FIN 4460 Name ________________________________
Spring 2017 Exam #1

Multiple choice – 3 points each – 30 points total

1. Suppose you feel a certain stock will appreciate in value. Which of the following option strategies will create a profit for you?
   I. Buy a call.
   II. Buy a put.
   III. Sell a call.
   IV. Sell a put.

   A. II and III only.
   B. I only.
   C. II and IV only.
   D. I and IV only.
   E. IV only.

2. A call option has a vega of 7 and a price of $4.25. If the volatility of the stock price goes from 40% to 38%, the new price of the option would be approximately:

   A. $4.11
   B. $4.18
   C. $4.25
   D. $4.32
   E. $4.39

3. The highest price for a call option is the _____, and the highest possible price of a put option is _______.

   A. strike price; stock price
   B. intrinsic value; strike price
   C. stock price; intrinsic value
   D. stock price; strike price
   E. intrinsic value; stock price

4. Which of the following is an income producing strategy?

   A. Naked calls.
   B. Protective puts.
   C. Covered calls.
   D. Straddles.
   E. Naked puts.

5. A stock is currently selling for $92. A put option on the stock is available for $5.25 with a strike price of $80 and three months to maturity. The risk-free rate is 4 percent. What is the price of a call option with the same strike and expiration?

A. $26.30
B. $5.83
C. $21.63
D. $18.05
E. $17.13

6. Which of the following is/are correct?

		Sign of Input Effect	
		Call	Put
I.	The strike price.	–	+
II.	The time to expiration.	+	–
III.	The volatility of the underlying	+	+
IV	The risk-free rate.	+	–

A. I and II only
B. I and III only
C. II and III only
D. II and IV only
E. I, III, and IV

7. All else the same, which of the following call options will have the highest price?

A. Stock price = $50, Standard deviation = 45 percent
B. Stock price = $50, Standard deviation = 50 percent
C. Stock price = $55, Standard deviation = 45 percent
D. Stock price = $55, Standard deviation = 50 percent
E. Insufficient information.

8. All else the same, which of the following put options will have the highest price?

A. Stock price = $50, Strike price = $45
B. Stock price = $50, Strike price = $50
C. Stock price = $55, Strike price = $45
D. Stock price = $55, Strike price = $50
E. Insufficient information.

9. You are managing a stock portfolio with a value of $50,000,000 and a beta of 1.15. The S&P 500 index is trading at 1,120. If the delta of the options is 0.48, how can you hedge your portfolio using call options?

A. buy 1,070 contracts
B. sell 1,130 contracts
C. sell 1,070 contracts
D. sell 1,095 contracts
E. buy 1,130 contracts

10. A call option has a delta of 0.48 and sells for $6.59. What is the estimate of the new call price if the stock price increases by $0.75?

A. $6.83
B. $6.72
C. $7.01
D. $7.07
E. $6.95

Partial Credit Problems – Show All Work – 70 Total Points

Problem 1 (4 points) You find a put and a call on a particular stock with an expiration date some time in the future and the same strike price that both sell for the same price. Can you tell whether the put or the call is in the money? Explain.

Problem 2 (15 points) A stock is currently selling for $74. There are puts and calls with a strike price of $75, and maturity of 83 days. The stock has a standard deviation of 52 percent per year and the risk-free rate is 4.5 percent. What is the price of the put and call? What are the delta, eta, vega, gamma, and rho for each option?

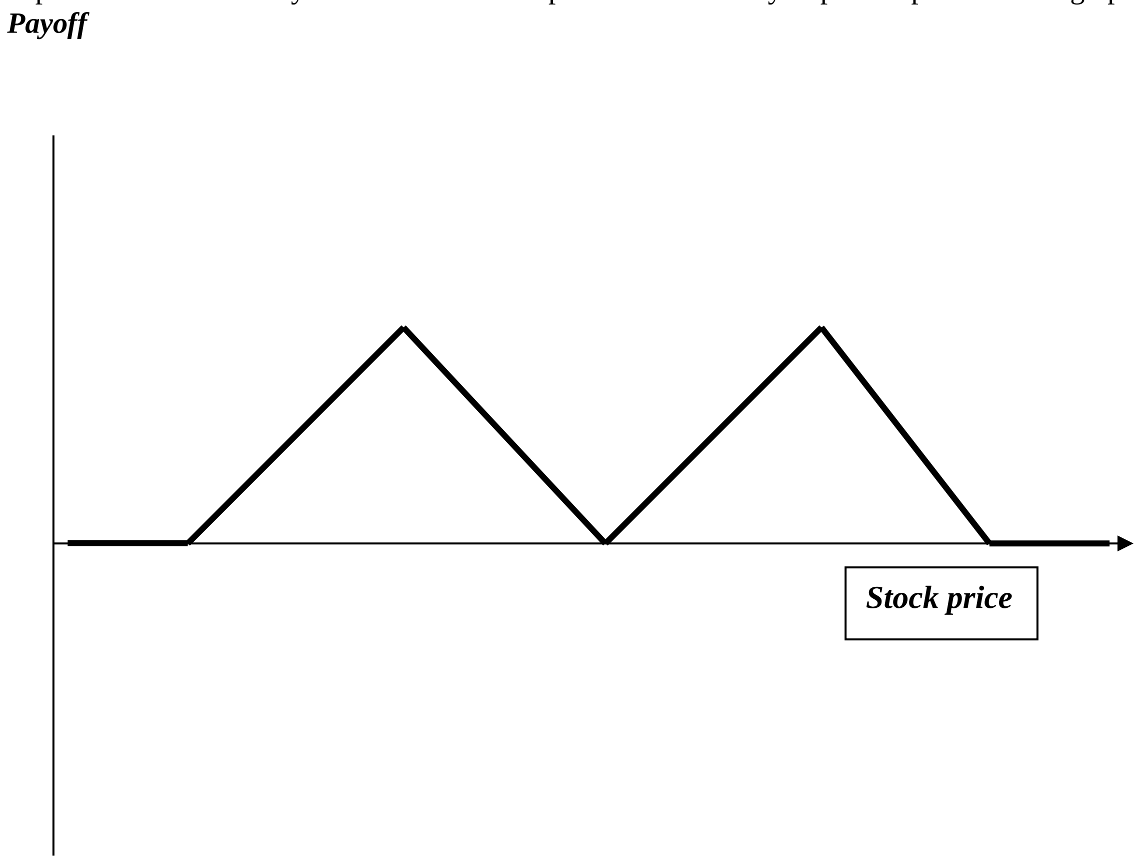
NAME: __________________________________

Problem 3 (15 points) There is an American put option on a stock with an annual standard deviation of 55%. The current stock price is $82, the expected return is 12%, and the risk-free rate is 5%. The strike price of the option is $80 and the option expires in four months. The stock will pay a dividend of $1.80 in one and one-half months. Price the option using a binomial tree with one-month steps.

Problem 4 (15 points) In your quest for riches, you have decided to invest in options using a modified butterfly. Instead of a 1 × 2 × 1 ratio, you enter into the contracts at a 2 × 3 × 1 ratio, that is, you buy 2 puts at X_1, sell 3 puts at X_2, and buy 1 put at X_3. Note in this case, $3(X_3 – X_2) = X_2 – X_1$. Using the option prices for IBM, construct a modified butterfly with X_1 = \$105, X_2 = \$120, and X_3 = \$125. You will be placing market orders so you will buy and sell at the appropriate price. A) What is your payoff for all possible stock price ranges in terms of X and S? B) Draw a payoff diagram. C) What is the breakeven point(s) for this investment? D) When would you implement such a strategy?

Strike	Symbol	Last	Chg	Bid	Ask	Vol	Open Int
90.00	IBM100220P00090000	0.02	0.00	N/A	0.02	39	550
95.00	IBM100220P00095000	0.03	0.00	N/A	0.03	0	855
100.00	IBM100220P00100000	0.01	↓ 0.06	N/A	0.02	3	843
105.00	IBM100220P00105000	0.04	↓ 0.03	0.01	0.05	2	898
110.00	IBM100220P00110000	0.07	↓ 0.01	0.05	0.07	166	2,339
115.00	IBM100220P00115000	0.10	↓ 0.04	0.08	0.10	671	7,163
120.00	IBM100220P00120000	0.35	↓ 0.29	0.33	0.35	1,930	12,330
125.00	IBM100220P00125000	2.00	↓ 0.95	2.00	2.06	2,232	13,530
130.00	IBM100220P00130000	6.28	↓ 1.07	6.25	6.35	915	9,455
135.00	IBM100220P00135000	11.20	↓ 0.76	11.15	11.30	66	3,703
140.00	IBM100220P00140000	16.35	0.00	16.05	16.55	27	1,212
145.00	IBM100220P00145000	22.58	0.00	21.05	21.55	1	683
150.00	IBV100220P00150000	25.09	0.00	26.00	26.55	0	262

Problem 5 (15 points) You want to construct a portfolio with the following payoff using only put and/or call options. Describe how you can construct the portfolio. Label any important points on the graph.



Problem 6 (6 points) A stock is currently selling for $93. A call and a put option expiring in six months exist with a strike price of $95. The risk-free rate is 6 percent. The call sells for $8.61 and the put sells for $8.15. Is there an arbitrage opportunity available? If so, explain how you would take advantage of the opportunity and calculate the arbitrage profit.

Answer Key FIN 4460 EXAM 1 Spring 2017

1. D
2. A
3. D
4. C
5. D $\$5.25 + \$92 – \$80e^{-.04(3/12)} = \$18.05$
6. E
7. D
8. B
9. C $\frac{1.15 \times \$50,000,000}{.48 \times 1120 \times \$100}$ = 1,070 contracts to write
10. E $\$6.59 + \$0.75(.48) = \$6.95$

Problem 1

The put is in the money. From put-call parity, we have:

$C – P = S – Xe^{-Rt}$

Since the put and call both have the same price, the left side of the equation is zero, so:

$0 = S – Xe^{-Rt}$
$S = Xe^{-Rt}$

Since the stock price is undiscounted, the strike price is discounted, and the difference is equal to zero, the only way this could work mathematically is for the stock price to be less than the strike price, so the put must always be in the money.

Problem 2

Stock price	$ 74.00		
Strike price	$ 75.00		
Risk-free rate	4.50%		
Maturity (days)	83		
Standard deviation	52.00%		
Dividend yield	0.00%		
d1	0.111119		
N(d1)	0.544239	N(-d1)	0.455761
d2	-0.136849		
N(d2)	0.445575	N(-d2)	0.554425
Call price	7.196		
Put price	7.432		

	Call	***Put***
Delta	0.54424	-0.45576
Eta	5.59685	-4.53785

Vega	13.99114	13.99114	N'(d1)	0.396487
Gamma	0.02161	0.02161		
Theta	-17.48561	-14.14497		
Theta (day)	-$0.069	-$0.056		
Rho	7.52182	-9.35934		

Problem 3

$u = e^{\sigma\sqrt{\Delta T}} = e^{.55\sqrt{(1/12)}} = 1.1721$

$d = \frac{1}{u} = \frac{1}{1.1721} = .8532$

$p = \frac{e^{\mu\Delta T} - d}{u - d} = \frac{e^{.12(1/12)} - .8532}{1.1721 - .8532} = .4919$

$1 - p = .5081$

Value @ a node = $e^{-R\Delta T}[pf_U + (1 - p)f_d]$

$e^{-R\Delta T} = e^{-.05(1/12)} = .9958$

Value @ I = .9958[.4919($0) + .5081($21.61)] = $10.93
Exercise value = $11.56, so exercise early
Value @ J = .9958[.4919($21.61) + .5081($37.50)] = $29.56
Exercise value = $30.81, so exercise early
Value @ D = $0
Value @ E = .9958[.4919($0) + .5081($11.56)] = $5.85
Value @ F = .9958[.4919($11.56) + .5081($30.18)] = $20.93
Exercise value = $21.61, so exercise early
Value @ B = .9958[.4919($0) + .5081($5.85)] = $2.96
Value @ C = .9958[.4919($5.85) + .5081($21.61)] = $13.80
Value @ A = .9958[.4919($2.96) + .5081($13.80)] = $8.43

PV Dividend	
T	PV
0	$1.7888
1	$1.7963

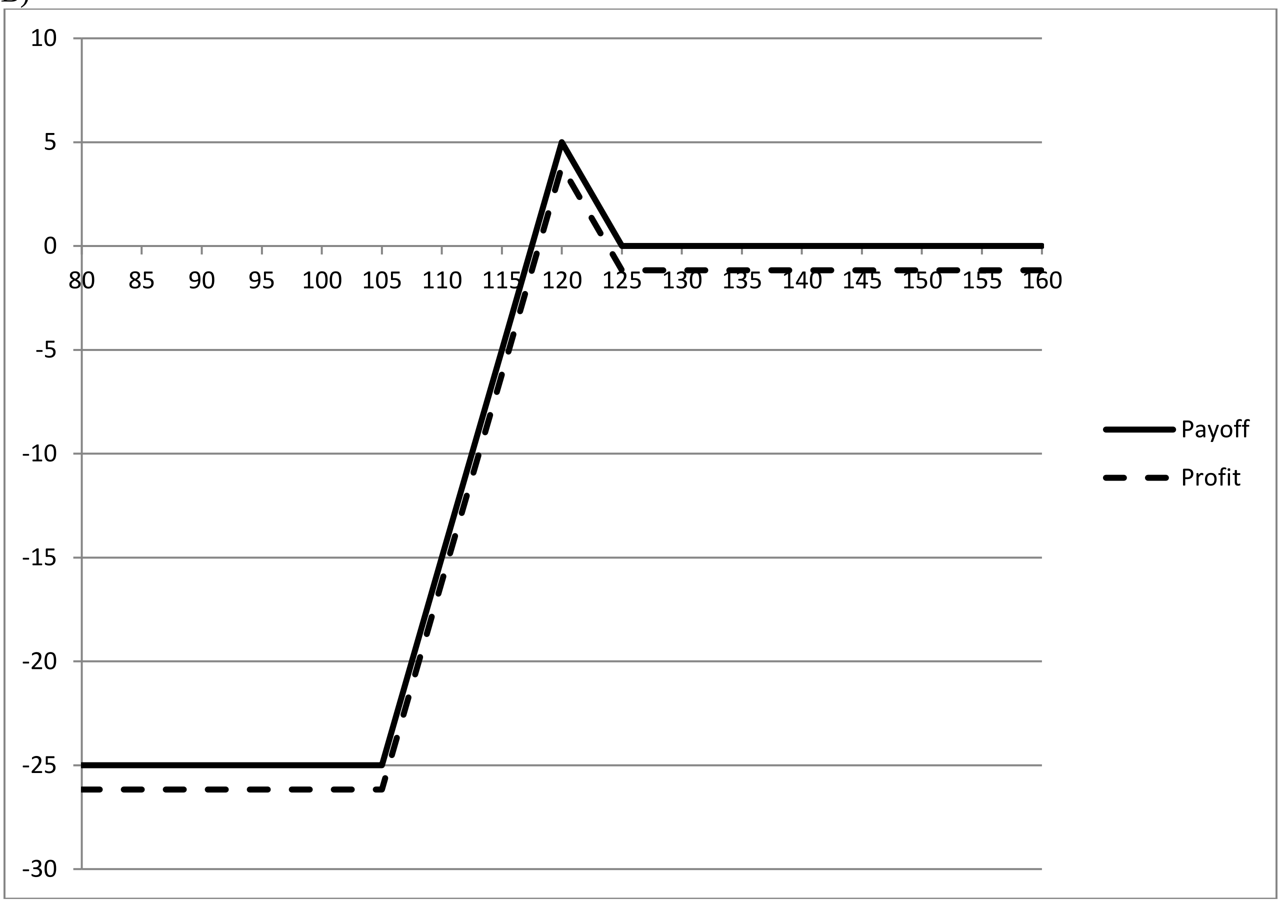
								S_K*	151.37
								S_K	151.37
								f_K	0.00
						S_G*	129.15		
						S_G	129.15		
						f_G	0.00		
				S_D*	110.19			S_L*	110.19
				S_D	110.19			S_L	110.19
				f_D	0.00			f_L	0.00
		S_B*	94.01			S_H*	94.01		
		S_B	95.81			S_H	94.01		
		f_B	2.96			f_H	0.00		
S_0*	80.21			S_E*	80.21			S_M*	80.21
S_0	82.00			S_E	80.21			S_M	80.21
f_A	8.43			f_E	5.85			f_M	0.00
		S_C*	68.44			S_I*	68.44		
		S_C	70.23			S_I	68.44		
		f_C	13.80			f_I	11.56		
				S_F*	58.39			S_N*	58.39
				S_F	58.39			S_N	58.39
				f_F	21.61			f_N	21.61
						S_J*	49.82		
						S_J	49.82		
						f_J	30.18		
								S_O*	42.50
								S_O	42.50
								f_O	37.50

Problem 4

A)

	$S_T < X_1$	$X_1 < S_T < X_2$	$X_2 < S_T < X_3$	$S_T > X_4$
Long 2 puts at X_1	$2(X_1 - S_T)$	0	0	0
Short 3 puts at X_2	$-3(X_2 - S_T)$	$-3(X_2 - S_T)$	0	0
Long put at X_3	$X_3 - S_T$	$X_3 - S_T$	$X_3 - S_T$	0
Payoff	$2X_1 - 3X_2 + X_3$	$X_3 - 3X_2 + 2S_T$	$X_3 - S_T$	

B)



C) You would buy at the ask and sell at the bid. The total cost of the strategy is Cost = –2($0.05) + 3($0.33) – $2.06 = –$1.17. In this case the profit is $1.17 below the payoff. One breakeven point is below $125. Since the slope of the line at that point is –1 (you lose $1 for every $1 drop in stock price), calculate where you will lose $1.17, which is $123.83. The other breakeven point is above $110. Above $110, you gain $2 for every $1 in stock price and you are losing $26.17 already at $105, so you need to gain $26.17 ($25 + 1.17). So $26.17/2 = $13.085. This means the other breakeven point is $118.085. You could also calculate from $120. You are making $3.83 here, so $3.83/2 = $1.915 and $120 – 1.915 = $118.05. The best you can do is make $4.27 ($5 – 1.17), assuming no transaction costs.

D) Similar to a butterfly, you would want the price to remain near X_2

Problem 5

This payoff diagram is a combination of 2 long butterflies:

Buy a call at X_1	Buy a call at X_1
Sell 2 calls at X_2	Sell 2 calls at X_2
Buy 2 calls at X_3	Buy a call at X_3
Sell 2 calls at X_4	Buy a put at X_3
Buy a call at X_5	Sell 2 puts at X_4
	Buy a put at X_5

OR:

Buy a put at X_1	Buy a put at X_1
Sell 2 puts at X_2	Sell 2 puts at X_2
Buy 2 puts at X_3	Buy a put at X_3
Sell 2 puts at X_4	Buy a call at X_3
Buy a put at X_5	Sell 2 calls at X_4
	Buy a call at X_5

Problem 6

Using put-call parity:

$S + P – C = Xe^{–rT}$

$\$93 + \$8.15 – C = \$95e^{–.06(6/12)}$

$C = \$8.96$

The call is underpriced. Re-writing put-call parity, we get $C = S + P – Xe^{–rT}$. So, we would buy the underpriced asset (the call) and sell the overpriced asset ($S + P – Xe^{–rT}$).

	Now	$S_T < X$	$S_T > X$
Call	–\$8.61	\$0	$S_T – 95$
Stock	+\$93	$–S_T$	$–S_T$
Put	+\$8.15	$–(\$95 – S_T)$	\$0
Borrow R_F	–\$92.19	\$95	\$95
	\$0.35	\$0	\$0

You make \$0.35 now and have no cash flow at expiration.