Finance 436 – Futures and Options
Review Notes for Final Exam

Chapter 9

1. Options: call options vs. put options, American options vs. European options
2. Characteristics: option premium, option type, underlying asset, expiration date, striking price
3. Options positions and profit/loss diagrams (4 positions)
4. Option premium, intrinsic value, and time value: concepts and calculations
5. Out-of-the money, in-the-money, and at-the-money options
6. Option payoffs at maturity (4 positions)
7. Margin requirements in naked option writing: concepts and calculations
8. Examples discussed in class and homework problems

Chapter 10

1. Six factors that affect option prices: concepts
2. Upper and lower bounds for option prices: concepts and applications
   Upper bounds for call options: $c \leq S$ *and* $C \leq S$
   Upper bounds for put options: $p \leq K$ *and* $P \leq K$
   Lower bounds for European call options (no dividend): $c \geq S - Ke^{-rT}$
   Lower bounds for European put options (no dividend): $p \geq Ke^{-rT} - S$
   If the conditions are violated, arbitrage opportunity exists (how?)
3. Put-call parity: concepts and calculations (how to arbitrage if the parity is violated?)
   $$c + Ke^{-rT} = p + S_0$$
4. Early exercise: never early exercise calls on non-dividend-paying stocks
   Why? Time value and insurance
5. Early exercise: if the put option is deep in the money
6. Effect of dividends: sometimes it is optional to exercise an American call option immediately prior to an ex-dividend date
7. Examples discussed in class and homework problems

Chapter 11

1. Combinations of a single option and a stock: concepts and calculations
   Long a stock + buy a put = buy a call (protective put)
   Short a stock + write a put = write a call
   Short a stock + buy a call = buy a put
   Long a stock + write a call = write a put (covered call)
2. Combinations of options: concepts and calculations
   Spreads: use two or more options of the same type
   Bull spreads, bear spreads, and butterfly spreads
   Straddles: use puts and calls on the same stock; when to use straddles
   Strangles: buying a strangle vs. writing a strangle; when to use strangles
3. Examples discussed in class and homework problems

Chapters 12&13

1. One-step binomial model: concepts and calculations
2. Risk-neutral valuation: concepts and calculations
3. Two-step binomial model: concepts
4. Black-Scholes option pricing model: concepts and calculations
5. Delta, Gamma, Theta, Vega, and Rho: concepts

Sample problems

Chapter 9

A stock sells for $50.00 and a 55 call option (the exercise price is $55) sells for $2.50. What is the intrinsic value of the call? What is the time value of the call?

Answer: Intrinsic value = 0 (out-of-the-money option); Time value = $2.50

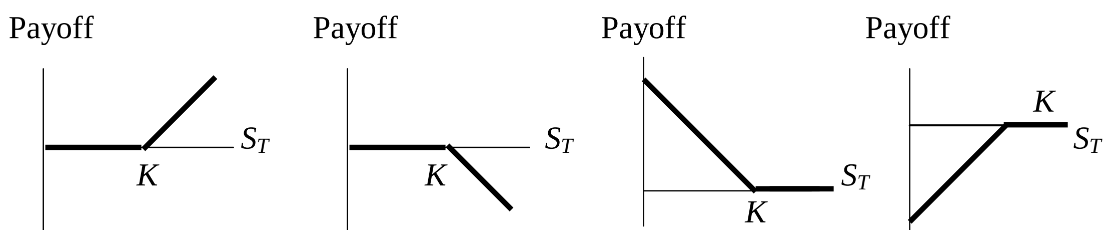
What if the stock price is $56?

Answer: Intrinsic value = $1.00 ($1.00 in-the-money option); Time value = $1.50

Quiz 9.6
Answer: the exercise price will be reduced to $30 and each call option gives the holder the right to purchase 200 shares of the underlying stock

Problem 9.22
Answer:
$5,950 from 1st alternative = 500*(3.50 + 0.2*57 - 3) since the option is $3 out of the money
$4,600 from 2nd alternative = 500*(3.5 + 0.1*57)
Take $5,950

Which one of the following diagrams represents buying a call? Writing a call? Buying a put? Writing a put?



(1) (2) (3) (4)

An investor has exchange-traded put options to sell 100 shares for $20. There is 25% stock dividend. Which of the following is the position of the investor after the stock dividend?
A) Put options to sell 100 shares for $20
B) Put options to sell 75 shares for $25
C) Put options to sell 125 shares for $15
D) Put options to sell 125 shares for $16

The price of a stock is $67. A trader sells 5 put option contracts on the stock with a strike price of $70 when the option price is $4. The options are exercised when the stock price is $69. What is the trader's net profit or loss?
A) Loss of $1,500
B) Loss of $500
C) Gain of $1,500
D) Loss of $1,000

The price of a stock is $64. A trader buys 1 put option contract on the stock with a strike price of $60 when the option price is $10. When does the trader make a profit?
A) When the stock price is below $60
B) When the stock price is below $64
C) When the stock price is below $54
D) When the stock price is below $50

Remember and understand the relationship between a call price (or a put price) with respect to the following variables. For example, when the underlying stock price rises, the call price will rise while the put price will fall.

Variables	European call	European put	American call	American put
Stock price	+	-	+	-
Strike price	-	+	-	+
Time to expiration	n/a	n/a	+	+
Volatility	+	+	+	+
Risk-free rate	+	-	+	-
Dividends	-	+	-	+

Chapter 10

Quiz 10.2: check the lower bound for a call option; if it is violated you can arbitrage, see the textbook for the answers

Quiz 10.3: check the lower bound for a put option; if it is violated you can arbitrage, see the textbook for the answers

Quiz 10.4: see the textbook for the answer (early exercise of American call options on non-dividend paying stocks is never optimal)

You are interested in XYZ stock options. You noticed that a six-month call option with the exercise price of $50 sells for $2.00, while a six-month put option with the same exercise price sells for $3.50. The 6-month interest rate is 6%, and the current stock price is $48. There is an arbitrage opportunity present. Show how you can take the advantage of it.

Answer: $c + Ke^{-rT} = 2 + 50\, e^{-0.06\,(0.5)} = 50.52$
$p + S = 3.50 + 48.00 = 51.50$
Arbitrage opportunity exists: p and S are too high relative to c

Strategy: Write a put and short sell the stock and use the proceeds to buy a call and invest the rest of money

		Stock Price at Expiration	
		If $S_T > 50$	If $S_T \le 50$
Buy a 50 call @	2.00	$(S_T - 50)$	0
Deposit $48.52 (present value of 50)	48.52	50	50
Short a share @ $48.00	48.00	$- S_T$	$- S_T$
Write a 50 put @ $3.50	3.50	0	$(S_T - 50)$
Net	$0.98	0	0

Problems 10.11

The present value of the strike price is $60e^{-0.12\times 4/12} = \$57.65$. The present value of the dividend is $0.80e^{-0.12\times 1/12} = 0.79$. Since $5 < 64 - 57.65 - 0.79$, the condition in equation (10.8) is violated. An arbitrageur should buy the option and short the stock. This generates 64 – 5 = $59. The arbitrageur invests $0.79 of this at 12% for one month to pay the dividend of $0.80 in one month. The remaining $58.21 is invested for four months at 12%. Regardless of what happens a profit will materialize.

If the stock price declines below $60 in four months, the arbitrageur loses the $5 spent on the option but gains on the short position. The arbitrageur shorts when the stock price is $64, has to pay dividends with a present value of $0.79, and closes out the short position when the stock price is $60 or less. Because $57.65 is the present value of $60, the short position generates at least 64 – 57.65 – 0.79 = $5.56 in present value terms. The present value of the arbitrageur's gain is therefore at least 5.56 – 5.00 = $0.56.

If the stock price is above $60 at the expiration of the option, the option is exercised. The arbitrageur buys the stock for $60 in four months and closes out the short position. The present value of the $60 paid for the stock is $57.65 and as before the dividend has a present value of $0.79. The gain from the short position and the exercise of the option is therefore exactly 64 – 57.65 − 0.79 = $5.56. The arbitrageur's gain in present value terms is 5.56 – 5.00 = $0.56.

When dividends increases with all else remaining the same, which of the following is true?
A) Both calls and puts increase in value
B) Both calls and puts decrease in value
C) Calls increase in value while puts decrease in value
D) Puts increase in value while calls decrease in value

The price of a stock, which pays no dividends, is $30 and the strike price of a one year European call option on the stock is $25. The risk-free rate is 4% (continuously compounded). Which of the following is a lower bound for the option such that there are arbitrage opportunities if the price is below the lower bound and no arbitrage opportunities if it is above the lower bound?
A) $5.00
B) $5.98
C) $4.98
D) $3.98

Chapter 11

Quiz 11.1: see the textbook for the answers

Quiz 11.4: see the textbook for the answer

Quiz 11.7: see the textbook for the answer

(1) Long a stock + write a call = write a put

(2) Short a stock + buy a call = buy a put

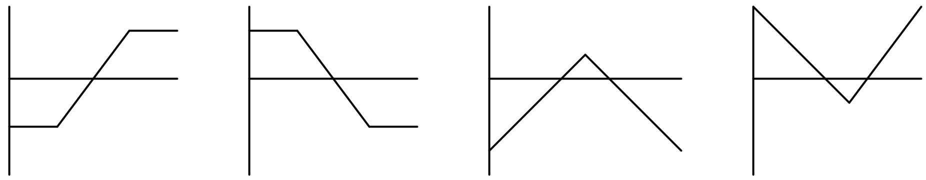
(3) Long a stock + buy a put = buy a call

(4) Short a stock + write a put = write a call

You need to remember, understand, and be able to prove those relationships

Which of the following describes a protective put?
A) A long put option on a stock plus a long position in the stock
B) A long put option on a stock plus a short position in the stock
C) A short put option on a stock plus a short call option on the stock
D) A short put option on a stock plus a long position in the stock

Which of the following represents a position of a bear spread?



(1) (2) (3) (4)

a. Position (1)
b. Position (2)
c. Position (3)
d. Position (4)

Suppose you buy XYZ stock at $48 per share, and simultaneously write a December 50 call option for $3.50. Draw a profit/loss diagram and label all significant points.

	Stock price at expiration			
	0	25	50	75
Buy XYZ stock at $48				
Write a Dec. 50 call at $3.50				
Net cost				

Profit/Loss

Stock price

The results will be discussed in class

Chapters 12&13

Quiz 12.4: see the textbook for the answer (one step binomial for put)

Quiz 12.5: see the textbook for the answer (one step binomial for call)

Quiz 13.4: see the textbook for the answer (B-S model for put)

Quiz 13.5: see the textbook for the answer (B-S model for put with dividend)

The current price of a non-dividend-paying stock is $30. Over the next six months it is expected to rise to $36 or fall to $26. Assume the risk-free rate is zero. An investor sells call options with a strike price of $32. Which of the following hedges the position?
A) Buy 0.6 shares for each call option sold
B) Buy 0.4 shares for each call option sold
C) Short 0.6 shares for each call option sold
D) Short 0.4 shares for each call option sold

The current price of a non-dividend-paying stock is $30. Over the next six months it is expected to rise to $36 or fall to $26. Assume the risk-free rate is zero. An investor sells call options with a strike price of $32. What is the value of each call option?
A) $1.6
B) $2.0
C) $2.4
D) $3.0

When the non-dividend paying stock price is $20, the strike price is $20, the risk-free rate is 6%, the volatility is 20% and the time to maturity is 3 months, which of the following is the price of a European call option on the stock?
A) 20N(0.1)-19.7N(0.2)
B) 20N(0.2)-19.7N(0.1)
C) 19.7N(0.2)-20N(0.1)
D) 19.7N(0.1)-20N(0.2)

What does N(x) denote?
A) The area under a normal distribution from zero to x
B) The area under a normal distribution up to x
C) The area under a normal distribution beyond x
D) The area under the normal distribution between -x and x