

## Derivatives Questions

### Question 1

Explain carefully the difference between hedging, speculation, and arbitrage.

### Question 2

What is the difference between entering into a long forward contract when the forward price is \$20 and taking a long position in a call option with a strike price of \$20?

### Question 3

What kind of swap should a financial institution enter into if it will be adversely affected by increasing interest rates over the next 2 years? Should the bank pay fixed and receive floating, or vice versa?

### Question 4

What is the major distinction between a forward contract and an options contract?

### Question 5

Hedgers, speculators, and arbitrageurs are three types of futures traders. For each type, explain what would motivate the trader to open a *long* futures position.

### Question 6

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

### Question 7

Suppose you manage a portfolio of \$100 million. You estimate that there is a probability of 20% that the portfolio value will go to \$80 million next year and a probability of 80% that it will go to \$120 million. If the value is less than \$90 million, you will be fired. How can you protect yourself with put options?

### Question 8

What is the role of credit derivatives?

**Question 9**

Suppose the stock price is \$100 and the call price is \$5 with a strike price of \$105. What is the profit or loss on the following two strategies when the stock price goes up to \$110 and when the stock goes down to \$90?

- a. Write a call option.
- b. Write a covered call option; that is, write a call and buy the stock.

**Question 10**

ABC Corp agrees to sell \$10,000,000 at an exchange rate of €0.97/\$1 to Bank A in six months. Six months later the exchange rate is \$1.15/€. What was ABC Corp profit on the forward contract?

**Question 11**

When first issued, a stock provides funds for a company. Is the same true of a stock option? Discuss.

**Question 12**

A 2-year LIBOR-based swap will have four future semiannual payments. If the fixed rate is 5% and the principal is \$3,000,000, the future cash flows will depend on the differences between 5% and the current LIBOR rate. If the LIBOR rate is 7% after 1 year, what semiannual payment must the fixed counterparty pay the receiver floating counterparty?

**Question 13**

Suppose  $\sigma = 35\%$ ,  $S_0 = \$100$ ,  $X = \$100$ ,  $r = 5\%$ ,  $q = 0$  and  $t = 1/2$ ,  $N(d_1) = 0.58892$  and  $N(d_2) = 0.49094$ . Calculate the Black-Scholes call and put option prices.

**Question 14**

On June 10, an investor sells five September S&P futures contracts at 1,120.50. On August 2, the investor enters into an offsetting trade with the futures contract priced at 1,098.93. If the dollar multiplier is \$250, what is the investor's gain or loss?

**Question 15**

An investor owns a stock at \$50 and buys a put on the same stock for \$2 with a strike price of \$48. What is the maximum loss on the strategy? What is the breakeven price of the underlying asset?

**Question 16**

Under what circumstances are appropriated:

- a. a short hedge
- b. a long hedge

### Question 17

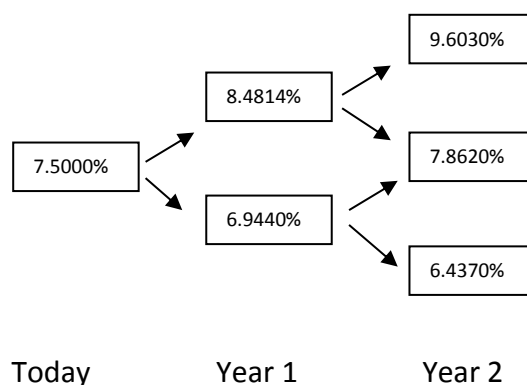
Explain why an FRA is equivalent to the exchange of a floating rate of interest for a fixed rate of interest.

### Question 18

Shaun has entered a pay fixed plain vanilla interest rate swap with quarterly settlement starting on the 1<sup>st</sup> July 2013, based on a fixed rate of 3.55% for LIBOR. LIBOR is 3.79% at the start of the swap and falls by 20bp by 1<sup>st</sup> October 2013 and a further 35bp by 1<sup>st</sup> January 2014. If the swap has a notional principal of £13,000,000 calculate the payment Shaun will make/receive on 1<sup>st</sup> January 2014. Show your calculations

### Question 19

Use the following arbitrage-free binomial interest rate tree to answer the questions that follow:



- What is the value of a 3-year Treasury bond with a 9% coupon rate?
- What is the value of a 2-year call option on a bond that currently has three years to maturity and coupon rate of 9% if the strike price is 98? Assume in this calculation that the current price of the 3-year Treasury bond is the value found in part a.

### Question 20

Companies A and B has been offered the following rates per annum on a \$20 million five-year loan:

	Fixed rate	Floating rate
Company A	5.0%	LiBOR + 0.1%
Company B	6.4%	LIBOR + 0.6%

Company A requires a floating-rate loan; company B requires a fixed-rate loan. Design a swap that will net a bank, acting as intermediary, 0.1% per annum and that will appear equally attractive to both companies.

**Question 21**

An investor owns a stock at \$35 and writes a call against it for \$2 with a strike price of \$37. What is the maximum profit that the investor could attain? What is the breakeven price of the underlying stock?

**Question 22**

Consider a one-month FRA (Forward Rate Agreement) contract, expiring in 30 days, based on 3-month LIBOR. The underlying rate on the contract is the 3-month LIBOR that will prevail in 30 days. Suppose the two parties to the contract agree on a fixed rate of 2.75%. The notional amount of the contract is \$100,000,000. Thirty days later, the 3-month LIBOR is 2.90%. Calculate the FRA payment to be made in thirty days.

**Question 23**

An investor 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 investor make a profit? Under what circumstances will the option be exercised? Draw a diagram showing the variation of the investor's profit with the stock price at the maturity of the option.

**Question 24**

Explain why an American option is always worth at least as much as a European option on the same asset with the same strike price and exercise date.

**Question 25**

Counterparty A enters into a pay fixed-for-floating interest rate swap with a notional principal of \$25 million with counterparty B. The swap agreement requires semi-annual payments. The swap fixed rate is 5% and the floating rate is 6-month LIBOR + 50 basis points. If the LIBOR rate is 4.3%, what is the first net payment?

**Question 26**

What features have been incorporated in mortgage-backed securities in order to help mitigate the contraction and extension risk for some investors?

**Question 27**

What is meant by a protective put? What position in call options is equivalent to a protective put?

**Question 28**

A call option with a strike price of \$50 costs \$2. A put option with a strike price of \$45 costs \$3. Explain how a strangle can be created from these two options. What is the pattern of profits from the strangle?

### Question 29

Assume the following Treasury spot rates:

Period	Years to Maturity	Spot Rate
1	0.5	5.0%
2	1.0	5.4%
3	1.5	5.8%
4	2.0	6.4%
5	2.5	7.0%
6	3.0	7.2%
7	3.5	7.4%
8	4.0	7.8%

Compute the following forward rates:

- i. the 6-month forward rate six months from now.
- ii. the 6-month forward rate one year from now.
- iii. the 6-month forward rate three years from now.

### Question 30

Suppose you have a long position in a 7-year bond and you want to hedge your position against a change in interest rates. What is the disadvantage of hedging with just one bond (e.g. 30-years bond) instead of hedging with two bonds (e.g. 2 year and 30 year bonds)?

### Question 31

Three put options on a stock have the same expiration date and strike prices of \$55, \$60, and \$65. The market prices are \$3, \$5, and \$8, respectively. Explain how a butterfly spread can be created. Construct a table showing the profit from the strategy. For what range of stock prices would the butterfly spread lead to a loss?

### Question 32

Explain the no-arbitrage and risk-neutral valuation approaches to valuing a European option using a one-step binomial tree.

### Question 33

A stock price is currently \$100. Over each of the next two six-month periods it is expected to go up by 10% or down by 10%. The risk-free interest rate is 8% per annum with continuous compounding. What is the value of a one-year European call option with a strike price of \$100?

### Question 34

The volatility of a stock price is 30% per annum. What is the standard deviation of the percentage price change in one trading day?

### Question 35

Explain the principle of risk-neutral valuation.

**Question 36**

How does contraction and extension risk arise in the context of mortgage-backed securities (MBS)?

**Question 37**

Calculate the price of a three-month European put option on a non-dividend paying stock with a strike price of \$50 when the current stock price is \$50, the risk-free interest rate is 10% per annum, and the volatility is 30% per annum.

**Question 38**

What is implied volatility? How can be calculated?

**Question 39**

Consider a position consisting of a \$100,000 investment in Asset A, and a \$100,000 investment in asset B. Assume that the daily volatilities of both assets are 1% and that the coefficient of correlation between their returns is 0.3. What is the 5-day 99% VaR for the portfolio?

**Question 40**

A stock price is currently \$40. Over each of the next two three-month periods it is expected to go up by 10% or down by 10%. The risk-free interest rate is 12% per annum with continuous compounding?

a. What is the value of a six-month European put option with a strike price of \$42?

b. What is the value of a six-month American put option with a strike price of \$42?