BAYLOR UNIVERSITY
HANKAMER SCHOOL OF BUSINESS
DEPARTMENT OF FINANCE, INSURANCE & REAL ESTATE

Options, Futures, and Other Derivatives Name ____________________
Dr. Garven
Sample Midterm Exam #1

Notes:

1. Please read the instructions carefully.
2. This test comprises 3 problems worth 32 points each.
3. You may have the entire class period to complete this examination. Be sure to show your work and provide a complete answer for each problem.

Good luck!

<u>Problem #1 (32 points)</u>

You are given the following set of prices:

Security	**Maturity (years from today)**	**Exercise Price**	**Current Price**
TC stock	-	-	$94
European Put Option on TC stock	1	$80	$5
European Call Option on TC	1	$80	?
Zero Coupon Treasury Bill (par/maturity value = $100 from today)	1	-	$91

A. (16 points) What is the price of the call option (assuming that TC stock does not pay dividends)?

B. (16 points) Now suppose that the market price of a TC call option (with an exercise price of $80) is $30. When you tell your boss that this call option is too expensive, he tells you that you must be wrong; after all, the formula which you used to price the call option is "just" a theory and perhaps the market knows something that you don't concerning the future (possibly "rosy") prospects for TC stock. Prove that your boss is wrong by applying the "arbitrage-free" argument.

Problem #2 (32 points)

Suppose the riskless rate of interest is 0%, the price of a riskless zero-coupon bond is \$1, and the price of a (non-dividend paying) stock is \$1. In the future, only two equally probable outcomes exist for the economy, good and bad. In the good state, the stock is worth \$2, whereas in the bad state, the stock is worth \$.50.

A. (8 points) Show that the replicating portfolio for a European call option with an exercise price of \$1 comprises a long position in 2/3 of a share of stock and a short position in 1/3 of one bond (*Hint*: you can either show this analytically or numerically by demonstrating that the state-contingent payoffs on the replicating portfolio and the call option are identical).

B. (8 points) What is the "arbitrage-free" price for this call option?

C. (8 points) Show that the replicating portfolio for a European put option with an exercise price of \$1 comprises a short position in 1/3 of a share of stock and a long position in 2/3 of one bond (*Hint*: you can either show this analytically or numerically by demonstrating that the state-contingent payoffs on the replicating portfolio and the put option are identical).

D. (8 points) What is the "arbitrage-free" price of a put option on the stock with an exercise price of \$1?

Problem #3 (32 points)

Suppose the euro is currently trading at $1.50 and that one-year zero-coupon bonds (with face values of 100) in the U.S. and Europe are trading at $95 and €93.10 respectively.

A. (8 points) What is the one-year forward price of the euro?

B. (8 points) What is the replicating portfolio for a one-year euro forward contract (based upon the forward price that you calculated in part (A))?

C. (8 points) Suppose the price of a one-year Euro forward contract is $1.49. Outline a trading strategy that would enable you to you make a riskless arbitrage profit. How much profit would you earn from implementing such a strategy?

D. (8 points) Suppose that you "buy" the forward contract for the price that you calculated in part (A), and immediately after your purchase, the Fed raises interest rates. With the rate hike,

- The U.S. bond falls in value from $95 to $93.10,
- The Euro bond price remains unchanged, and
- The dollar strengthens, with the dollar value of the Euro falling to $1.48.

If you immediately close out the contract (i.e., sell it), how much money will you make or lose?

MIDTERM EXAM #1 FORMULA SHEET

Pricing Forwards/Futures

$$F(t,T) = V(t) \times e^{r \times (T-t)}$$

where

$F(t, T)$ = Forward/futures price, where t corresponds to today and T corresponds to the maturity date.
r = Continuously compounded risk-free interest rate (assumed to be constant).
$V(t)$ = Value of the "right" underlying = amount of money required at time t for a strategy that generates one unit of the underlying security at time T.

$V(t)$ for stock without dividends:

$V(t) = S(t)$, where $S(t)$ is the current stock price

$V(t)$ for stock with continuous dividend yield δ:

$$V(t) = S(t)e^{-\delta(T-t)}$$

$V(t)$ for foreign currency (buy $e^{-r_{\text{foreign}} \times (T-t)}$ units of the currency at time t, earn foreign interest, and hold until time T):

$V(t) = S(t) \times e^{-r_{\text{foreign}} \times (T-t)}$, where $S(t)$ corresponds to the foreign currency spot price

Put-call parity theorem (assuming no dividends):

$$c + e^{-rT} K = p + S$$

where

c = value of a European call option with an exercise price of K and T years until expiration;
p = value of a European put option with an exercise price of K and T years until expiration;
r = the annualized (continuously compounded) riskless rate of interest; and
S = the value of the underlying asset.

Payoffs on call options $(c(T))$**, put options** $(p(T))$**, and forward/futures contracts** $(f(T))$ **at date** T**:**

$$c(T) = \max(0, S(T) - K),$$
$$p(T) = \max(0, K - S(T)),$$
$$\text{"long" forward:} f(T) = S(T) - K, \text{ and}$$
$$\text{"short" forward:} f(T) = K - S(T).$$