

1. A one-year forward contract is an agreement where:
 - A. One side has the right to buy an asset for a certain price in one year's time.
 - B. One side has the obligation to buy an asset for a certain price in one year's time.
 - C. One side has the obligation to buy an asset for a certain price at some time during the next year.
 - D. One side has the obligation to buy an asset for the market price in one year's time.

Answer: B

A one-year forward contract is an obligation to buy or sell in one year's time for a predetermined price. By contrast, an option is the right to buy or sell.

2. Which of the following is NOT true?
 - A. When a CBOE call option on IBM is exercised, IBM issues more stock.
 - B. An American option can be exercised at any time during its life.
 - C. A call option will always be exercised at maturity if the underlying asset price is greater than the strike price.
 - D. A put option will always be exercised at maturity if the strike price is greater than the underlying asset price.

Answer: A

When an IBM call option is exercised, the option seller must buy shares in the market to sell to the option buyer. IBM is not involved in any way. Answers B, C, and D are true.

3. A one-year call option on a stock with a strike price of \$30 costs \$3; a one-year put option on the stock with a strike price of \$30 costs \$4. Suppose that a trader buys two call options and one put option. The breakeven stock price above which the trader makes a profit is:
 - A. \$35
 - B. \$40
 - C. \$30
 - D. \$36

Answer: A

When the stock price is \$35, the two call options provide a payoff of $2 \times (35 - 30)$ or \$10. The put option provides no payoff. The total cost of the options is $2 \times 3 + 4$ or \$10. The stock price in A, \$35, is therefore the breakeven stock price above which the position is profitable because it is the price for which the cost of the options equals the payoff.

4. A one-year call option on a stock with a strike price of \$30 costs \$3; a one-year put option on the stock with a strike price of \$30 costs \$4. Suppose that a trader buys two call options and one put option. The breakeven stock price below which the trader makes a profit is:
 - A. \$25
 - B. \$28
 - C. \$26
 - D. \$20

Answer: D

When the stock price is \$20, the two call options provide no payoff. The put option provides a payoff of $30 - 20$ or \$10. The total cost of the options is $2 \times 3 + 4$ or \$10. The stock price in D, \$20, is therefore the breakeven stock price below which the position is profitable because it is the price for which the cost of the options equals the payoff.

5. Which of the following is approximately true when size is measured in terms of the underlying principal amounts or value of the underlying assets?
- A. The exchange-traded market is twice as big as the over-the-counter market.
 - B. The over-the-counter market is twice as big as the exchange-traded market.
 - C. The exchange-traded market is about ten times as big as the over-the-counter market.
 - D. The over-the-counter market is about ten times as big as the exchange-traded market.

Answer: D

The over-the-counter market is about \$600 trillion whereas the exchange-traded market is about \$60 trillion.

6. Which of the following best describes the term “spot price”?
- A. The price for immediate delivery.
 - B. The price for delivery at a future time.
 - C. The price of an asset that has been damaged.
 - D. The price of renting an asset.

Answer: A

The spot price is the price for immediate delivery. The futures or forward price is the price for delivery in the future.

7. Which of the following is true about a long forward contract?
- A. The contract becomes more valuable as the price of the asset declines.
 - B. The contract becomes more valuable as the price of the asset rises.
 - C. The contract is worth zero if the price of the asset declines after the contract has been entered into.
 - D. The contract is worth zero if the price of the asset rises after the contract has been entered into.

Answer: B

A long forward contract is an agreement to buy the asset at a predetermined price. The contract becomes more attractive as the market price of the asset rises. The contract is only worth zero when the predetermined price in the forward contract equals the current forward price (as it usually does at the beginning of the contract).

8. An investor sells a futures contract on an asset when the futures price is \$1,500. Each contract is on 100 units of the asset. The contract is closed out when the futures price is \$1,540. Which of the following is true?
- A. The investor has made a gain of \$4,000.
 - B. The investor has made a loss of \$4,000.
 - C. The investor has made a gain of \$2,000.
 - D. The investor has made a loss of \$2,000.

Answer: B

An investor who buys (has a long position) has a gain when a futures price increases. An investor who sells (has a short position) has a loss when a futures price increases.

9. Which of the following describes European options?
- A. Sold in Europe
 - B. Priced in Euros
 - C. Exercisable only at maturity
 - D. Calls (there are no European puts)

Answer: C

European options can be exercised only at maturity. This is in contrast to American options which can be exercised at any time. The term "European" has nothing to do with geographical location, currencies, or whether the option is a call or a put.

10. Which of the following is NOT true?
- A. A call option gives the holder the right to buy an asset by a certain date for a certain price.
 - B. A put option gives the holder the right to sell an asset by a certain date for a certain price.
 - C. The holder of a call or put option must exercise the right to sell or buy an asset.
 - D. The holder of a forward contract is obligated to buy or sell an asset.

Answer: C

The holder of a call or put option has the right to exercise the option but is not required to do so. A, B, and D are correct.

11. Which of the following is NOT true about call and put options?
- A. An American option can be exercised at any time during its life.
 - B. A European option can only be exercised only on the maturity date.
 - C. Investors must pay an upfront price (the option premium) for an option contract.
 - D. The price of a call option increases as the strike price increases.

Answer: D

A call option is the option to buy for the strike price. As the strike price increases, this option becomes less attractive and is therefore less valuable. A, B, and C are true.

12. The price of a stock on July 1 is \$57. A trader buys 100 call options on the stock with a strike price of \$60 when the option price is \$2. The options are exercised when the stock price is \$65. The trader's net profit is:
- A. \$700
 - B. \$500
 - C. \$300
 - D. \$600

Answer: C

The payoff from the options is $100 \times (65 - 60)$ or \$500. The cost of the options is 2×100 or \$200. The net profit is therefore $500 - 200$ or \$300.

13. The price of a stock on February 1 is \$124. A trader sells 200 put options on the stock with a strike price of \$120 when the option price is \$5. The options are exercised when the stock price is \$110. The trader's net profit or loss is:
- A. Gain of \$1,000
 - B. Loss of \$2,000
 - C. Loss of \$2,800
 - D. Loss of \$1,000

Answer: D

The payoff that must be made on the options is $200 \times (120 - 110)$ or \$2000. The amount received for the options is 5×200 or \$1000. The net loss is therefore $2000 - 1000$ or \$1000.

14. The price of a stock on February 1 is \$84. A trader buys 200 put options on the stock with a strike price of \$90 when the option price is \$10. The options are exercised when the stock price is \$85. The trader's net profit or loss is:
- A. Loss of \$1,000
 - B. Loss of \$2,000
 - C. Gain of \$200
 - D. Gain of \$1,000

Answer: A

The payoff is $90 - 85$ or \$5 per option. For 200 options, the payoff is therefore 5×200 or \$1000. However, the options cost 10×200 or \$2000. There is therefore a net loss of \$1000.

15. The price of a stock on February 1 is \$48. A trader sells 200 put options on the stock with a strike price of \$40 when the option price is \$2. The options are exercised when the stock price is \$39. The trader's net profit or loss is:
- A. Loss of \$800
 - B. Loss of \$200
 - C. Gain of \$200
 - D. Loss of \$900

Answer: C

The payoff is $40 - 39$ or \$1 per option. For 200 options, the payoff is therefore 1×200 or \$200. However, the premium received by the trader is 2×200 or \$400. The trader therefore has a net gain of \$200.

16. A speculator can choose between buying 100 shares of a stock for \$40 per share and buying 1000 European call options on the stock with a strike price of \$45 for \$4 per option. For second alternative to give a better outcome at the option maturity, the stock price must be above:
- A. \$45
 - B. \$46
 - C. \$55
 - D. \$50

Answer: D

When the stock price is \$50, the first alternative leads to a position in the stock worth 100×50 or \$5000. The second alternative leads to a payoff from the options of $1000 \times (50 - 45)$ or \$5000. Both alternatives cost \$4000. It follows that the alternatives are equally profitable when the stock price is \$50. For stock prices above \$50, the option alternative is more profitable.

17. A company knows it will have to pay a certain amount of a foreign currency to one of its suppliers in the future. Which of the following is true?
- A. A forward contract can be used to lock in the exchange rate.
 - B. A forward contract will always give a better outcome than an option.
 - C. An option will always give a better outcome than a forward contract.
 - D. An option can be used to lock in the exchange rate.

Answer: A

A forward contract ensures that the effective exchange rate will equal the current forward exchange rate. An option provides insurance that the exchange rate will not be worse than a certain level, but requires an upfront premium. Options sometimes give a better outcome and sometimes give a worse outcome than forwards.

18. A short forward contract on an asset plus a long position in a European call option on the asset with a strike price equal to the forward price is equivalent to:
- A. A short position in a call option.
 - B. A short position in a put option.
 - C. A long position in a put option.
 - D. None of the above.

Answer: C

Suppose that S_T is the final asset price and K is the strike price/forward price. A short forward contract leads to a payoff of $K - S_T$. A long position in a European call option leads to a payoff of $\max(S_T - K, 0)$. When added together, we see that the total position leads to a payoff of $\max(0, K - S_T)$, which is the payoff from a long position in a put option. C can also be seen to be true by plotting the payoffs as a function of the final stock price.

19. A trader has a portfolio worth \$5 million that mirrors the performance of a stock index. The stock index is currently 1,250. Futures contracts trade on the index with one contract being on 250 times the index. To remove market risk from the portfolio the trader should:
- A. Buy 16 contracts
 - B. Sell 16 contracts
 - C. Buy 20 contracts
 - D. Sell 20 contracts

Answer: B

One futures contract protects a portfolio worth 1250×250 . The number of contracts required is therefore $5,000,000 / (1250 \times 250) = 16$. To remove market risk, we need to gain on the contracts when the market declines. A short futures position is therefore required.

20. Which of the following best describes a central clearing party (CCP)?
- A. It is a trader that works for an exchange.
 - B. It stands between two parties in the over-the-counter market.
 - C. It is a trader that works for a bank.
 - D. It helps facilitate futures trades.

Answer: B

A central clearing party is a clearing house that stands between two parties in the over-the-counter market. It serves the same purpose as an exchange clearing house.

1. Which of the following is true?
 - A. Both forward and futures contracts are traded on exchanges.
 - B. Forward contracts are traded on exchanges, but futures contracts are not.
 - C. Futures contracts are traded on exchanges, but forward contracts are not.
 - D. Neither futures contracts nor forward contracts are traded on exchanges.

Answer: C

Futures contracts trade only on exchanges. Forward contracts trade only in the over-the-counter market.

2. Which of the following is NOT true?
 - A. Futures contracts nearly always last longer than forward contracts.
 - B. Futures contracts are standardized; forward contracts are not.
 - C. Delivery or final cash settlement usually takes place with forward contracts; the same is not true of futures contracts.
 - D. Forward contracts usually have one specified delivery date; futures contracts often have a range of delivery dates.

Answer: A

Forward contracts often last longer than futures contracts. B, C, and D are true.

3. In the corn futures contract, a number of different types of corn can be delivered (with price adjustments specified by the exchange) and there are a number of different delivery locations. Which of the following is true?
 - A. This flexibility tends to increase the futures price.
 - B. This flexibility tends to decrease the futures price.
 - C. This flexibility may increase and may decrease the futures price.
 - D. This flexibility has no effect on the futures price.

Answer: B

The party with the short position chooses between the alternatives. The alternatives therefore make the futures contract more attractive to the party with the short position. The lower the futures price, the less attractive it is to the party with the short position. The benefit of the alternatives available to the party with the short position is therefore compensated for by the futures price being lower than it would otherwise be.

4. A company enters into a short futures contract to sell 50,000 units of a commodity for 70 cents per unit. The initial margin is \$4,000 and the maintenance margin is \$3,000. What is the futures price per unit above which there will be a margin call?
 - A. 78 cents
 - B. 76 cents
 - C. 74 cents

D. 72 cents

Answer: D

There will be a margin call when more than \$1,000 has been lost from the margin account so that the balance in the account is below the maintenance margin level. Because the company is short, each one cent rise in the price leads to a loss of $0.01 \times 50,000$ or \$500. A greater than 2 cent rise in the futures price will therefore lead to a margin call. The futures price is currently 70 cents. When the price rises above 72 cents, there will be a margin call.

5. A company enters into a long futures contract to buy 1,000 units of a commodity for \$60 per unit. The initial margin is \$6,000 and the maintenance margin is \$4,000. What futures price will allow \$2,000 to be withdrawn from the margin account?
- A. \$58
 - B. \$62
 - C. \$64
 - D. \$66

Answer: B

Amounts in the margin account in excess of the initial margin can be withdrawn. Each \$1 increase in the futures price leads to a gain of \$1,000. When the futures price increases by \$2 the gain will be \$2,000 and this can be withdrawn. The futures price is currently \$60. The answer is therefore \$62.

6. One futures contract is traded where both the long and short parties are closing out existing positions. What is the resultant change in the open interest?
- A. No change
 - B. Decrease by one
 - C. Decrease by two
 - D. Increase by one

Answer: B

The open interest goes down by one. There is one less long position and one less short position.

7. Who initiates delivery in a corn futures contract?
- A. The party with the long position.
 - B. The party with the short position.
 - C. Either party
 - D. The exchange

Answer: B

The party with the short position initiates delivery by sending a "Notice of Intention to Deliver" to the exchange. The exchange has a procedure for choosing a party with a long position to take delivery.

8. You sell one December futures contracts when the futures price is \$1,010 per unit. Each contract is on 100 units and the initial margin per contract that you provide is \$2,000. The maintenance margin per contract is \$1,500. During the next day, the futures price rises to \$1,012 per unit. What is the balance of your margin account at the end of the day?
- A. \$1,800
 - B. \$3,300
 - C. \$2,200
 - D. \$3,700

Answer: A

The price has increased by \$2. Because you have a short position you lose 2×100 or \$200. The balance in the margin account therefore goes down from \$2,000 to \$1,800.

9. A hedger takes a long position in a futures contract on a commodity on November 1, 2012, to hedge an exposure on March 1, 2013. The initial futures price is \$60. On December 31, 2012, the futures price is \$61. On March 1, 2013, it is \$64. The contract is closed out on March 1, 2013. What gain is recognized in the accounting year January 1 to December 31, 2013? Each contract is on 1,000 units of the commodity.
- A. \$0
 - B. \$1,000
 - C. \$3,000
 - D. \$4,000

Answer: D

Hedge accounting is used. The whole of the gain or loss on the futures is therefore recognized in 2013. None is recognized in 2012. In this case, the gain is \$4 per unit or \$4,000 in total.

10. A speculator takes a long position in a futures contract on a commodity on November 1, 2012, to hedge an exposure on March 1, 2013. The initial futures price is \$60. On December 31, 2012, the futures price is \$61. On March 1, 2013, it is \$64. The contract is closed out on March 1, 2013. What gain is recognized in the accounting year January 1 to December 31, 2013? Each contract is on 1,000 units of the commodity.
- A. \$0
 - B. \$1,000
 - C. \$3,000
 - D. \$4,000

Answer: C

In this case, there is no hedge accounting. Gains or losses are accounted for as they are accrued. The price per unit increases by \$3 in 2013. The total gain in 2013 is therefore \$3,000.

11. The frequency with which futures margin accounts are adjusted for gains and losses is:
- A. Daily
 - B. Weekly
 - C. Monthly
 - D. Quarterly

Answer: A

In futures contracts, margin accounts are adjusted for gains or losses daily.

12. Margin accounts have the effect of:
- A. Reducing the risk of one party regretting the deal and backing out.
 - B. Ensuring funds are available to pay traders when they make a profit.
 - C. Reducing systemic risk due to collapse of futures markets.
 - D. All of the above.

Answer: D

Initial margin requirements dramatically reduce the risk that a party will walk away from a futures contract. As a result, they reduce the risk that the exchange clearing house will not have enough funds to pay profits to traders. Furthermore, if traders are less likely to suffer losses because of counterparty defaults, there is less systemic risk.

13. Clearing houses are:
- A. Never used in futures markets and sometimes used in OTC markets.
 - B. Used in OTC markets, but not in futures markets.
 - C. Always used in futures markets and sometimes used in OTC markets.
 - D. Always used in both futures markets and OTC markets.

Answer: C

Clearing houses are always used by exchanges trading futures. Increasingly, OTC products are cleared through CCPs, which are a type of clearing house.

14. Which of the following best describes central counterparties?
- A. Help market participants to value derivative transactions.
 - B. Must be used for all OTC derivative transactions.
 - C. Are used for futures transactions.
 - D. Perform a similar function to exchange clearing houses.

Answer: D

CCPs do for the OTC market what exchange clearing houses do for the exchange-traded market. The correct answer is therefore D. CCPs must be used for most standard OTC derivatives transactions, but not for all derivatives transactions.

15. Which of the following are cash settled?

- A. All futures contracts
- B. All option contracts
- C. Futures on commodities
- D. Futures on stock indices

Answer: D

Futures on stock indices are usually cash settled. The rest are usually settled by delivery of the underlying assets.

1. The basis is defined as spot minus futures. A trader is hedging the sale of an asset with a short futures position. The basis increases unexpectedly. Which of the following is true?
 - A. The hedger's position improves.
 - B. The hedger's position worsens.
 - C. The hedger's position sometimes worsens and sometimes improves.
 - D. The hedger's position stays the same.

Answer: A

The price received by the trader is the futures price plus the basis. It follows that the trader's position improves when the basis increases.

2. Futures contracts trade with every month as a delivery month. A company is hedging the purchase of the underlying asset on June 15. Which futures contract should it use?
 - A. The June contract
 - B. The July contract
 - C. The May contract
 - D. The August contract

Answer: B

As a general rule, the futures maturity month should be as close as possible to, but after the month when the asset will be purchased. In this case, the asset will be purchased in June and so the best contract is the July contract.

3. On March 1 a commodity's spot price is \$60 and its August futures price is \$59. On July 1, the spot price is \$64 and the August futures price is \$63.50. A company entered into futures contracts on March 1 to hedge its purchase of the commodity on July 1. It closed out its position on July 1. What is the effective price (after taking account of hedging) paid by the company?
 - A. \$59.50
 - B. \$60.50
 - C. \$61.50
 - D. \$63.50

Answer: A

The user of the commodity takes a long futures position. The gain on the futures is $63.50 - 59$ or \$4.50. The effective paid realized is therefore $64 - 4.50$ or \$59.50. This can also be calculated as the March 1 futures price ($=59$) plus the basis on July 1 ($=0.50$).

4. On March 1 the price of a commodity is \$1,000 and the December futures price is \$1,015. On November 1, the price is \$980 and the December futures price is \$981. A producer of the commodity entered into a December futures contracts on March 1 to hedge the sale of the commodity on November 1. It closed out its position on November 1. What is the effective price (after taking account of hedging) received by the company for the commodity?

- A. \$1,016
- B. \$1,001
- C. \$981
- D. \$1,014

Answer: D

The producer of the commodity takes a short futures position. The gain on the futures is $1015 - 981$ or \$34. The effective price realized is therefore $980 + 34$ or \$1,014. This can also be calculated as the March 1 futures price ($=1015$) plus the November 1 basis ($=-1$).

5. Suppose that the standard deviation of monthly changes in the price of commodity A is \$2. The standard deviation of monthly changes in a futures price for a contract on commodity B (which is similar to commodity A) is \$3. The correlation between the futures price and the commodity price is 0.9. What hedge ratio should be used when hedging a one month exposure to the price of commodity A?
- A. 0.60
 - B. 0.67
 - C. 1.45
 - D. 0.90

Answer: A

The optimal hedge ratio is $0.9 \times (2/3)$ or 0.6.

6. A company has a \$36 million portfolio with a beta of 1.2. The futures price for a contract on an index is 900. Futures contracts on \$250 times the index can be traded. What trade is necessary to reduce beta to 0.9?
- A. Long 192 contracts
 - B. Short 192 contracts
 - C. Long 48 contracts
 - D. Short 48 contracts

Answer: D

To reduce the beta by 0.3 we need to short $0.3 \times 36,000,000 / (900 \times 250)$ or 48 contracts.

7. A company has a \$36 million portfolio with a beta of 1.2. The futures price for a contract on an index is 900. Futures contracts on \$250 times the index can be traded. What trade is necessary to increase beta to 1.8?
- A. Long 192 contracts
 - B. Short 192 contracts
 - C. Long 96 contracts
 - D. Short 96 contracts

Answer: C

To increase beta by 0.6, we need to go long $0.6 \times 36,000,000 / (900 \times 250)$ or 96 contracts.

8. Which of the following is true?

- A. The optimal hedge ratio is the slope of the best fit line when the spot price (on the y-axis) is regressed against the futures price (on the x-axis).
- B. The optimal hedge ratio is the slope of the best fit line when the futures price (on the y-axis) is regressed against the spot price (on the x-axis).
- C. The optimal hedge ratio is the slope of the best fit line when the change in the spot price (on the y-axis) is regressed against the change in the futures price (on the x-axis).
- D. The optimal hedge ratio is the slope of the best fit line when the change in the futures price (on the y-axis) is regressed against the change in the spot price (on the x-axis).

Answer: C

The optimal hedge ratio reflects the ratio of movements in the spot price to movements in the futures price.

9. A company due to pay a certain amount of a foreign currency in the future decides to hedge with futures contracts. Which of the following best describes the advantage of hedging?

- A. It leads to a better exchange rate being paid.
- B. It leads to a more predictable exchange rate being paid.
- C. It caps the exchange rate that will be paid.
- D. It provides a floor for the exchange rate that will be paid.

Answer: B

Hedging is designed to reduce risk not increase expected profit. Options can be used to create a cap or floor on the price. Futures attempt to lock in the price.

10. Which of the following increases basis risk?

- A. A large difference between the futures prices when the hedge is put in place and when it is closed out.
- B. Dissimilarity between the underlying asset of the futures contract and the hedger's exposure.
- C. A reduction in the time between the date when the futures contract is closed and its delivery month.
- D. None of the above.

Answer: B

Basis is the difference between spot and futures at the time the hedge is closed out. This increases as the time between the date when the futures contract is put in place and the delivery month increases. (C is not therefore correct). It also increases as the asset underlying the futures contract becomes more different from the asset being hedged. (B is therefore correct.)

11. Which of the following is a reason for hedging a portfolio with an index futures?

- A. The investor believes the stocks in the portfolio will perform better than the market but is

uncertain about the future performance of the market.

- B. The investor believes the stocks in the portfolio will perform better than the market and the market is expected to do well.
- C. The portfolio is not well diversified and so its return is uncertain.
- D. All of the above.

Answer: A

Index futures can be used to remove the impact of the performance of the overall market on the portfolio. If the market is expected to do well, hedging against the performance of the market is not appropriate. Hedging cannot correct for a poorly diversified portfolio.

12. A company will buy 1,000 units of a certain commodity in one year. It decides to hedge 80% of its exposure using futures contracts. The spot price and the futures price are currently \$100 and \$90, respectively. The spot price and the futures price in one year turn out to be \$112 and \$110, respectively. What is the average price paid for the commodity?
- A. \$92
 - B. \$96
 - C. \$102
 - D. \$106

Answer: B

On the 80% (hedged) part of the commodity purchase, the price paid will be $112 - (110 - 90)$ or \$92. On the other 20%, the price paid will be the spot price of \$112. The weighted average of the two prices is $0.8 \times 92 + 0.2 \times 112$ or \$96.

1. An investor shorts 100 shares when the share price is \$50 and closes out the position six months later when the share price is \$43. The shares pay a dividend of \$3 per share during the six months. How much does the investor gain?
A. \$1,000
B. \$400
C. \$700
D. \$300

Answer: B

The investor gains \$7 per share because they sell at \$50 and buy at \$43. However, the investor has to pay the \$3 per share dividend. The net profit is therefore $7 - 3$ or \$4 per share. 100 shares are involved. The total gain is therefore \$400.

2. The spot price of an investment asset that provides no income is \$30 and the risk-free rate for all maturities (with continuous compounding) is 10%. What is the three-year forward price?
A. \$40.50
B. \$22.22
C. \$33.00
D. \$33.16

Answer: A

The 3-year forward price is the spot price grossed up for 3 years at the risk-free rate. It is $30e^{0.1 \times 3} = \$40.50$.

3. The spot price of an investment asset is \$30 and the risk-free rate for all maturities is 10% with continuous compounding. The asset provides an income of \$2 at the end of the first year and at the end of the second year. What is the three-year forward price?
A. \$19.67
B. \$35.84
C. \$45.15
D. \$40.50

Answer: B

The present value of the income is $2e^{-0.1 \times 1} + 2e^{-0.1 \times 2} = \3.447 . The three-year forward price is obtained by subtracting the present value of the income from the current stock price and then grossing up the result for three years at the risk-free rate. It is $(30 - 3.447)e^{0.1 \times 3} = \35.84 .

4. An exchange rate is 0.7000 and the six-month domestic and foreign risk-free interest rates are 5% and 7% (both expressed with continuous compounding). What is the six-month forward rate?
A. 0.7070
B. 0.7177
C. 0.7249
D. 0.6930

Answer: D

The six-month forward rate is $0.7000e^{-(0.05-0.07)\times 0.5} = 0.6930$.

5. Which of the following is true?
- A. The convenience yield is always positive or zero.
 - B. The convenience yield is always positive for an investment asset.
 - C. The convenience yield is always negative for a consumption asset.
 - D. The convenience yield measures the average return earned by holding futures contracts.

Answer: A

The convenience yield measures the benefit of owning an asset rather than having a forward/futures contract on an asset. For an investment asset, it is always zero. For a consumption asset, it is greater than or equal to zero.

6. A short forward contract that was negotiated some time ago will expire in three months and has a delivery price of \$40. The current forward price for three-month forward contract is \$42. The three-month risk-free interest rate (with continuous compounding) is 8%. What is the value of the short forward contract?
- A. +\$2.00
 - B. -\$2.00
 - C. +\$1.96
 - D. -\$1.96

Answer: D

The contract gives one the obligation to sell for \$40 when a forward price negotiated today would give one the obligation to sell for \$42. The value of the contract is the present value of -\$2 or $-2e^{-0.08\times 0.25} = -\1.96 .

7. Which of the following describes the way the forward price of a foreign currency is quoted?
- A. The number of U.S. dollars per unit of the foreign currency.
 - B. The number of the foreign currency per U.S. dollar.
 - C. Some forward prices are quoted as the number of U.S. dollars per unit of the foreign currency and some are quoted the other way round.
 - D. There are no quotation conventions for forward prices.

Answer: C

The futures price is quoted as the number of US dollars per unit of the foreign currency. Spot exchange rates and forward exchange rates are sometimes quoted this way and sometimes quoted the other way round.

8. Which of the following is NOT a reason why a short position in a stock is closed out?
- A. The investor with the short position chooses to close out the position.
 - B. The lender of the shares issues instructions to close out the position.

- C. The broker is no longer able to borrow shares from other clients.
- D. The investor does not maintain margins required on their margin account.

Answer: B

A, C, and D are all reasons why the short position might be closed out. B is not. The lender of shares cannot issue instructions to close out the short position.

9. What should a trader do when the one-year forward price of an asset is too low? Assume that the asset provides no income.
- A. The trader should borrow the price of the asset, buy one unit of the asset and enter into a short forward contract to sell the asset in one year.
 - B. The trader should borrow the price of the asset, buy one unit of the asset and enter into a long forward contract to buy the asset in one year.
 - C. The trader should short the asset, invest the proceeds of the short sale at the risk-free rate, enter into a short forward contract to sell the asset in one year.
 - D. The trader should short the asset, invest the proceeds of the short sale at the risk-free rate, enter into a long forward contract to buy the asset in one year.

Answer: D

If the forward price is too low relative to the spot price, the trader should short the asset in the spot market and buy it in the forward market.

10. Which of the following is NOT true about forward and futures contracts?
- A. Forward contracts are more liquid than futures contracts.
 - B. The futures contracts are traded on exchanges while forward contracts are traded in the over-the-counter market.
 - C. In theory, forward prices and futures prices are equal when there is no uncertainty about future interest rates.
 - D. Taxes and transaction costs can lead to forward and futures prices being different.

Answer: A

Futures contracts are more liquid than forward contracts. To unwind a futures position, it is simply necessary to take an offsetting position. The statements in B, C, and D are correct.

11. As the convenience yield increases, which of the following is true?
- A. The one-year futures price as a percentage of the spot price increases.
 - B. The one-year futures price as a percentage of the spot price decreases.
 - C. The one-year futures price as a percentage of the spot price stays the same.
 - D. Any of the above can happen.

Answer: B

As the convenience yield increases, the futures price declines relative to the spot price. This is because the convenience of owning the asset (as opposed to having a futures contract) becomes more important.

12. As inventories of a commodity decline, which of the following is true?
- A. The one-year futures price as a percentage of the spot price increases.
 - B. The one-year futures price as a percentage of the spot price decreases.
 - C. The one-year futures price as a percentage of the spot price stays the same.
 - D. Any of the above can happen.

Answer: B

When inventories decline, the convenience yield increases and the futures price as a percentage of the spot price declines.

13. Which of the following describes a known dividend yield on a stock?
- A. The size of the dividend payments each year is known.
 - B. Dividends per year as a percentage of today's stock price are known.
 - C. Dividends per year as a percentage of the stock price at the time when dividends are paid are known.
 - D. Dividends will yield a certain return to a person buying the stock today.

Answer: C

The dividend yield is the dividend per year as a percent of the stock price at the time when the dividend is paid.

14. Which of the following is true for a consumption commodity?
- A. There is no limit to how high or low the futures price can be, except that the futures price cannot be negative.
 - B. There is a lower limit to the futures price but no upper limit.
 - C. There is an upper limit to the futures price but no lower limit, except that the futures price cannot be negative.
 - D. The futures price can be determined with reasonable accuracy from the spot price and interest rates.

Answer: C

If the futures price of a consumption commodity becomes too high an arbitrageur will buy the commodity and sell futures to lock in a profit. An arbitrageur cannot follow the opposite strategy of buying futures and selling or shorting the asset when the futures price is low. This is because consumption assets cannot be shorted. Furthermore, people who hold the asset in general do so because they need the asset for their business. They are not prepared to swap their position in the asset for a similar position in a futures. Consequently, there is an upper limit but no lower limit to the futures price.

1. Which of the following describes a call option?
- A. The right to buy an asset for a certain price.
 - B. The obligation to buy an asset for a certain price.
 - C. The right to sell an asset for a certain price.
 - D. The obligation to sell an asset for a certain price.

Answer: A

A call option is the right, but not the obligation to buy.

2. Which of the following is true?
- A. A long call is the same as a short put.
 - B. A short call is the same as a long put.
 - C. A call on a stock plus a stock is the same as a put.
 - D. None of the above.

Answer: D

None of the statements are true. Long calls, short calls, long puts, and short puts all have different payoffs as indicated by Figure 10.5. A put on a stock plus the stock provides a payoff that is similar to a call, as explained in Chapters 11 and 12. But a call on a stock plus a stock does not provide a similar payoff to a put.

3. An investor has exchange-traded put options to sell 100 shares for \$20. There is a \$1 cash dividend. Which of the following is then the position of the investor?
- A. The investor has put options to sell 100 shares for \$20.
 - B. The investor has put options to sell 100 shares for \$19.
 - C. The investor has put options to sell 105 shares for \$19.
 - D. The investor has put options to sell 105 shares for \$19.05.

Answer: A

Cash dividends unless they are unusually large have no effect on the terms of an option.

4. Which of the following describes a short position in an option?
- A. A position in an option lasting less than one month.
 - B. A position in an option lasting less than three months.
 - C. A position in an option lasting less than six months.
 - D. A position where an option has been sold.

Answer: D

A short position is a position where the option has been sold (the opposite to a long position).

5. Which of the following is an example of an option series?
- A. All calls on a certain stock.
 - B. All calls with a particular strike price on a certain stock.

- C. All calls with a particular time to maturity on a certain stock.
- D. All calls with a particular time to maturity and strike price on a certain stock.

Answer: D

All options on a certain stock of a certain type (calls or put) with a certain strike price and time to maturity are referred to as an option series.

6. Which of the following must post margin?
- A. The seller of an option.
 - B. The buyer of an option.
 - C. The seller and the buyer of an option.
 - D. Neither the seller nor the buyer of an option.

Answer: A

The seller of the option must post margin as a guarantee that the payoff on the option (if there is one) will be made. The buyer of the option usually pays for the option upfront and so no margin is required.

7. Which of the following describes a long position in an option?
- A. A position where there is more than one year to maturity.
 - B. A position where there is more than five years to maturity.
 - C. A position where an option has been purchased.
 - D. A position that has been held for a long time.

Answer: C

A long position is a position where an option has been purchased. It can be contrasted with a short position which is a position where an option has been sold.

8. When a six-month option is purchased:
- A. The price must be paid in full.
 - B. Up to 25% of the option price can be borrowed using a margin account.
 - C. Up to 50% of the option price can be borrowed using a margin account.
 - D. Up to 75% of the option price can be borrowed using a margin account.

Answer: A

Only options lasting more than 9 months can be bought on margin.

9. The price of a stock is \$67. A trader sells 5 put option contracts on the stock with a strike price of \$70 when the option price is \$4. The options are exercised when the stock price is \$69. What is the trader's net profit or loss?
- A. Loss of \$1,500
 - B. Loss of \$500

- C. Gain of \$1,500
- D. Loss of \$1,000

Answer: C

The option payoff is $70 - 69 = \$1$. The amount received for the option is \$4. The gain is \$3 per option. In total $5 \times 100 = 500$ options are sold. The total gain is therefore $\$3 \times 500 = \$1,500$.

10. A trader buys a call and sells a put with the same strike price and maturity date. What is the position equivalent to?
- A. A long forward
 - B. A short forward
 - C. Buying the asset
 - D. None of the above

Answer: A

From adding up the two payoffs, we see that A is true: $\max(S_T - K, 0) - \max(K - S_T, 0) = S_T - K$

11. The price of a stock is \$64. A trader buys 1 put option contract on the stock with a strike price of \$60 when the option price is \$10. When does the trader make a profit?
- A. When the stock price is below \$60.
 - B. When the stock price is below \$64.
 - C. When the stock price is below \$54.
 - D. When the stock price is below \$50.

Answer: D

The payoff must be more than the \$10 paid for the option. The stock price must therefore be below \$50.

12. Consider a put option and a call option with the same strike price and time to maturity. Which of the following is true?
- A. It is possible for both options to be in the money.
 - B. It is possible for both options to be out of the money.
 - C. One of the options must be in the money.
 - D. One of the options must be either in the money or at the money.

Answer: D

If the stock price is greater than the strike price, the call is in the money and the put is out of the money. If the stock price is less than the strike price, the call is out of the money and the put is in the money. If the stock price is equal to the strike price, both options are at the money.

1. When the stock price increases with all else remaining the same, which of the following is true?
- A. Both calls and puts increase in value.
 - B. Both calls and puts decrease in value.
 - C. Calls increase in value while puts decrease in value.
 - D. Puts increase in value while calls decrease in value.

Answer: C

Stock price increases cause the values of calls to increase and the values of puts to decline.

2. When the strike price increases with all else remaining the same, which of the following is true?
- A. Both calls and puts increase in value.
 - B. Both calls and puts decrease in value.
 - C. Calls increase in value while puts decrease in value.
 - D. Puts increase in value while calls decrease in value.

Answer: D

Strike price increases cause the values of puts to increase and the values of calls to decline.

3. When volatility increases with all else remaining the same, which of the following is true?
- A. Both calls and puts increase in value.
 - B. Both calls and puts decrease in value.
 - C. Calls increase in value while puts decrease in value.
 - D. Puts increase in value while calls decrease in value.

Answer: A

Volatility increases the likelihood of a high payoff from either a call or a put option. The payoff can never be negative. It follows that as volatility increases the value of all options increase.

4. When dividends increase with all else remaining the same, which of the following is true?
- A. Both calls and puts increase in value.
 - B. Both calls and puts decrease in value.
 - C. Calls increase in value while puts decrease in value.
 - D. Puts increase in value while calls decrease in value.

Answer: D

Dividends during the life of an option reduce the final stock price. As a result dividend increases cause puts to increase in value and calls to decrease in value.

5. When interest rates increase with all else remaining the same, which of the following is true?
- A. Both calls and puts increase in value.
 - B. Both calls and puts decrease in value.

- C. Calls increase in value while puts decrease in value.
- D. Puts increase in value while calls decrease in value.

Answer: C

Calls increase and puts decrease in value. As explained in the text, an increase in interest rates causes the growth rate of the stock price to increase and the discount rate to increase. An increase in interest rates therefore reduces the value of puts because puts are hurt by both a discount rate increase and a growth rate increase. For calls, it turns out that the growth rate increase is more important than the discount rate increase so that their values increase when interest rates increase. (Note that we are assuming all else equal and so the asset price does not change.)

6. When the time to maturity increases with all else remaining the same, which of the following is true?
- A. European options always increase in value.
 - B. The value of European options either stays the same or increases.
 - C. There is no effect on European option values.
 - D. European options are liable to increase or decrease in value.

Answer: D

When the time to maturity increases from X to Y , European options usually increase in value. But this is not always the case. For example, European call options can decrease in value if a big dividend is expected between X and Y .

7. The price of a stock, which pays no dividends, is \$30 and the strike price of a one year European call option on the stock is \$25. The risk-free rate is 4% (continuously compounded). Which of the following is a lower bound for the option such that there are arbitrage opportunities if the price is below the lower bound and no arbitrage opportunities if it is above the lower bound?
- A. \$5.00
 - B. \$5.98
 - C. \$4.98
 - D. \$3.98

Answer: B

The lower bound in $S_0 - Ke^{-rT}$. In this case it is $30 - 25e^{-0.04 \times 1} = \5.98 .

8. A stock price (which pays no dividends) is \$50 and the strike price of a two year European put option is \$54. The risk-free rate is 3% (continuously compounded). Which of the following is a lower bound for the option such that there are arbitrage opportunities if the price is below the

lower bound and no arbitrage opportunities if it is above the lower bound?

- A. \$4.00
- B. \$3.86
- C. \$2.86
- D. \$0.86

Answer: D

The lower bound is $Ke^{-rT} - S_0$. In this case, it is $54e^{-0.03 \times 2} - 50 = \0.86 .

9. Which of the following is NOT true? (Present values are calculated from the end of the life of the option to the beginning.)

- A. An American put option is always worth less than the present value of the strike price.
- B. A European put option is always worth less than the present value of the strike price.
- C. A European call option is always worth less than the stock price.
- D. An American call option is always worth less than the stock price.

Answer: A

If it is optimal to exercise an American option today and the stock price is very low, the option will be worth more than the present value of the strike price.

10. Which of the following best describes the intrinsic value of an option?

- A. The value it would have if the owner had to exercise it immediately or not at all.
- B. The Black-Scholes-Merton price of the option.
- C. The lower bound for the option's price.
- D. The amount paid for the option.

Answer: A

The intrinsic value of an option is the value it would have if it were about to expire which is the same as the value in A.

11. Which of the following describes a situation where an American put option on a stock becomes more likely to be exercised early?

- A. Expected dividends increase
- B. Interest rates decrease
- C. The stock price volatility decreases
- D. All of the above

Answer: C

As the volatility of the option decreases, the time value declines and the option becomes more likely to be exercised early. In the case of A and B, time value increases and the option is less likely to be exercised early.

12. Which of the following is true?

- A. An American call option on a stock should never be exercised early.
- B. An American call option on a stock should never be exercised early when no dividends are expected.
- C. There is always some chance that an American call option on a stock will be exercised early.
- D. There is always some chance that an American call option on a stock will be exercised early when no dividends are expected.

Answer: B

An American call option should never be exercised early when the underlying stock does not pay dividends. There are two reasons. First, it is best to delay paying the strike price. Second, the insurance provided by the option (that the stock price will fall below the strike price) is lost.

13. Which of the following is the put-call parity result for a non-dividend-paying stock?

- A. The European put price plus the European call price must equal the stock price plus the present value of the strike price.
- B. The European put price plus the present value of the strike price must equal the European call price plus the stock price.
- C. The European put price plus the stock price must equal the European call price plus the strike price.
- D. The European put price plus the stock price must equal the European call price plus the present value of the strike price.

Answer: D

The put-call parity result is $c + Ke^{-rT} = p + S_0$.

14. Which of the following is true when dividends are expected?

- A. Put-call parity does not hold.
- B. The basic put-call parity formula can be adjusted by subtracting the present value of expected dividends from the stock price.
- C. The basic put-call parity formula can be adjusted by adding the present value of expected dividends to the stock price.
- D. The basic put-call parity formula can be adjusted by subtracting the dividend yield from the interest rate.

Answer: B

Put call parity still holds for European options providing the present value of the dividends is subtracted from the stock price.

15. The price of a European call option on a non-dividend-paying stock with a strike price of \$50 is \$6. The stock price is \$51, the continuously compounded risk-free rate (all maturities) is 6% and the time to maturity is one year. What is the price of a one-year European put option on the

stock with a strike price of \$50?

- A. \$9.91
- B. \$7.00
- C. \$6.00
- D. \$2.09

Answer: D

Put-call parity is $c + Ke^{-rT} = p + S_0$. In this case $K = 50$, $S_0 = 51$, $r = 0.06$, $T = 1$, and $c = 6$. It follows that

$$p = 6 + 50e^{-0.06 \times 1} - 51 = 2.09.$$

16. The price of a European call option on a stock with a strike price of \$50 is \$6. The stock price is \$51, the continuously compounded risk-free rate (all maturities) is 6% and the time to maturity is one year. A dividend of \$1 is expected in six months. What is the price of a one-year European put option on the stock with a strike price of \$50?

- A. \$8.97
- B. \$6.97
- C. \$3.06
- D. \$1.12

Answer: C

Put-call parity is $c + Ke^{-rT} = p + S_0 - D$. In this case $K = 50$, $S_0 = 51$, $r = 0.06$, $T = 1$, and $c = 6$.

The present value of the dividend, D , is $1 \times e^{-0.06 \times 0.5} = 0.97$. It follows that

$$p = 6 + 50e^{-0.06 \times 1} - (51 - 0.97) = 3.06.$$

17. A European call and a European put on a stock have the same strike price and time to maturity. At 10:00 am on a certain day, the price of the call is \$3 and the price of the put is \$4. At 10:01 am news reaches the market that has no effect on the stock price or interest rates, but increases volatilities. As a result, the price of the call changes to \$4.50. Which of the following is correct?
- A. The put price increases to \$6.00.
 - B. The put price decreases to \$2.00.
 - C. The put price increases to \$5.50.
 - D. It is possible that there is no effect on the put price.

Answer: C

The price of the call has increased by \$1.50. From put-call parity the price of the put must increase by the same amount. Hence, the put price will become $4.00 + 1.50 = \$5.50$.

18. Interest rates are zero. A European call with a strike price of \$50 and a maturity of one year is worth \$6. A European put with a strike price of \$50 and a maturity of one year is worth \$7. The current stock price is \$49. Which of the following is true?

- A. The call price is high relative to the put price.
- B. The put price is high relative to the call price.
- C. Both the call and put must be mispriced.
- D. None of the above.

Answer: D

In this case because interest rates are zero $c + K = p + S_0$. The left side of this equation is $50 + 6 = 56$. The right side is $49 + 7 = 56$. There is no mispricing.

19. Which of the following is true for American options?

- A. Put-call parity provides an upper and a lower bound for the difference between call and put prices.
- B. Put call parity provides an upper bound but no lower bound for the difference between call and put prices.
- C. Put call parity provides a lower bound but no upper bound for the difference between call and put prices.
- D. There are no put-call parity results.

Answer: A

Put call parity provides both an upper and a lower bound for the difference between call and put prices. See equation (11.11).

20. Which of the following can be used to create a long position in a European put option on a stock?

- A. Buy a call option on the stock and buy the stock.
- B. Buy a call on the stock and short the stock.
- C. Sell a call option on the stock and buy the stock.
- D. Sell a call option on the stock and sell the stock.

Answer: B

As payoff diagrams show, a call on a stock combined with a short position in the stock gives a payoff similar to a put option. Alternatively, we can use put-call parity, which shows that a call minus the stock equals the put minus the present value of the strike price.

1. Which of the following is assumed by the Black–Scholes–Merton model?
- A. The return from the stock in a short period of time is lognormal.
 - B. The stock price at a future time is lognormal.
 - C. The stock price at a future time is normal.
 - D. None of the above.

Answer: B

Black–Scholes–Merton assumes that the return from a stock in a short period of time is normally distributed. This means that the stock price at a future time is lognormally distributed.

2. Which of the following is a definition of volatility?
- A. The standard deviation of the return, measured with continuous compounding, in one year.
 - B. The variance of the return, measured with continuous compounding, in one year.
 - C. The standard deviation of the stock price in one year.
 - D. The variance of the stock price in one year.

Answer: A

Volatility when multiplied by the square root of Δt is the standard deviation of the return in a short period of time of length Δt . It is also the standard deviation of the continuously compounded return in one year.

3. A stock price is \$100. Volatility is estimated to be 20% per year. What is an estimate of the standard deviation of the change in the stock price in one week?
- A. \$0.38
 - B. \$2.77
 - C. \$3.02
 - D. \$0.76

Answer: B

The estimate is $100 \times 0.2 \times \sqrt{1/52} = \2.77 .

4. What does $N(x)$ denote?
- A. The area under a normal distribution from zero to x .
 - B. The area under a normal distribution up to x .
 - C. The area under a normal distribution beyond x .
 - D. The area under the normal distribution between $-x$ and x .

Answer: B

The normal distribution runs from minus infinity to plus infinity. $N(x)$ is the area under the distribution between minus infinity and x .

5. Which of the following is true for a one-year call option on a stock that pays dividends every three months?
- A. It is never optimal to exercise the option early.
 - B. It can be optimal to exercise the option at any time.
 - C. It is only ever optimal to exercise the option immediately after an ex-dividend date.
 - D. None of the above.

Answer: D

When there are dividends, it is sometimes optimal to exercise immediately before an ex-dividend date, but it is never optimal to exercise at other times. None of the first three answers are therefore correct.

6. What is the number of trading days in a year usually assumed for equities?
- A. 365
 - B. 252
 - C. 262
 - D. 272

Answer: B

Analysts usually assume that there are 252 trading days in a year for equities.

7. The risk-free rate is 5% and the expected return on a non-dividend-paying stock is 12%. Which of the following is a way of valuing a derivative?
- A. Assume that the expected growth rate for the stock price is 17% and discount the expected payoff at 12%.
 - B. Assuming that the expected growth rate for the stock price is 5% and discounting the expected payoff at 12%.
 - C. Assuming that the expected growth rate for the stock price is 5% and discounting the expected payoff at 5%.
 - D. Assuming that the expected growth rate for the stock price is 12% and discounting the expected payoff at 5%.

Answer: C

Risk-neutral valuation shows that a derivative can be correctly valued by assuming that the stock grows at the risk-free rate and discounting the expected payoff at the risk-free rate. It follows that C is the correct answer.

8. Which of the following is measured by the VIX index?
- A. Implied volatilities for stock options trading on the CBOE.
 - B. Historical volatilities for stock options trading on CBOE.
 - C. Implied volatilities for options trading on the S&P 500 index.
 - D. Historical volatilities for options trading on the S&P 500 index.

Answer: C

The VIX index measures the implied volatilities of one-month options trading on the S&P 500 index.

9. What was the original Black–Scholes–Merton model designed to value?
- A. A European option on a stock providing no dividends.
 - B. A European or American option on a stock providing no dividends.
 - C. A European option on any stock.
 - D. A European or American option on any stock.

Answer: A

The original Black–Scholes–Merton model was designed to value a European option on a stock paying no dividends.

10. An investor has earned 2%, 12% and –10% on equity investments in successive years (annually compounded). This is equivalent to earning which of the following annually compounded rates for the three year period.
- A. 1.33%
 - B. 1.23%
 - C. 1.13%
 - D. 0.93%

Answer: D

Over the three year period, \$100 grows to $100 \times 1.02 \times 1.12 \times 0.9 = \102.816 . This corresponds to an annually compounded return per year of $\sqrt[3]{1.02816} - 1 = 0.0093$ or 0.93%. One plus the return is the geometric average of 1.02, 1.12, and 0.90.

11. Which of the following is NOT true?
- A. Risk-neutral valuation provides prices that are only correct in a world where investors are risk-neutral.
 - B. Options can be valued based on the assumption that investors are risk neutral.
 - C. In risk-neutral valuation, the expected return on all investment assets is set equal to the risk-free rate.
 - D. In risk-neutral valuation, the risk-free rate is used to discount expected cash flows.

Answer: A

Risk-neutral valuation produces a valuation that is correct in all situations not just those where investors are risk-neutral. The expected return on all investments is assumed to be the risk-free rate and the risk-free rate is used to discount expected payoffs.

12. When the non-dividend paying stock price is \$20, the strike price is \$20, the risk-free rate is 6%, the volatility is 20% and the time to maturity is 3 months which of the following is the price of a European call option on the stock?

- A. $20N(0.1) - 19.7N(0.2)$
- B. $20N(0.2) - 19.7N(0.1)$
- C. $19.7N(0.2) - 20N(0.1)$
- D. $19.7N(0.1) - 20N(0.2)$

Answer: B

The formula for the option price is

$$S_0 N(d_1) - Ke^{-rT} N(d_2)$$

$$d_1 = \frac{\ln(S_0 / K) + (r + \sigma^2 / 2)T}{\sigma\sqrt{T}} \quad \text{and} \quad d_2 = d_1 - \sigma\sqrt{T}$$

In this case, $S_0 = K = 20$, $r = 0.06$, $\sigma = 0.2$, and $T = 0.25$ so that $Ke^{-rT} = 20e^{-0.06 \times 0.25} = 19.7$. Also $d_1 = [\ln(1) + (0.06 + 0.04/2) \times 0.25] / (0.2 \times 0.5) = 0.2$ and $d_2 = 0.2 - 0.2 \times 0.5 = 0.1$.

B is therefore the correct answer.

13. When the non-dividend paying stock price is \$20, the strike price is \$20, the risk-free rate is 6%, the volatility is 20% and the time to maturity is 3 months, which of the following is the price of a European put option on the stock?

- A. $19.7N(-0.1) - 20N(-0.2)$
- B. $20N(-0.1) - 20N(-0.2)$
- C. $19.7N(-0.2) - 20N(-0.1)$
- D. $20N(-0.2) - 20N(-0.1)$

Answer: A

The formula for the option price is

$$Ke^{-rT} N(-d_2) - S_0 N(-d_1)$$

$$d_1 = \frac{\ln(S_0 / K) + (r + \sigma^2 / 2)T}{\sigma\sqrt{T}} \quad \text{and} \quad d_2 = d_1 - \sigma\sqrt{T}$$

In this case, $S_0 = K = 20$, $r = 0.06$, $\sigma = 0.2$, and $T = 0.25$ so that $Ke^{-rT} = 20e^{-0.06 \times 0.25} = 19.7$. Also $d_1 = [\ln(1) + (0.06 + 0.04/2) \times 0.25] / (0.2 \times 0.5) = 0.2$ and $d_2 = 0.2 - 0.2 \times 0.5 = 0.1$.

A is therefore the correct answer.

14. A stock price is 20, 22, 19, 21, 24, and 24 on six successive Fridays. Which of the following is closest to the volatility per annum estimated from this data?

- A. 50%
- B. 60%
- C. 70%
- D. 80%

Answer: D

The price relative for the first week is $22/20$ or 1.1 . The natural log of the price relative is $\ln(1.1)$ or 0.09531 . Similarly, the \ln of the price relatives for the other weeks are -0.1466 , 0.1001 , 0.1335 , and 0 . The standard deviation of 0.09531 , -0.1466 , 0.1001 , 0.1335 , and 0 is 0.1138 . The volatility per week is therefore 11.38% . This corresponds to a volatility per year of 0.1138 multiplied by the square root of 52 or about 82% . The answer is therefore D.

15. The volatility of a stock is 18% per year. Which is closest to the volatility per month?

- A. 1.5%
- B. 3.0%
- C. 5.2%
- D. 6.3%

Answer: C

The volatility per month is the volatility per year multiplied by the square root of $1/12$. The square root of $1/12$ is 0.2887 and 18% multiplied by this is 5.2% .

1. A call option on a stock has a delta of 0.3. A trader has sold 1,000 options. What position should the trader take to hedge the position?
- A. Sell 300 shares
 - B. Buy 300 shares
 - C. Sell 700 shares
 - D. Buy 700 shares

Answer: B

When the stock price increases by a small amount, the option price increases by 30% of this amount. The trader therefore has a hedged position if he or she buys 300 shares. For small changes, the gain or loss on the stock position is equal and opposite to the loss or gain on the option position.

2. What does theta measure?
- A. The rate of change of delta with the asset price.
 - B. The rate of change of the portfolio value with the passage of time.
 - C. The sensitivity of a portfolio value to interest rate changes.
 - D. None of the above.

Answer: B

Theta measures the rate of change in the value of a portfolio with the passage of time.

3. What does gamma measure?
- A. The rate of change of delta with the asset price.
 - B. The rate of change of the portfolio value with the passage of time.
 - C. The sensitivity of a portfolio value to interest rate changes.
 - D. None of the above.

Answer: A

Gamma measures the rate of change of delta with the asset price.

4. What does vega measure?
- A. The rate of change of delta with the asset price.
 - B. The rate of change of the portfolio value with the passage of time.
 - C. The sensitivity of a portfolio value to interest rate changes.
 - D. None of the above.

Answer: D

Vega measures the rate of change of the value of the portfolio value with volatility.

5. What does rho measure?
- A. The rate of change of delta with the asset price.
 - B. The rate of change of the portfolio value with the passage of time.
 - C. The sensitivity of a portfolio value to interest rate changes.
 - D. None of the above.

Answer: C

Rho measures the rate of change of the value of the portfolio with interest rates. (Usually a parallel shift in interest rates is considered.)

6. Which of the following is true?
- A. The delta of a European put equals minus the delta of a European call.
 - B. The delta of a European put equals the delta of a European call.
 - C. The gamma of a European put equals minus the gamma of a European call.
 - D. The gamma of a European put equals the gamma of a European call.

Answer: D

The delta of a put on a non-dividend-paying stock equals the delta of the call minus one. The gamma of a put equals the gamma of call even when there are dividends.

7. A portfolio of derivatives on a stock has a delta of 2400 and a gamma of -10 . An option on the stock with a delta of 0.5 and a gamma of 0.04 can be traded. What position in the option is necessary to make the portfolio gamma neutral?
- A. Long position in 250 options
 - B. Short position in 250 options
 - C. Long position in 20 options
 - D. Short position in 20 options

Answer: A

The options must have a gamma of $+10$ to neutralize the gamma of the portfolio. Each option has a gamma of 0.04. Hence a long position of $10/0.04 = 250$ options is required.

8. Maintaining a delta-neutral portfolio is an example of which of the following?
- A. Stop-loss strategy
 - B. Dynamic hedging
 - C. Hedge and forget strategy
 - D. Static hedging

Answer: B

Delta-neutral hedging is an example of dynamic hedging. The hedge has to be adjusted periodically. (In theory, to maintain a delta-neutral hedge, the hedge must be adjusted continuously.)

9. Which of the following could NOT be a delta-neutral portfolio?

- A. A long position in call options plus a short position in the underlying stock.
- B. A short position in call options plus a short position in the underlying stock.
- C. A long position in put options and a long position in the underlying stock.
- D. A long position in a put option and a long position in a call option.

Answer: B

Calls have a positive delta. Puts have a negative delta. A long stock position has a positive delta. A short stock position has a negative delta. B cannot be delta neutral (i.e., have a delta of zero) because both parts of the portfolio have a negative delta.

10. Which of the following is NOT true about gamma?

- A. A highly positive or highly negative value of gamma indicates that a portfolio needs frequent rebalancing to stay delta neutral.
- B. The magnitude of gamma is a measure of the curvature of the portfolio value as a function of the underlying asset price.
- C. A big positive value for gamma indicates that a big movement in the asset price in either direction will lead to a loss.
- D. A long position in either a call or a put has a positive gamma.

Answer: C

C is not true. The change in the value is a gain of $0.5\Gamma\Delta S^2$. There is a gain from a big movement when gamma is positive and a loss from a big movement when gamma is negative.

11. Gamma tends to be high for which of the following?

- A. At-the money options
- B. Out-of-the money options
- C. In-the-money options
- D. Options with a long time to maturity

Answer: A

Gamma tends to be high for at-the-money options. See Figure 19.9.

12. Which of the following is true for a call option on a non-dividend-paying stock when the stock's price equals the strike price?

- A. It has a delta of 0.5.
- B. It has a delta less than 0.5.
- C. It has a delta greater than 0.5.
- D. Delta can be greater than or less than 0.5.

Answer: C

The delta is $N(d_1)$ where

$$d_1 = \frac{\ln(S_0 / K) + (r + \sigma^2 / 2)T}{\sigma\sqrt{T}}$$

From this it can be seen that, when $S_0 = K$, d_1 is

$$\frac{(r + \sigma^2 / 2)\sqrt{T}}{\sigma}$$

This is always positive. Hence, delta is always greater than 0.5.

13. The risk-free rate is 5% and the dividend yield on an index is 2%. Which of the following is the delta with respect to the index for a one-year futures on the index?
- A. 0.98
 - B. 1.05
 - C. 1.03
 - D. 1.02

Answer: C

The futures price is given by $F_0 = S_0 e^{(r-q)T}$. Hence, the delta of the futures with respect to the spot is $e^{(r-q)T}$. In this case, this is $e^{(0.05-0.03) \times 1} = 1.03$.

14. The gamma of a delta-neutral portfolio is 500. What is the impact of a jump of \$3 in the price of the underlying asset?
- A. A gain of \$2,250
 - B. A loss of \$2,250
 - C. A gain of \$750
 - D. A loss of \$750

Answer: A

The change in the value is a gain of $0.5\Gamma\Delta S^2 = 0.5 \times 500 \times 3^2 = \$2,250$.

15. Vega tends to be high for which of the following?
- A. At-the money options
 - B. Out-of-the money options
 - C. In-the-money options
 - D. Options with a short time to maturity

Answer: A

Vega tends to be high for at-the-money options. See Figure 19.11.

16. The delta of a call option on a non-dividend-paying stock is 0.4. What is the delta of the corresponding put option?
- A. -0.4
 - B. 0.4
 - C. -0.6
 - D. 0.6

Answer: C

The delta of a call option is $N(d_1)$ and the delta of a put is $N(d_1)-1$. When $N(d_1) = 0.4$, $N(d_1)-1$ is -0.6 .

17. A call option on a non-dividend-paying stock has a strike price of \$30 and a time to maturity of six months. The risk-free rate is 4% and the volatility is 25%. The stock price is \$28. What is the delta of the option?

- A. $N(-0.1342)$
- B. $N(-0.1888)$
- C. $N(-0.2034)$
- D. $N(-0.2241)$

Answer: B

The delta is $N(d_1)$ where

$$d_1 = \frac{\ln(S_0 / K) + (r + \sigma^2 / 2)T}{\sigma\sqrt{T}}$$

In this case

$$d_1 = \frac{\ln(28/30) + (0.04 + 0.25^2 / 2) \times 0.5}{0.25\sqrt{0.5}} = -0.1888$$

18. Which of the following is NOT a letter in the Greek alphabet?

- A. delta
- B. rho
- C. vega
- D. gamma

Answer: C

Vega, although it is referred to a "Greek letter" by option traders, is not a letter in the Greek alphabet.

19. Which of the following is true for a long position in an option?

- A. Both gamma and vega are negative.
- B. Gamma is negative and vega is positive.
- C. Gamma is positive and vega is negative.
- D. Both gamma and vega are positive.

Answer: D

Gamma and vega are both positive for a long position in an option. It does not matter whether the option is a call or a put.

1. Which of the following is true of a volatility smile?
 - A. Implied volatility is on the horizontal axis and strike price is on the vertical axis.
 - B. Historical volatility is on the horizontal axis and strike price is on the vertical axis.
 - C. Implied volatility is on the vertical axis and strike price is on the horizontal axis.
 - D. Historical volatility is on the vertical axis and strike price is on the horizontal axis.

Answer: C

A volatility smile shows implied volatility (which is on the vertical axis) as a function of the strike price (which is on the horizontal axis).

2. Which of the following is true?
 - A. Volatility smile for European puts is the same as for European calls.
 - B. Volatility smile for European puts is the same as for American puts.
 - C. Volatility smile for European calls is the same as for American calls.
 - D. Volatility smile for American puts is the same as for American calls.

Answer: A

Put call parity shows that the volatility smile for European puts should be exactly the same as that for European calls. The volatility smile for American options is usually close to but not exactly the same as that for European options.

3. Which of the following is true when the tails of a future foreign currency distribution are compared with those of a lognormal distribution with the same mean and standard deviation?
 - A. The left tail and right tail are thinner.
 - B. The left tail is thinner and the right tail is fatter.
 - C. The right tail is thinner and the left tail is fatter.
 - D. Both tails are fatter.

Answer: D

Both tails of the foreign currency distribution are fatter. This leads to a U-shaped smile.

4. Why do traders use volatility smiles for pricing options?
 - A. To allow for non-lognormality of the probability distribution of future asset price.
 - B. Because it is consistent with recent market moves.
 - C. As a tool to reflect their views about extreme market moves.
 - D. Because extreme market moves are always more likely than Black–Scholes–Merton assumes.

Answer: A

Volatility smiles allow for the fact that the assumptions underlying the Black–Scholes–Merton model do not hold exactly. The BSM assumptions imply a lognormally distributed future asset price.

5. What does the shape of the volatility smile reveal about put options on equity?
- A. Options close-to-the-money have the lowest implied volatility.
 - B. Options deep-in-the-money have a relatively high implied volatility.
 - C. Options deep-out-of-the-money have a relatively high implied volatility.
 - D. All of the above.

Answer: C

The volatility smile shows that low-strike-price options have high implied volatilities relative to at-the-money options. High-strike-price options have low implied volatilities relative to at-the-money options. Out-of-the-money put options have a low strike price. Hence C is correct.

6. What does the shape of the volatility smile reveal about call options on a currency?
- A. Options close-to-the-money have the lowest implied volatility.
 - B. Options deep-in-the-money have a relatively high implied volatility.
 - C. Options deep-out-of-the-money have a relatively high implied volatility.
 - D. All of the above.

Answer: D

D is correct. The volatility smile for currency options is U-shaped.

7. Which of the following is NOT true?
- A. A volatility surface provides more information than a single volatility smile.
 - B. A volatility surface is used to determine the implied volatility of an option that does not trade actively.
 - C. A volatility surface can be determined from a single volatility smile using interpolation.
 - D. A volatility surface incorporates information about options with different maturity dates.

Answer: C

A volatility surface requires a knowledge of how implied volatilities vary with option maturity. C is therefore not true.

8. A volatility surface is a table showing the relationship among which of the following?
- A. Implied volatility, time to maturity, and strike price
 - B. Implied volatility, historical volatility, and time to maturity
 - C. Historical volatility, strike price, and time to maturity
 - D. None of the above

Answer: A

A volatility surface is a table showing implied volatilities as a function of strike price and time to maturity.

9. Which of the following could be a result of “crashophobia”?

- A. High volatilities for in-the-money calls
- B. High volatilities for in-the-money puts
- C. High volatilities for at-the-money calls
- D. Low volatilities for at-the-money puts

Answer: A

Crashophobia is the word used to describe a possible “phobia” that traders might have that the market will crash. It would lead to out-of-the-money put options with low strike prices having high values and therefore high implied volatilities. In-the-money call options have the same implied volatilities as the corresponding out-of-the-money put options. Hence, they also have high implied volatilities and the correct answer is A.

10. Which of the following is true for European call and put options?

- A. If they have the same strike price, they have the same implied volatility.
- B. If they have the same time to maturity, they have the same implied volatility.
- C. If they have the same strike price and time to maturity, they have the same implied volatility.
- D. None of the above.

Answer: C

If a European call and put option have the same strike price and time to maturity put-call parity shows that they must have the same implied volatility. Otherwise there are arbitrage opportunities.

11. The daily percentage change in an exchange rate is compared to a normal distribution with the same mean and standard deviation. Which of the following is true?

- A. Both small and large exchange rate moves are more likely than with the normal distribution.
- B. Small exchange rate moves are less likely and large exchange rate moves are more likely than with the normal distribution.
- C. Large exchange rate moves are less likely and small exchange rate moves are more likely than with the normal distribution.
- D. Both small and large exchange rate moves are less likely than with the normal distribution.

Answer: A

Both large and small movements in the exchange rate happen more often than the normal distribution would predict.

12. If the volatility implied from an at-the-money put stock option were used to price other put options on the stock, which of the following would be true?

- A. Out-of-the money and in-the-money prices would be too high.
- B. Out-of-the money and in-the-money prices would be too low.
- C. Out-of-the-money option prices would be too high and in-the-money option prices

would be too low.

- D. Out-of-the-money option prices would be too low and in-the-money option prices would be too high.

Answer: D

The volatility smile for equity options shows that at-the-money put options have lower implied volatilities than out-of-the-money put options and a higher volatility than in-the-money put options. This means that using at-the-money implied volatilities for out-of-the-money put options would lead to underpricing and using at-the-money implied volatilities for in-the-money put options would lead to overpricing . Hence, the correct answer is D.