced at Rs.10 and simultaneously purchased SAIL DEC 150 call option priced at Rs.12. Under which of the following situations, Mr. Sumit will make profit from his spread strategy? [<Answer>](#)
- Stock price remains above Rs.148 till expiration of both the contracts and then starts decreasing
 - Stock price remains below Rs.152 till expiration of both the contracts and then starts increasing
 - Stock price remains above Rs.150 till expiration of November contract and then starts decreasing
 - Stock price remains below Rs.150 till expiration of November contract and then starts increasing
 - Stock price remains below Rs.160 till expiration of November contract and then starts increasing.
28. Asset-backed securities though relatively new to the market, have a good growth potential. Which of the following statements is/are **true** with respect to such securities? [<Answer>](#)
- There is always an uncertainty with respect to cash flows from such securities and the time period when the cash flows will take place.
 - The investors of such securities have the opportunity to diversify investments as they have additional avenue to invest their funds.
 - The presence of collateral as guarantee for payment increases the creditworthiness of such securities.
 - They provide better yield than the bonds or mortgage-backed securities of similar quality and maturity.
- Only (IV) above
 - Both (I) and (IV) above
 - (I), (II) and (III) above
 - (II), (III) and (IV) above
 - All (I), (II), (III) and (IV) above.

29. If Mr. Udyan expects there will be significant price movement of the underlying asset from the current spot price in any direction. Under such a scenario, to make profit from his view with limited downside potential, the option strategy to be adopted by him is [<Answer>](#)

- (a) Strip
- (b) Short butterfly spread
- (c) Long butterfly spread
- (d) Calendar spread
- (e) Bearish spread.

30. A swap quote for US dollar interest rate swap fixed vs. LIBOR is 20/50 basis points over 364 days US T-bills. This quote can be interpreted as [<Answer>](#)

- (a) The ask rate is 20 basis points over yields on the 364 days US T-bills versus LIBOR
- (b) The ask rate is 30 basis points over yields on the 364 days US T-bills versus LIBOR
- (c) The bid rate is 50 basis points over yields on the 364 days US T-bills versus LIBOR
- (d) The bid rate is 30 basis points over yields on the 364 days US T-bills versus LIBOR
- (e) The bid rate is 20 basis points over yields on the 364 days US T-bills versus LIBOR.

END OF SECTION A

Section B : Problems/Caselet (0 Marks)

- This section consists of questions with serial number 1 – 0.
- Answer all questions.
- Marks are indicated against each question.
- Detailed workings/explanations should form part of your answer.
- Do not spend more than 110 - 120 minutes on Section B.

1 On March 01, 2008 Orbit Inc., a Japanese firm had imported equipments worth \$25 million from a US company. The payment for the same was due on May 31, 2008. On March 01, the dollar-yen spot exchange rate was ¥106.60/\$. A bank in Japan quoted a forward rate for delivery on May 31 as ¥108.15/\$. The treasurer of the Japanese firm is evaluating the alternative of hedging the dollar exposure through June ¥ futures traded at IMM.

[<Answer>](#)
≥

The June ¥ - futures were quoted at \$ 0.00931 on March 01. The contract size of each ¥ - futures contract is ¥12.5 million. On May 31, the spot ¥/\$ rate turned out as 107.98 and June futures price as \$ 0.00926.

You are **required** to:

- a. Explain how Orbit Inc. can hedge the exposure through ¥ - futures contract. marks
(3)
- b. Which hedge, forward or futures, has given better result? (show all your computations) marks
(5)

2. SouthWest Off Airlines, US based airline company has decided to take a 3-year floating rate loan of US \$500 million to finance its acquisition. The loan is indexed to 6 month US \$ LIBOR with a spread of 75 basis points.

[<Answer>](#)

The company has identified the following caps and floors quoted by a Axa Bank:

Term	Cap		Floor	
	3-years	3-years	3-years	3-years
Underlying interest rate	6 month US \$ LIBOR	6 month US \$ LIBOR	6 month US \$ LIBOR	6 month US \$ LIBOR
Strike rate	3.0%	3.75%	3.25%	3.75%
Premium	2.0%	1.5%	1.25%	2.0%

(10marks)

Face value	US \$500 million	US \$500 million	US \$500 million	US \$500 million
------------	------------------	------------------	------------------	------------------

You are **required** to show how the company can hedge its interest rate exposure by using an interest rate collar strategy. Also calculate the effective cost of the loan showing all the relevant cash flows if the 6 month US \$ LIBOR at the 6 reset dates turn out to be: 3.85%, 4.10%, 3.50%, 3.30%, 3.10%, and 3.00%.

(Use a discount rate of 4% to amortize the premium).

3. The equity shares of Punj Lloyd are currently trading at Rs.220. The three month European call option on the stock of Punj Lloyd, with a strike price of Rs.240, is commanding a premium of Rs.15 in the market. No dividend is expected in the next three months. The standard deviation of returns on the stock is 22.5% p.a. and the risk-free rate of interest is 7.75% p.a.

[<Answer>](#)

You are **required** to calculate the change in the value of call option on Punj Lloyd's stock if

- The time to expiration decreases by 1 month.
- Interest rate increases by 1%.
- Volatility of the stock increases by 2%.

(Assume only one variable will change at a time)

(9 marks)

4. Currently, the equity shares of JP Hydro Power are trading at a price of Rs.50 each. A two year American call option on the company's stock with a strike price of Rs.44 is available in the market. Mr. Ayush, an retail investor, anticipates that due to the huge fluctuations in the price trend of the stock in the past few years, the price of the stock in the next two years time may either move up or down by 15%.

[<Answer>](#)

As an analyst, you are **required** to assist Mr. Ayush to find out the price of the two year American call option on the company's stock as per the Two-step Binomial Model. The risk free rate prevailing in the market is 7.75%.

(8 marks)

Caselet

Read the caselet carefully and answer the following questions:

5. Utilizing commodity derivatives effectively is a big challenge considering that there exists a thin line of difference between hedging and speculation. Elucidate.
6. Why is regulation necessary for the proper functioning of the commodity derivatives market?

[<Answer>](#)

(8 marks)

[<Answer>](#)

(7 marks)

Participants in commodity markets have always been exposed to various types of risks. These include price risk, demand risk, systematic risk, etc. To mitigate these risks, producers earlier used to book forward contracts with buyers in order to lock in their margins in advance. These contracts were supposedly Over-the-Counter (OTC) and customized based on the requirements of the producers and buyers. However, risk of counter-party default still prevailed which was the driving force behind the setting up of commodity exchanges.

Commodity exchanges provided a platform for buyers and sellers to book contracts for buying or selling the commodity they required. Moreover, these exchanges guaranteed the participants against counter-party default. Since a large number of buyers and sellers participated in these exchanges the default rate could be reduced to a large extent. However, the customized OTC contracts had to be done away with. This resulted in the evolution of standardized contracts traded on commodity exchanges. Standardization brought in more uniformity in the trade. Also, the prices of commodities based on standard specifications started being used as a benchmark for other variants of the same commodity. For example, there are over 150 types of crude oil, but benchmarks like light sweet crude oil, Brent crude oil, etc., are used while pricing other variants of crude oil based on their quality specification.

Once these standardized contracts were being traded at exchanges, producers and consumers started booking future contracts to lock in their margins/costs as they previously did with forward contracts. These enabled them to manage their respective risks.

In the US, commodity trading started with agricultural products in the 19th century. Historically, dating from ancient Sumerian use of sheep or goats, pigs, rare seashells or other items as commodity money, people have sought ways to standardize and trade contracts in the delivery of such items, so that the trade can be smooth and predictable. Commodity money and commodity markets in crude form are believed to have originated in Sumer where small baked clay tokens in the shape of sheep or goats were used in trade. Sealed in clay vessels, certain number of such tokens, with some numbers written on the outside, they represented a promise to deliver that number. This made them a form of commodity money. However, they were also known to contain promises of time and date of delivery like a modern futures contract. Regardless of the details, it was only possible to verify the number of tokens inside by shaking the vessel or by breaking it, at which point the number or terms written on the outside became subject to doubt. Eventually the tokens disappeared, but the contracts remained on flat tablets. This represented the first system of commodity accounting.

Today, in the US, there are around 13 exchanges that are designated as 'Contract Markets'. The commodities market in the US is regulated by the Commodity Futures Trading Commission (CFTC), which was formed in 1974 as an independent agency of the US government. It is responsible for recording and monitoring the trading of futures contracts on the US futures exchanges. The CFTC has the authority to fine, suspend, or sue the company or individual in the federal court in case of misconduct, fraud, or a rule-breaking occurs.

END OF CASELET
END OF SECTION B

Section C : Applied Theory (67 Marks)

- | |
|--|
| <ul style="list-style-type: none"> • This section consists of questions with serial number 7 - 8. • Answer all questions. • Marks are indicated against each question. • Do not spend more than 25 -30 minutes on Section C. |
|--|

7.Trading in futures market acts as a substitute for cash market transactions, as the former allows one to know about the actual outflow/inflow before hand. Explain the mechanics of futures trading.

[<Answer>](#)

(10marks)

8.“Option value, is influenced by the option prices, which in turn depend on a number of factors.” Discuss the assumptions of Black and Scholes Model for option pricing?

[<Answer>](#)

(10marks)

END OF SECTION C

END OF QUESTION PAPER

Suggested Answers

Derivatives: Analysis & Valuation (CFA630): October 2008

Section A : Basic Concepts

- | Answer | Reason |
|---------------|---|
| 1. E | When a forward contract is initiated, by market design, its value is Zero as far all the derivative instruments at its initiation. After initiation its value can fluctuate and be either positive or negative. The value of forward contract when it matures is the difference between the spot price on that date and the initial forward price. < TOP > |
| 2. B | The quote means deposit interest starting 6 months from now for 3 month is 5.25% < TOP >
and borrowing interest rate starting 6 months from now for 3 month is 5.50%. |
| 3. B | Backwardation in the futures market arises: < TOP >
i. if the cash prices are higher than futures prices.
ii. if the futures price are determined by the factors other than cost-of-carry
So both statements (I) and (IV) are correct.
Basis = current cash prices – futures price
In case of backwardation market, since current cash prices are higher than futures price, the basis is positive.
If the futures market featured by progressively rising futures prices as the futures contracts are of longer maturity then it is a contango market. |
| 4. C | The price of an option increases if the strike price decreases for a call option and if the strike price increases for a put option. < TOP > |
| 5. E | < TOP >
Minimum variance hedge ratio, $H = \rho \frac{\sigma_s}{\sigma_f}$
$= 0.95 \times \frac{0.15}{0.055}$ $= 2.59.$ |
| 6. C | Short hedge also known as selling hedge and happens when the futures are sold in order to hedge the cash commodity against declining prices. < TOP > |
| 7. B | Buying a call and writing a put at same strike price will give a pay-off similar to the outright purchase of stock. < TOP > |
| 8. E | Tick size is minimum price fluctuation. Here the lot size is 50 and minimum change in the value of index is 0.05. So the tick size is $50 \times 0.05 = \text{Rs.}2.50$. < TOP > |
| 9. D | Invoice price = (futures settlement price $\times$ conversion factor) + accrued interest. < TOP >
Computation of Accrued interest-
The bond has coupon payment dates of May 15 and November 15. Thus, the last coupon payment date was May 15, 2008. The number of days from May 15 to September 15 is 123 days. Thus, the accrued interest is
$\$100,000 \times 0.0975 \times 0.5 \times (123/182) = \3294.64
Therefore, invoice price = $103,500 (1.1803) + 3294.64 = \$125,455.69 = \$125,456(\text{approx})$. |
| 10. E | If the value of the collateral is greater than the value of the liability, then the deal is said to be overcollateralized. The extent to which collateral is overvalued can be used to absorb future losses. Here overcollateralization is Rs. 25 million = Rs.(350-325) million. Hence the loss of Rs. 20 million will be entirely absorbed by the overcollateralization. No tranche will realize a loss. < TOP > |

11. E • **Lookback options**- The payoff from these options depends on the maximum [< TOP >](#) (put option) or the minimum price (call option) reached during the life of the option. Thus in the present scenario, the Indian exporters, afraid of \$. depreciation can opt for Lookback put option and can contract to sell the receivables at the highest price achieved during the tenure of the option.
- But a lookback option is more expensive than a standard option. The justification for this higher cost is that the holder of a lookback option can never miss the best underlying asset price.
- **Asian Options**- In case of these options, the pay-off depends on the average price of the underlying asset during a prespecified period of the life of the option.
 - **Barriers options**- these are the options whose payoff depends on whether the underlying asset price reaches a certain level during a certain period of time.
 - **Exchange options**- these are options to exchange one asset for another under which in turn for foregoing one asset, the investor can receive another asset.
 - **Forward start options**-these are options paid for now but that will start at a certain time in futures.
- Thus, among the above options, Lookback options would best serve the purpose of U.S. exporters.
12. B As the portfolio has positive gamma, so to make the portfolio gamma neutral, we [< TOP >](#) have to go short on call option. Number of call options to be sold $200/0.125 = 1600$
13. B Intrinsic value = Exercise price – Spot price = $380 - 367 = \text{Rs.}13$ [< TOP >](#)
Time value = Premium – Intrinsic value = $20 - 13 = \text{Rs.}7$.
14. E The techniques involved in credit enhancement are: [< TOP >](#)
- Collateralization
 - Third Party Loan Guarantees
 - Credit Insurance
 - Letters Of Credit
 - Special Purpose Vehicle.
15. B A trader going long Treasury Bond futures expects long-term interest rates to decline. [< TOP >](#)
16. C A knock-out option is one that ceases to exist when the stock price reaches a certain [< TOP >](#) barrier. A knock in option is one that comes in to existence only when the underlying asset price reaches a certain barrier. Hence, statement (III) is false. All the other statements are correct.
17. C Reverse time spread using calls involves the purchase of a call expiring in a short [< TOP >](#) period of time and write another call with the same exercise price, but which has a longer time period until expiration
18. E The price after one year can be either Rs. 216 or Rs. 144. The call option with [< TOP >](#) exercise price of Rs. 220 will be out-of-the money, so the value of call will be zero according to binomial option pricing model.
19. D Loss on futures = $(917.25 - 905) \times 100 = \1225 [< TOP >](#)
Balance in margin a/c = $\$21450 - \$1225 = \$20,225$
Margin call = $\$22,500 - \$20,225 = \$2275$.
20. D Weather swaps are **privately negotiated** financial contracts that allow two parties to [< TOP >](#) exchange specific weather risk exposures over a period of time. Hence statement (II) is not true.
All the other statements are true.
21. D Effective rate of interest = $(1.0925 \times 1.0875 \times 1.085 \times 1.085 \times 1.085)^{1/5} - 1 = 8.70\%$. [< TOP >](#)
22. D The smile effect in option pricing models show that volatility of deep-in-the-money [< TOP >](#) and out-of-the-money options is greater than those at-the-money options.
23. B Minimum profit share = $175 - (165 + 7) = \text{Rs.}3$. [< TOP >](#)

24. B The biggest single disadvantage of writing covered calls is opportunity losses if [< TOP >](#)
exercise occurs since the call will be exercised when spot price is more than the strike price.
Commissions are not required for writing call, risk is controlled, margin requirement is not there since the call is covered and also there is no regulatory hassle for this.
25. C In order to hedge his position, Mr. Saha simply sells the index futures contract. By [< TOP >](#)
doing so, he is said to have hedged away his index exposure. In order to determine the number of futures he has to sell, the beta of the stock should be known. Here $\beta = 1.5$ the size of the position that the investor needs to hedge his index exposure is $1.5 \times 3,00,000 = \text{Rs } 4,50,000$.
Once he does this his position will be as follows:
Long stock : 3,00,000
Short index futures : 4,50,000.
26. D Vega measures the sensitivity of the option premium with respect to the volatility of [< TOP >](#)
the asset provided other factors determining the option premium are constant. Vega of call and put will always be identical and positive because all options gain value with rising volatility.
27. D A long time spread using calls will allow investor to purchase a call with several [< TOP >](#)
months until expiration and write a call only several weeks until expiration. Both the calls having same exercise price. Investors using this strategy will make profits on both the calls if the stock remains below the exercise price until the written call expires, allowing investor to capture 100% of the premium written. After the expiration of the written call, investor would hope for the underlying stock to make a bullish move making the purchased call even more valuable. So, in the given case if the Stock price remains below Rs.150 till expiration of November contract and then starts increasing, Mr. Sumit will be able to profit from his spread strategy.
28. D Some of the benefits of asset backed securities are [< TOP >](#)
I. **Predictability of cash flows** – the cash flows from asset backed securities can be predicted with certainty, as the pool of underlying assets is known. Moreover, there is certainty with respect to time period when the cash flow will take place
II. **Better yield**- asset-backed securities provide better yield than the bonds or mortgage-backed securities of similar quality and maturity
III. **Better credit quality** - The presence of collateral as guarantee for payment increases the creditworthiness of such securities.
IV. **Diversification and internal diversification** - The investors of such securities have the opportunity to diversify investments as they have additional avenue to invest their funds.
Hence statement (I) is not true.
All the other options are correct.
29. B If the expectation is that the asset price is likely to fluctuate significantly, and the [< TOP >](#)
direction of movement is not sure, the strategy to be adopted to minimize loss is the short butterfly spread.
Long butterfly is adopted when expectation is price will remain close to the current spot price. Strip is also a relevant strategy for such price expectation, but the loss potential is much higher.
Bearish spread is used when the price is expected to fall.
Calendar spread is similar to the long butterfly spread.
30. E The given quote can be interpreted as the bid rate is 20 basis points over yields on the [< TOP >](#)
364 days US T-bills versus LIBOR and the ask rate is 50 basis points over yields on the 364 days US T-bills versus LIBOR.

Section B : Problems

- 1.a. The Japanese firm is short on dollar, so it can hedge the exposure by going long on dollar futures. $\leq$
As dollar futures are not available so it will hedge through yen futures which is quoted in terms of $\geq$ TOP dollar. To hedge the exposure it should sell yen futures, which will give an equivalent position of $\geq$ going long on dollar futures.

Number of ¥ - futures contract to be sold

$$= \frac{\$25,000,000}{\$0.00931 / ¥12,500,000} = 214.82 \approx 215 \text{ contracts}$$

- b. The firm had sold 215 contracts at \$0.00931

On May 31, ¥ - futures price is \$0.00926

Gain on futures contract = $(\$0.00931 - 0.00926) \times 215 \times 12,500,000 = \$134,375$

Outflow of dollar to settle the payable = \$25 million

Net dollar outflow = $\$25,000,000 - \$134,375 = \$24,865,625$

Net outflow in yen at spot market = $\$24,865,625 \times ¥107.98 / \$$

= ¥2684.99 million

If covered through the forward market outflow would be

= $\$25,000,000 \times ¥108.15 / \$$

= ¥2703.75 million

So, futures market cover has given a better result as it entail lower outflow.

2. The company should go for interest rate collar i.e. it should buy the cap at a higher strike rate and sell $\leq$ the floor at the lower strike rate. Therefore, the company should buy cap at the strike rate of 3.75% and $\geq$ TOP sell floor at the strike rate of 3.25%.

$$\begin{aligned} \text{Net premium outflow} &= (1.5\% - 1.25\%) \text{ of } \$500 \text{ million} \\ &= \$12,50,000 \end{aligned}$$

$$\begin{aligned} \text{Amortization of premium} &= \frac{\$12,50,000}{\text{PVIFA}(2.00\%, 6)} = \frac{12,50,000}{5.6014} \\ &= \$223,157 \end{aligned}$$

Time	LIBOR (%)	Interest rate applicable to loan (%)	Cash flow on loan	Amortization of premium	Cash flow from Cap	Cash flow from floor	Net cash flow
0			+500,000,000				+500,000,000
1	3.85	4.60	-11,500,000	-223,157	+250,000	—	-11,473,157
2	4.10	4.85	-12,125,000	-223,157	+875,000	—	-11,473,157
3	3.50	4.25	-10,625,000	-223,157	—	—	-10,848,157
4	3.30	4.05	-10,125,000	-223,157	—	—	-10,348,157
5	3.10	3.85	-9,625,000	-223,157	—	—	-10,223,157
6	3.00	3.75	-(9,375,000 + 500,000,000)	-223,157	—	375,000 625,000	510,223,157

Effective cost 'r' is given by the following equation:

$$500,000,000 = 11,473,157 \text{PVIF}(r, 1) + 11,473,157 \text{PVIF}(r, 2) + 10,848,157 \text{PVIF}(r, 3) + 10,348,157 \text{PVIF}(r, 4) + 10,223,157 \text{PVIF}(r, 5) + 510,223,157 \text{PVIF}(r, 6)$$

At $r = 2\%$, L.H.S = 504,381,382.

At $r = 3\%$, L.H.S = 477,197,789.

Applying interpolation,

$$\begin{aligned} \frac{3 - 2}{3 - x} &= \frac{477,197,789 - 504,381,382}{477,197,789 - 500,000,000} \\ &= 2.16\% \text{ (approx)} \end{aligned}$$

$$\text{Annualized rate} = (1.0216)^2 - 1 = 4.37\%.$$

$$\begin{aligned}
3.S &= \text{Rs.220} \\
X &= \text{Rs.240} \\
P &= \text{Rs.15} \\
\sigma &= \text{Rs.22.5\%} \\
r &= 7.75\%
\end{aligned}$$

[<](#)
[TOP](#)
[>](#)

- 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.

$$\text{Theta of call} = \frac{-SN'(d_1)\sigma}{2\sqrt{t}} - rXe^{-rt} N(d_2)$$

$$N'(d_1) = \frac{1}{\sqrt{2\pi}} e^{-d_1^2/2}$$

$$d_1 = \frac{\ln(s/x) + (r + \frac{\sigma^2}{2})t}{\sigma\sqrt{t}}$$

$$= \frac{\ln(220/240) + (0.0775 + \frac{0.225^2}{2}) \times \frac{3}{12}}{0.225\sqrt{3/12}}$$

$$= \frac{-0.087 + 0.02570}{0.1125} = -0.545$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$= -0.545 - 0.225\sqrt{0.25}$$

$$= -0.6575$$

$$N(d_2) = 0.255$$

$$N'(d_1) = \frac{1}{\sqrt{2\pi}} e^{-(0.545)^2/2}$$

$$= \frac{1}{2.5066} \times 0.862 = 0.3439$$

$$\text{Theta} = \frac{-220 \times 0.3439 \times 0.225}{2\sqrt{0.25}} - 0.0775 \times 240 \times e^{-0.25 \times 0.0775} \times 0.255$$

$$= -17.023 - 4.652$$

$$= -21.675$$

$$\text{For 1 month decrease in expiration change in call price} = \left(-\frac{1}{12}\right) \times (-21.675) = + \text{Rs.1.806}$$

So call price will increase by Rs.1.806

- ii. The rho of an option indicates the change in the value of option with respect to change in interest rate

$$\text{Rho of call} = Xt e^{-rt} N(d_2)$$

$$= 240 \times 0.25 \times e^{-(0.25 \times 0.0775)} \times 0.255$$

$$= 15.01$$

So if interest rate increase by 1%, the option price will increase by $(15.01 \times 0.01) = \text{Rs. 0.15}$

- iii. The vega of the option indicates the change in the value of option with respect to volatility of stock.

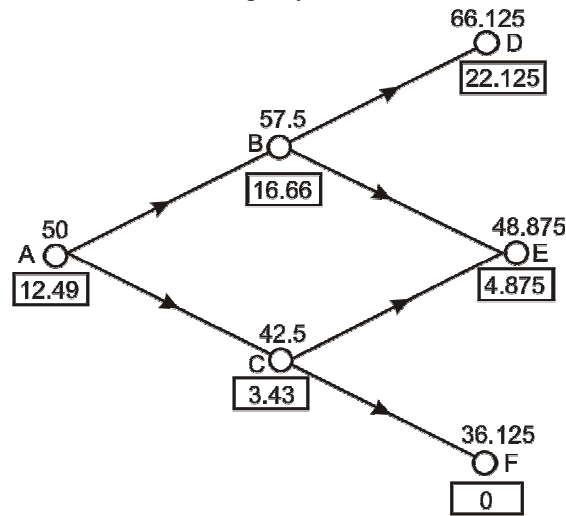
$$\text{Vega of call} = S\sqrt{t} \times N'(d_1)$$

$$= 220 \times \sqrt{0.25} \times 0.3439$$

$$= 37.83$$

So if volatility increase by 2%, the value of call will increase by $(37.83 \times 0.02) = \text{Rs. } 0.7566$.

4. The situation can be represented in the following way:



[< TOP >](#)

Using single-period model, the probability of price increase, $p = \frac{R - d}{u - d} = \frac{1.0775 - 0.85}{1.15 - 0.85} = 0.758$

$\therefore$ Probability of price decrease $= 1 - 0.758 = 0.242$

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 : $66.125 - 44 = 22.125$

Value at node E : $48.875 - 44 = 4.875$

Value at node F : as stock price is less than strike price, $(36.126 < 44)$, so call has zero value.

Using single-period model, the value of call option at node B is

$$C = \frac{C_u p + C_d (1 - p)}{R}$$

$$= \frac{22.125 \times 0.758 + 4.875 \times 0.242}{1.0775} = 16.66$$

At node B pay-off from early exercise is Rs.13.50, 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.16.66.

Value at node C is

$$C = \frac{4.875 \times 0.758 + 0 \times 0.242}{1.0775} = 3.43$$

At node C, value of early exercise is zero, hence at node C value of call is Rs.3.43.

Value of American call option at node A is

$$C = \frac{16.66 \times 0.758 + 3.43 \times 0.242}{1.0775} = 12.49$$

The value of early exercise at node A is Rs.6, which is less than the value arrived through single-period binomial model. Hence, the value of two-year American call option is Rs.12.49.

5. Though commodity derivatives have lot of advantages, utilizing them is rather a task. Fundamentals of each commodity are different and there are various factors that affect prices. Moreover, the problem is compounded by the fact that there is no guarantee which factor will affect the prices at a particular time. Hence, commodity markets become too complicated for a simple businessman to hedge his risk on. He would rather plan his activity and bear less loss rather than hedge in commodity derivatives and burn his fingers. Commodity prices are very volatile and lack of discipline can cause losses to a great

[< TOP >](#)

extent. Further, there exists a thin line of difference between hedging and speculation. Hedging requires strict discipline while trading and this factor is a deterrent for many participants. The movement of prices in one direction causes extensive speculation and it becomes easy to get carried away. This is when hedging becomes speculation and risk of losing gets higher.

Moving further, there exists the risk of calculating a wrong hedge ratio. A person with a particular exposure to a commodity may be tempted to take equal position in the derivative market on the pretext of a complete hedge (maybe opportunity for profit through trading). However, one needs to understand that hedging requires taking an exposure that minimizes one's risk. It is also equally important to understand that 'risk' can only be 'minimized' and not 'eliminated' all together.

The challenges mentioned are still to be overcome and only time and increased participation will help mature the commodity derivative markets.

6. Regulation of commodity market is necessary for the following reasons:

"To ensure that markets efficiently perform the twin economic functions of price discovery and price risk management". [<TOP>](#)

To maintain market integrity and financial integrity across the market, the exchanges and the intermediaries (brokers, warehouses, assayers).

To maintain financial integrity by ensuring capital adequacy of exchanges and intermediaries and payment of adequate margins by intermediaries.

"To maintain market integrity by the effective surveillance and monitoring as well as audit of exchanges and intermediaries".

To properly integrate spot and future prices.

To provide protection against unscrupulous intermediaries.

To ensure fairness and transparency in trading, clearing and settlement process—this can be ensured by establishing demutualized set-up of the exchanges, through electronic trading and corporate governance in the exchanges.

Section C: Applied Theory

7. THE MECHANICS OF FUTURES TRADING

[<TOP>](#)

Initially, an individual willing to trade futures contracts must place an order. For that purpose he needs to open an account with a broker. The individual is required to make minimum deposit and must sign a disclosure statement agreeing to all the possible risks.

Placing an Order

An investor can place different types of orders. When an investor places an order the broker makes a phone call to the firm's desk on the exchange floor and conveys the order to the firm's floor broker, who in turn goes to the pit in which the contract is traded. The pit can be described as an octagonal or polygonal shaped ring with steps descending to the center. Bids and make offers are placed through hand signals and verbal activity. This is known as open outcry system. Once the order is filled, the information is relayed to the broker's office, and the broker will now confirm the trade to the customer by telephone.

Open outcry system is very old tradition. Today, many of the futures exchanges are fully automated. The bids and offers are submitted through the computer and trades are executed off the floor.

Role of Clearing House

Every futures exchange has its own independent clearing house which acts as an intermediary and guarantor to each transaction. Stock holders of clearing house are its member clearing firms. Each firm maintains a margin account with the clearing house and must also maintain minimum amount in the account. All the parties to the futures transactions should maintain an account with the clearing firm or with the firm that has an account with the clearing firm.

Daily Settlement

Daily settlement is a significant feature of futures market and is the major difference between futures and forward markets. Every futures contract involves initial margin and maintenance

margin. The amount required to be deposited in the margin account at the time of entering the contract is called initial margin. Generally, the initial margin is set between 5% and 15% of the total value of the contract. It covers losses arising because of price fluctuations. On closure of position or at time of maturity of futures contract, the initial margin is released again. The margin account is readjusted at the end of each trading day to reflect the investor's gain or loss on its open position. The amount that is maintained everyday thereafter is called maintenance margin. Some times, additional funds called variation funds might be required to be deposited immediately whenever notified. At the close of each day, a committee comprising clearing house officials determines a settlement price. Usually, settlement price is an average of the prices of the last few trades of the day. Using this settlement price, each account is marked to market. Marked to market is a unique feature of futures contract wherein the positions of both buyers and sellers of the contracts are adjusted everyday for the change in the market price that day. In other words, the profits or losses related with price movements are either credited or debited from an investor's account even if he does not trade. Any difference in the current settlement price and the previous day's settlement price is determined and if the difference is positive because of increase in settlement price, then the dollar amount is credited to the margin account of the buyer. If the difference is negative because of decrease in the settlement price, then the amount is credited to the margin account of seller.

Delivery and Cash Settlement

All the contracts expire at some or the other time. Every contract has a delivery month and the delivery procedure differs from one contract to the other. While some contracts can be delivered on any business day of the delivery month, others can be delivered only after the contract is traded for the last day. This last day also varies from contract to contract. In the case of contracts that are cash settled there is no delivery at all. For example, for stock index futures the settlement price on the last trading day is determined at the closing spot price of the underlying instrument. All the contracts are marked to market on that day and the positions are considered to be closed.

For non-cash-settled financial futures, the clearing member firms inform the clearing house about their customers who hold long positions. Two business days prior to the intended delivery day, the holder of the short position willing to make delivery notifies the same to the clearing house. This day is known as 'position day'. The next business day is known as 'notice of intention day'. On this day the exchange selects the holder of the oldest long position to receive the delivery. On the third day or the delivery day, delivery takes place and the holder of long position will pay the holder of short position. Usually traders close out their positions prior to contract expiration. Such process is called offsetting.

8. Assumptions of Black and Scholes Model

[< TOP >](#)

i. The stock pays no dividends during the option's life

Most companies pay dividends to their shareholders, so this might seem to be 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 suggests 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. 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. 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 periods 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 time 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.

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 collect the intrinsic value. Towards the end of the call, the remaining time value is very small, but the intrinsic value is the same.

[< TOP OF THE DOCUMENT >](#)