EXAMPLE 8.1: FRM EXAM 2007—QUESTION 84

According to put-call parity, buying a put option on a stock is equivalent to

a. Buying a call option and buying the stock with funds borrowed at the risk-free rate
b. Selling a call option and buying the stock with funds borrowed at the risk-free rate
c. Buying a call option, selling the stock, and investing the proceeds at the risk-free rate
d. Selling a call option, selling the stock, and investing the proceeds at the risk-free rate

EXAMPLE 8.2: FRM EXAM 2005—QUESTION 72

A one-year European put option on a non-dividend-paying stock with strike at EUR 25 currently trades at EUR 3.19. The current stock price is EUR 23 and its annual volatility is 30%. The annual risk-free interest rate is 5%. What is the price of a European call option on the same stock with the same parameters as those of this put option? Assume continuous compounding.

a. EUR 1.19
b. EUR 3.97
c. EUR 2.41
d. Cannot be determined with the data provided

EXAMPLE 8.3: FRM EXAM 2008—QUESTION 2-10

The current price of stock ABC is \$42 and the call option with a strike at \$44 is trading at \$3. Expiration is in one year. The corresponding put is priced at \$2. Which of the following trading strategies will result in arbitrage profits? Assume that the risk-free rate is 10% and that the risk-free bond can be shorted costlessly. There are no transaction costs.

a. Long position in both the call option and the stock, and short position in the put option and risk-free bond
b. Long position in both the call option and the put option, and short position in the stock and risk-free bond
c. Long position in both the call option and the risk-free bond, and short position in the stock and the put option
d. Long position in both the put option and the risk-free bond, and short position in the stock and the call option

EXAMPLE 8.4: FRM EXAM 2006—QUESTION 74

Jeff is an arbitrage trader, who wants to calculate the implied dividend yield on a stock while looking at the over-the-counter price of a five-year European put and call on that stock. He has the following data: $S = \$85$, $K = \$90$, $r = 5\%$, $c = \$10$, $p = \$15$. What is the continuous implied dividend yield of that stock?

a. 2.48%
b. 4.69%
c. 5.34%
d. 7.71%

EXAMPLE 8.5: RISK OF OPTION CONTRACTS

Which of the following is the riskiest form of speculation using option contracts?

a. Setting up a spread using call options
b. Buying put options
c. Writing naked call options
d. Writing naked put options

EXAMPLE 8.6: FRM EXAM 2007—QUESTION 103

An investor sells a June 2008 call of ABC Limited with a strike price of USD 45 for USD 3 and buys a June 2008 call of ABC Limited with a strike price of USD 40 for USD 5. What is the name of this strategy and the maximum profit and loss the investor could incur?

a. Bear spread, maximum loss USD 2, maximum profit USD 3
b. Bull spread, maximum loss unlimited, maximum profit USD 3
c. Bear spread, maximum loss USD 2, maximum profit unlimited
d. Bull spread, maximum loss USD 2, maximum profit USD 3

EXAMPLE 8.7: FRM EXAM 2006—QUESTION 45

A portfolio manager wants to hedge his bond portfolio against changes in interest rates. He intends to buy a put option with a strike price below the portfolio's current price in order to protect against rising interest rates. He also wants to sell a call option with a strike price above the portfolio's current price in order to reduce the cost of buying the put option. What strategy is the manager using?

a. Bear spread
b. Strangle
c. Collar
d. Straddle

EXAMPLE 8.8: FRM EXAM 2002—QUESTION 42

Consider a bearish option strategy of buying one \$50 strike put for \$7, selling two \$42 strike puts for \$4 each, and buying one \$37 put for \$2. All options have the same maturity. Calculate the final profit per share of the strategy if the underlying is trading at \$33 at expiration.

a. \$1 per share
b. \$2 per share
c. \$3 per share
d. \$4 per share

EXAMPLE 8.9: FRM EXAM 2009—QUESTION 3-8

According to an in-house research report, it is expected that USDJPY (quoted as JPY/USD) will trade near 97 at the end of March. Frankie Shiller, the investment director of a house fund, decides to use an option strategy to capture this opportunity. The current level of the USDJPY exchange rate is 97 on February 28. Accordingly, which of the following strategies would be the most appropriate for the largest profit while the potential loss is limited?

a. Long a call option on USDJPY and long a put option on USDJPY with the same strike price of USDJPY 97 and expiration date
b. Long a call option on USDJPY with strike price of USDJPY 97 and short a call option on USDJPY with strike price of USDJPY 99 and the same expiration date
c. Short a call option on USDJPY and long a put option on USDJPY with the same strike price of USDJPY 97 and expiration date
d. Long a call option with strike price of USDJPY 96, long a call option with strike price of USDJPY 98, and sell two call options with strike price of USDJPY 97, all of them with the same expiration date

EXAMPLE 8.10: FRM EXAM 2002—QUESTION 50

Given strictly positive interest rates, the best way to close out a long American call option position early (on a stock that pays no dividends) would be to

a. Exercise the call
b. Sell the call
c. Deliver the call
d. Do none of the above

EXAMPLE 8.11: FRM EXAM 2005—QUESTION 15

You have been asked to verify the pricing of a two-year European call option with a strike price of USD 45. You know that the initial stock price is USD 50, and the continuous risk-free rate is 3%. To verify the possible price range of this call, you consider using price bounds. What is the difference between the upper and lower bounds for that European call?

a. 0.00
b. 7.62
c. 42.38
d. 45.00

EXAMPLE 8.12: FRM EXAM 2008—QUESTION 2-6

Which two of the following four statements are *correct* about the early exercise of American options on non-dividend-paying stocks?

I. It is never optimal to exercise an American call option early.
II. It can be optimal to exercise an American put option early.
III. It can be optimal to exercise an American call option early.
IV. It is never optimal to exercise an American put option early.

a. I and II
b. I and IV
c. II and III
d. III and IV

EXAMPLE 8.13: FRM EXAM 2001—QUESTION 91

Using the Black-Scholes model, calculate the value of a European call option given the following information: spot rate = 100; strike price = 110; risk-free rate = 10%; time to expiry = 0.5 years; $N(d_1) = 0.457185$; $N(d_2) = 0.374163$.

a. \$10.90
b. \$9.51
c. \$6.57
d. \$4.92

EXAMPLE 8.14: PROBABILITY OF EXERCISE

In the Black-Scholes expression for a European call option, the term used to compute option probability of exercise is

a. d_1
b. d_2
c. $N(d_1)$
d. $N(d_2)$

EXAMPLE 8.15: FRM EXAM 2003—QUESTION 34

Which of the following options is strongly path-dependent?

a. An Asian option
b. A binary option
c. An American option
d. A European call option

EXAMPLE 8.16: FRM EXAM 2006—QUESTION 59

All else being equal, which of the following options would cost more than plain-vanilla options that are currently at-the-money?

I. Lookback options
II. Barrier options
III. Asian options
IV. Chooser option

a. I only
b. I and IV
c. II and III
d. I, III, and IV

EXAMPLE 8.17: FRM EXAM 2002—QUESTION 19

Of the following options, which one does *not* benefit from an increase in the stock price when the current stock price is \$100 and the barrier has not yet been crossed?

a. A down-and-out call with barrier at \$90 and strike at \$110
b. A down-and-in call with barrier at \$90 and strike at \$110
c. An up-and-in put with barrier at \$110 and strike at \$100
d. An up-and-in call with barrier at \$110 and strike at \$100

EXAMPLE 8.18: FRM EXAM 2006—QUESTION 86

Which one of the following statements about American options is *incorrect*?

a. American options can be exercised at any time until maturity.
b. American options are always worth at least as much as European options.
c. American options can easily be valued with Monte Carlo simulation.
d. American options can be valued with binomial trees.

8.7 ANSWERS TO CHAPTER EXAMPLES

Example 8.1: FRM Exam 2007—Question 84

c. Buying a put creates a gain if the stock price falls, which is similar to selling the stock on the downside. On the upside, the loss is capped by buying a call.

Example 8.2: FRM Exam 2005—Question 72

c. By put-call parity, $c = p + Se^{-r^*\tau} - Ke^{-r\tau} = 3.19 + 23 - 25\exp(-0.05 \times 1) = 3.19 - 0.78 = 2.409$. Note that the volatility information is not useful.

Example 8.3: FRM Exam 2008—Question 2-10

c. Answers a. and b. have payoffs that depend on the stock price and therefore cannot create arbitrage profits. Put-call parity says that $c - p = 3 - 2 = \$1$ should equal $S - Ke^{-r\tau} = 42 - 44 \times 0.9048 = \$2.19$. The call option is cheap. Therefore buy the call and hedge it by selling the stock, for the upside. The benefit from selling the stock if S goes down is offset by selling a put.

Example 8.4: FRM Exam 2006—Question 74

c. By put-call parity, $c - p = Se^{-r^*\tau} - Ke^{-r\tau}$. Therefore, $Se^{-r^*\tau} = (c - p + Ke^{-r\tau}) = (10 - 15 + 90\exp(0.05 \times 5) = 65.09$. The dividend yield is then $y = -(1/T)\ln(65.09/85) = 5.337\%$.

Example 8.5: Risk of Option Contracts

c. Long positions in options can lose at worst the premium, so b. is wrong. Spreads involve long and short positions in options and have limited downside loss, so

a. is wrong. Writing options exposes the seller to very large losses. In the case of puts, the worst loss is the strike price K, if the asset price goes to zero. In the case of calls, however, the worst loss is in theory unlimited because there is a small probability of a huge increase in S. Between c. and d., c. is the better answer.

Example 8.6: FRM Exam 2007—Question 103

d. This position is graphed in Figure 8.6. It benefits from an increase in the price between 40 and 45, so is a bull spread. The worst loss occurs below $K_1 = 40$, when none of the options is exercised and the net lost premium is $5 - 3 = 2$. The maximum profit occurs above $K_2 = 45$, when the two options are exercised, for a net profit of \$5 minus the lost premium, which gives \$3.

Example 8.7: FRM Exam 2006—Question 45

c. The manager is long a portfolio, which is protected by buying a put with a low strike price and selling a call with a higher strike price. This locks in a range of profits and losses and is a collar. If the strike prices were the same, the hedge would be perfect.

Example 8.8: FRM Exam 2002—Question 42

b. Because the final price is below the lowest of the three strike prices, all the puts will be exercised. The final payoff is (\$50 − \$33) − 2(\$42 − \$33) + (\$37 − \$33) = \$17 − \$18 + \$4 = \$3. From this, we have to deduct the up-front cost, which is −\$7 + 2(\$4) − \$2 = −\$1. The total profit is then, ignoring the time value of money, \$3 − \$1 = \$2 per share.

Example 8.9: FRM Exam 2009—Question 3-8

d. The best strategy among these is a long butterfly, which benefits if the spot stays at the current level. Answer a. is a long straddle, which is incorrect because this will lose money if the spot rate does not move. Answer b. is a bull spread, which is incorrect because it assumes the spot price will go up. Answer c. is the same as a short spot position, which is also incorrect.

Example 8.10: FRM Exam 2002—Question 50

b. When there is no dividend, there is never any reason to exercise an American call early. Instead, the option should be sold to another party.

Example 8.11: FRM Exam 2005—Question 15

c. The upper bound is $S = 50$. The lower bound is $c \geq S - Ke^{-rT} = 50 - 45\exp(-0.03 \times 2) = 50 - 42.38 = 7.62$. Hence, the difference is 42.38.

Example 8.12: FRM Exam 2008—Question 2-6

a. If the stock does not pay a dividend, the value of the American call option alive is always higher than if exercised (basically because there is no dividend to capture).

Hence, it never pays to exercise a call early. On the other hand, exercising an American put early may be rational because it is better to receive the strike price now than later, with positive interest rates.

Example 8.13: FRM Exam 2001—Question 91

c. We use Equation (8.14), assuming there is no income payment on the asset. This gives $c = SN(d_1) - K\exp(-r\tau)N(d_2) = 100 \times 0.457185 - 110\exp(-0.1 \times 0.5) \times 0.374163 = \$6.568$.

Example 8.14: Probability of Exercise

d. This is the term multiplying the present value of the strike price, by Equation (8.17).

Example 8.15: FRM Exam 2003—Question 34

a. The payoff of an Asian option depends on the average value of S and therefore is path-dependent.

Example 8.16: FRM Exam 2006—Question 59

b. Lookback options use the maximum stock price over the period, which must be more than the value at the end. Hence they must be more valuable than regular European options. Chooser options involve an additional choice during the life of the option, and as a result are more valuable than regular options. Asian options involve the average, which is less volatile than the final price, so must be less expensive than regular options. Finally, barrier options can be structured so that the sum of two barrier options is equal to a regular option. Because each premium is positive, a barrier option must be less valuable than regular options.

Example 8.17: FRM Exam 2002—Question 19

b. A down-and-in call comes alive only when the barrier is touched; so an increase in S brings it away from the barrier. This is not favorable, so b. is the correct answer. A down-and-out call (answer a.) where the barrier has not been touched is still alive and hence benefits from an increase in S. An up-and-in put (c.) would benefit from an increase in S as this would bring it closer to the barrier of \$110. Finally, an up-and-in call (d.) would also benefit if S gets closer to the barrier.

Example 8.18: FRM Exam 2006—Question 86

c. This statement is incorrect because Monte Carlo simulations are strictly backward-looking, and cannot take into account optimal future exercise, which a binomial tree can do.