Chapter 8: Option pricing in continuous time

Self test questions

1. What does Black and Scholes' option pricing assume about stock returns over time?
   (a) That they are independently distributed ☐ True ☐ False
   (b) That they are identically distributed ☐ True ☐ False
   (c) That they follow a random walk ☐ True ☐ False
   (d) That they are lognormally distributed ☐ True ☐ False

2. Under the B&S assumptions, stock returns over a given time period:
   (a) Increase proportionally with time
   (b) Increase proportionally with the square root of time
   (c) Are independent of time

3. Under the B&S assumptions, the variance of stock returns over a given time period:
   (a) Increases proportionally with time
   (b) Increases proportionally with the square root of time
   (c) Is independent of time

4. Under the B&S assumptions, the standard deviation of stock returns over a given time period:
   (a) Increases proportionally with time
   (b) Increases proportionally with the square root of time
   (c) Is independent of time

5. Under the B&S assumptions, the instantaneous stock return:
   (a) Increases proportionally with time
   (b) Increases proportionally with the square root of time
   (c) Is independent of time

6. How well do the B&S assumptions fit real life stock returns?
   (a) Very well, real life stock returns are also normally distributed ☐ True ☐ False
   (b) Real life stock returns have a higher expectation ☐ True ☐ False
   (c) Real life stock returns have fatter tails ☐ True ☐ False
   (d) Real life stock returns are skewed ☐ True ☐ False

7. Which of the following characteristics must the increments of a dynamic process have if it is a Brownian motion?
   (a) They are independent ☐ True ☐ False
   (b) They are lognormally distributed ☐ True ☐ False
   (c) They are stationary ☐ True ☐ False

8. Brownian motion is included in the model of stock price behaviour over time to reflect:

   (a) The instantaneous return of the stock ☐ True ☐ False
   (b) The drift in stock prices over time ☐ True ☐ False
   (c) The random element in stock prices over time ☐ True ☐ False
   (d) The arrival of new information on stock prices ☐ True ☐ False

9. In Black and Scholes' option pricing, stock price changes are modelled in a stochastic differential equation with:

   (a) Stochastic drift and diffusion terms
   (b) A deterministic drift and a stochastic diffusion term
   (c) A stochastic drift and a deterministic diffusion term
   (d) Deterministic drift and diffusion terms

10. Which of the following stock price patterns are possible under the assumptions of Black and Scholes' option pricing model?

    (a) Sudden jumps ☐ True ☐ False
    (b) Mean reversion ☐ True ☐ False
    (c) Rapid growth to very high prices ☐ True ☐ False
    (d) Negative prices ☐ True ☐ False
    (e) Momentum in prices ☐ True ☐ False

11. In Black and Scholes' option pricing, the probability measure is changed with:

    (a) The vector of state prices
    (b) The vector of discounted state prices
    (c) Minus the market price of risk: $-(\mu - r)/\sigma$
    (d) None of the above

12. In the Black and Scholes' option pricing formula, $O^E_{c,0} = S_0 N(d_1) - X e^{-rT} N(d_2)$, the term $N(d_1)$ is:

    (a) The risk neutral probability that the option will be exercised
    (b) The 'moneyness' of the option
    (c) The option delta
    (d) None of the above

13. In the Black and Scholes' option pricing formula, $O^E_{c,0} = S_0 N(d_1) - X e^{-rT} N(d_2)$, the term $N(d_2)$ is:

    (a) The risk neutral probability that the option will be exercised
    (b) The 'moneyness' of the option
    (c) The option delta
    (d) None of the above

14. What is the option delta in the Black and Scholes' option pricing formula, $O^E_{c,0} = S_0 N(d_1) - X e^{-rT} N(d_2)$?

    (a) The hedge ratio ☐ True ☐ False
    (b) The option price's sensitivity for changes in the stock price ☐ True ☐ False
    (c) The partial derivative $\partial O^E_{c,0}/\partial S_0$ ☐ True ☐ False
    (d) $N(d_1)$ ☐ True ☐ False

15. In the Black and Scholes' option pricing formula, the price of a call option:

    (a) Increases with the exercise price
    (b) Is independent of the exercise price
    (c) Decreases with the exercise price
    (d) Cannot say without more information

16. In the Black and Scholes' option pricing formula, the price of a put option:

    (a) Increases with the exercise price
    (b) Is independent of the exercise price
    (c) Decreases with the exercise price
    (d) Cannot say without more information

17. In the Black and Scholes' option pricing formula, the price of a call option:

    (a) Increases with the stock price
    (b) Is independent of the stock price
    (c) Decreases with the stock price
    (d) Cannot say without more information

18. In the Black and Scholes' option pricing formula, the price of a put option:

    (a) Increases with the stock price
    (b) Is independent of the stock price
    (c) Decreases with the stock price
    (d) Cannot say without more information

19. In the Black and Scholes' option pricing formula, the price of a call option:

    (a) Increases with the stock price volatility
    (b) Is independent of the stock price volatility
    (c) Decreases with the stock price volatility
    (d) Cannot say without more information

20. In the Black and Scholes' option pricing formula, the price of a put option:

    (a) Increases with the stock price volatility
    (b) Is independent of the stock price volatility
    (c) Decreases with the stock price volatility
    (d) Cannot say without more information

21. In the Black and Scholes' option pricing formula, the price of a call option:

    (a) Increases with the time to maturity
    (b) Is independent of the time to maturity
    (c) Decreases with the time to maturity
    (d) Cannot say without more information

22. In the Black and Scholes' option pricing formula, the price of a put option:

    (a) Increases with the time to maturity
    (b) Is independent of the time to maturity
    (c) Decreases with the time to maturity
    (d) Cannot say without more information

23. In the Black and Scholes' option pricing formula, the price of a call option:

    (a) Increases with the risk free interest rate
    (b) Is independent of the risk free interest rate
    (c) Decreases with the risk free interest rate
    (d) Cannot say without more information

24. In the Black and Scholes' option pricing formula, the price of a put option:

    (a) Increases with the risk free interest rate
    (b) Is independent of the risk free interest rate
    (c) Decreases with the risk free interest rate
    (d) Cannot say without more information

25. If the Black and Scholes assumptions obtain, then implied volatility

    (a) Increases with in- and out-of-the-moneyness
    (b) Is independent of in- and out-of-the-moneyness
    (c) Decreases with in- and out-of-the-moneyness
    (d) Cannot say without more information

26. Empirical research shows that implied volatility

    (a) Increases with in- and out-of-the-moneyness
    (b) Is independent of in- and out-of-the-moneyness
    (c) Decreases with in- and out-of-the-moneyness
    (d) Cannot say without more information