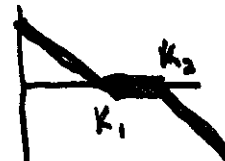


**UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN**  
**Actuarial Science Program**  
**DEPARTMENT OF MATHEMATICS**

Math 370 (Z)  
 Exam 2/FM Preparation

Prof. Rick Gorvett

**Forwards, Options, and Derivatives Strategies**  
Review Problems



CAS/SOA Sample Problems for Exam FM

- 1) Which statement about zero-cost purchased collars is FALSE? → **EQUAL PREMIUMS:  $P=C$**  → **PURCHASE PUT( $K_1$ )  
SELL CALL( $K_2$ ),  $K_1 < K_2$**
- (A) A zero-width, zero-cost collar can be created by setting both the put and call strike prices at the forward price.
- (B) There are an infinite number of zero-cost collars.
- (C) The put option can be at-the-money.
- (D) The call option can be at-the-money. → IF SO, THEN  $P(K_1)$  WOULD COST LESS THAN  $C(K_2)$ .**
- (E) The strike price on the put option must be at or below the forward price.

(2007 sample question # 1) (OR, FOR  $P=C$ ,  $K_1$  WOULD HAVE TO BE HIGHER THAN  $K_2$ ).

2) You are given the following information:

- The current price to buy one share of XYZ stock is 500.
- The stock does not pay dividends.
- The risk-free interest rate, compounded continuously, is 6%.
- A European call option on one share of XYZ stock with a strike price of  $K$  that expires in one year costs 66.59.
- A European put option on one share of XYZ stock with a strike price of  $K$  that expires in one year costs 18.64.

Using put-call parity, determine the strike price,  $K$ .

- (A) 449  
 (B) 452  
**(C) 480**  
 (D) 559  
 (E) 582

$$C - P = S - PV(K)$$

$$66.59 - 18.64 = 500 - e^{-.06}(K)$$

$$\Rightarrow K = \underline{\underline{480.00}} \quad (2007 \text{ sample question \# 2})$$

3) Happy Jalapenos, LLC has an exclusive contract to supply jalapeno peppers to the organizers of the annual jalapeno eating contest. The contract states that the contest organizers will take delivery of 10,000 jalapenos in one year at the market price. It will cost Happy Jalapenos 1,000 to provide 10,000 jalapenos and today's market price is 0.12 for one jalapeno. The continuously compounded risk-free interest rate is 6%.

Happy Jalapenos has decided to hedge as follows (both options are one-year, European):

Buy 10,000 0.12-strike put options for 84.30 and sell 10,000 0.14-strike call options for 74.80.

Happy Jalapenos believes the market price in one year will be somewhere between 0.10 and 0.15 per pepper. Which interval represents the range of possible profit one year from now for Happy Jalapenos?

- (A) -200 to 100
- (B) -110 to 190
- (C) -100 to 200
- (D) 190 to 390
- (E) 200 to 400

<u>MKT. PRICE (p)</u>	<u>PROFIT</u>
(a) $p < 0.12$ :	$10,000(0.12 - p) + 10,000p - 1000$ $- (84.30 - 74.80) e^{+0.06}$ $= 1200 - 1000 - 10.09 = \underline{\underline{189.91}}$ <p style="text-align: right;"><i>(2007 sample question # 3)</i></p>

(b)  $.12 \leq p \leq .14$  :

$p = .12 \Rightarrow \underline{\underline{189.91}}$

$p = .14 \Rightarrow \underline{\underline{389.91}}$

(c)  $p > 0.14$  :

$$-10,000(p - .14) + 10,000p - 1000 - 10.09$$

$$= \underline{\underline{389.91}}$$

4) You believe that the volatility of a stock is higher than indicated by market prices for options on that stock. You want to speculate on that belief by buying or selling at-the-money options. What should you do?

- (A) Buy a strangle  $\rightarrow$  BUY OUT-OF-THE-MONEY OPTIONS
  - (B) Buy a straddle  $\rightarrow$  PURCHASE AT-THE-MONEY PUT AND CALL.
  - (C) Sell a straddle
  - (D) Buy a butterfly spread
  - (E) Sell a butterfly spread
- } A VARIETY OF STRIKE PRICES. *(2007 sample question # 8)*

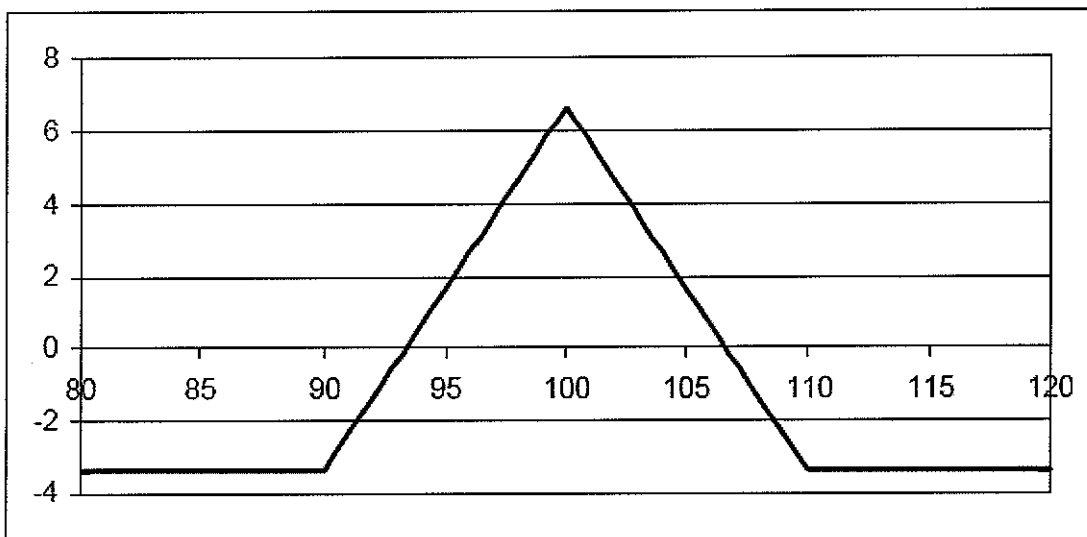


5) You are given the following information:

- The current price to buy one share of ABC stock is 100
- The stock does not pay dividends
- The risk-free rate, compounded continuously, is 5%
- European options on one share of ABC stock expiring in one year have the following prices:

Strike Price	Call option price	Put option price
90	14.63	0.24
100	6.80	1.93
110	2.17	6.81

A butterfly spread on this stock has the following profit diagram:



Which of the following will NOT produce this profit diagram?

- (A) Buy a 90 put, buy a 110 put, sell two 100 puts
- (B) Buy a 90 call, buy a 110 call, sell two 100 calls
- (C) Buy a 90 put, sell a 100 put, sell a 100 call, buy a 110 call
- (D) Buy one share of the stock, buy a 90 call, buy a 110 put, sell two 100 puts
- (E) Buy one share of the stock, buy a 90 put, buy a 110 call, sell two 100 calls

(2007 sample question # 9)

E.g., consider  $S_T < 90$ . LOOKING FOR CONSTANT VALUE.

$$(A) (90 - S) + (110 - S) - 2(100 - S) = 0$$

$$(B) 0$$

$$(C) (90 - S) - (100 - S) = -10$$

$$(D) S + (110 - S) - 2(100 - S) = 2S - 90 \Rightarrow \underline{\underline{NOT}} \text{ CONSTANT.}$$

$$(E) S + (90 - S) = 90$$

### Other Problems

- 6) You purchase 250 shares of ABC stock. At the time of purchase, the bid and ask prices are 43.25 and 43.75, respectively. You later sell these shares when the bid and ask prices are 44.00 and 44.50, respectively. The commission rate on stock transactions is 0.5%. Determine your profit / (loss) from this complete buy-sell transaction.

- (A) 47.19
- (B) 18.53
- (C) 0.00
- (D) 18.53
- (E) 47.19

$$\begin{aligned} \text{PAY} &: (43.75 \times 250)(1.005) = 10,992.19 \\ \text{RECEIVE} &: (44.00 \times 250) - .005(44 \times 250) = 10,945 \\ \text{NET} &: \underline{\underline{-47.19}} \end{aligned}$$

- 7) The price of ABC stock is 77. A 6-month 75-strike European put option is purchased on ABC stock; the put has a premium of 3.50. The annual continuously-compounded risk-free interest rate is 6%. At the expiration of the put, the price of ABC stock is 72.75. Find the profit / (loss) on the long put position.

- (A) 2.90
- (B) 1.36
- (C) 0.00
- (D) 1.36
- (E) (2.90)

$$(75 - 72.75) - (3.50 \cdot e^{.06(1/2)}) = \underline{\underline{-1.36}}$$

- 8) Which of the following position will NOT benefit from a price increase?

- (A) Long call
- (B) Short put
- (C) Short forward
- (D) Long stock
- (E) Long forward

- 9) You purchase a one-year 50-strike European call option for 7.00, and sell a one-year 65-strike European call option for 2.00. Both options are on ABC stock, which has a current price of 51.50. The annual continuously-compounded interest rate is 8%. Find the maximum possible profit from your position on the expiration date of the options.

- (A) 9.58
- (B) 10.00
- (C) 10.26
- (D) 11.03
- (E) 12.11

$$(65 - 50) - [(7 - 2) \cdot e^{.08}] = \underline{\underline{9.58}}$$