Questions and Answers

1. What is the difference between entering into a long forward contract when the forward price is $50 and taking a long position in a call option with a strike price of $50?

Solution. In the first case the trader is obligated to buy the asset for $50. (The trader does not have a choice.) In the second case the trader has an option to buy the asset for $50. (The trader does not have to exercise the option.)

2. Explain carefully the difference between writing (selling) a call option and buying a put option.

Solution. Writing a call option involves selling an option to someone else. It gives a payoff of

\[ \min(X - S_T, 0). \]

Buying a put option involves buying an option from someone else. It gives a payoff of

\[ \max(X - S_T, 0). \]
In both cases the potential payoff is $X - S_T$. When you write a call option, the payoff is negative or zero. (This is because the counterparty chooses whether to exercise.) When you buy a put option, the payoff is zero or positive. (This is because you choose whether to exercise.)

3. A trader enters into a short forward contract on 100 million yen. The forward exchange rates is $0.0080$ per yen. How much does the trader gain or lose if the exchange rate at the end of the contract is (a) $0.0074$ per yen; (b) $0.0091$ per yen?

Solution.

(a) The trader sells 100 million yen for $0.0080$ per yen when the exchange rate is $0.0074$ per yen. The gain is

$$(0.0080 - 0.0074) \times 100 = $60,000.$$

(b) The trader sells 100 million yen for $0.0080$ per yen when the exchange rate is $0.0091$ per yen. The loss is

$$(0.0091 - 0.0080) \times 100 = $110,000.$$

4. A trader enters into a short cotton futures contract when the futures price is 50 cents per pound. The contract is for the delivery of 50,000 pounds. How much does the trader
gain or lose if the cotton price at the end of the contract is (a) 48.20 cents per pound; (b) 51.30 cents per pound?

**Solution.**

(a) The trader sells for 50 cents per pound something that is worth 48.20 cents per pound.

\[ \text{Gain} = (0.5000 - 0.4820) \times 50,000 = 900. \]

(b) The trader sells for 50 cents per pound something that is worth 51.30 cents per pound.

\[ \text{Loss} = (0.5130 - 0.5000) \times 50,000 = 650. \]

5. A trader buys a European put on a share for $3. The stock price is $42 and the strike price is $40. Under what circumstances does the trader make a profit? Under what circumstances will the option be exercised? Draw a diagram showing the variation of the trader’s profit with the stock price at the maturity of the option.

**Solution.** The trader makes a profit if the stock price is below $37 at the maturity of the option. The option will be exercised if the stock price is below $40. See Figure 1.1 for the variation of the profit with the stock price.

6. A trader sells a European call on a share for $4. The stock
price is $47 and the strike price is $50. Under what circumstances does the trader make a profit? Under what circumstances will the option be exercised? Draw a diagram showing the variation of the trader’s profit with the stock price at the maturity of the option.

**Solution.** The trader makes a profit if the stock price is below $54 at the maturity of the option. The option will be exercised by the counterparty if the stock price is above $50. See Figure 1.2 for the variation of the profit with the stock price.

7. A trader buys a call option with a strike price of $45 and a put option with a strike price of $40. Both options have the same maturity. The call costs $3 and the put costs $4. Draw a diagram showing the variation of the trader’s profit with the asset price.

**Solution.** See Figure 1.3 for the variation of the trader’s position with the asset price. We can divide the alternative asset prices into three ranges:

(a) When the asset price less than $40, the put option provides a payoff of $40 − S_T$ and the call option provides no payoff. The options cost $7 and so the total profit is $33 − S_T$. 

(b) When the asset price is between $40 and $45, neither option provides a payoff. There is net loss of $7.

(c) When the asset price greater than $45, the call option provides a payoff of $S_T - 45$ and the put option provides no payoff. Taking into account the $7 cost of the options, the total profit is $S_T - 52$.

The trader makes a profit (ignoring the time value of money) if the stock price is less than $33 or greater than $52.

8. The price of gold is currently $500 per ounce. The forward price for delivery in one year is $700. An arbitrageur can borrow money at 10% per annum. What should the arbitrageur do? Assume that the cost of storing gold is zero.

Solution. The arbitrageur could borrow money to buy 100 ounces of gold today and short futures contracts on 100 ounces of gold for delivery in one year. This means that gold is purchased for $500 per ounce and sold for $700 per ounce. The return (40% per annum) is far greater than the 10% cost of the borrowed funds. This is such a profitable opportunity that the arbitrageur should buy as many ounces of gold as possible and short futures contracts on the same number of ounces.
Figure 1.1 Profit from long put position
Figure 1.2  Profit from long put position
Figure 1.3  Profit from trading strategy