MFE5130 – Financial Derivatives
First Term, 2017-18
Midterm Examination

Exam Duration: 2 hours

Instruction

1. Total Marks: 100 points.
2. Answer **ALL** questions.
3. You must show all the steps in order to get full mark for each question.

1. (15 points) Consider the following two portfolios:

   A: Buy a 108-strike European call option and sell a 109-strike European call option.

   B: Buy a 109-strike European put option and sell a 108-strike European put option.

   Let $C_A(0)$ and $C_B(0)$ be the cost at time 0 to construct Portfolio A and Portfolio B respectively.

   You are given:

   (i) $C_A(0) = 0.3$.

   (ii) All the options in the above two portfolios are 1-year to expiration and are on the same non-dividend paying stock.

   (iii) The continuously compounded annual risk-free interest rate is 22%.

   Determine $C_B(0)$.

2. Suppose the dollar-denominated interest rate is 6%, the yen-denominated interest rate is 2% (both rates are continuously compounded), the spot exchange rate is 0.008\$/¥, and the price of a dollar-denominated European yen **put** with 1 year to expiration and a strike price of \$0.008 is \$0.0009.

   a. (8 points) Consider a dollar-denominated European yen **call** with 1 year to expiration and a strike price of \$0.008, what is the price of this call option such that there is no arbitrage opportunity?

   b. (10 points) Suppose that a 1-year dollar-denominated European yen call with a strike of \$0.008 has a premium of \$0.0019. Demonstrate the arbitrage.

   c. (7 points) What is the price of the yen-denominated European dollar put with 1 year to expiration and a strike price of ¥125 such that there is no arbitrage opportunity?

3. Consider a 4-year swap contract on gold. The notional amount of the swap contract is 200 troy ounces of gold. The current spot price of gold is $1,300 per troy ounce. The lease rate of gold is assumed to be a constant and is equal to 2.5% per annum.

   The current prices of zero-coupon bonds with different maturities are given as follows:

Maturity (in Years)	1	2	3	4
Zero-Coupon Bond Price (that pays $1 at Maturity)	0.9958	0.9621	0.9411	0.9102

   a. (10 points) With level payments at the end of each year, find the fixed swap price per troy ounce of gold in the swap.

   b. (15 points) Just after the swap payment at the end of the year 1, the spot price of gold becomes $1,350 per troy ounce. The lease rate is still a constant but becomes 1.8% per annum. The prices of zero-coupon bonds at that time are

Maturity (in Years)	1	2	3
Zero-Coupon Bond Price (that pays $1 at Maturity)	0.9852	0.9598	0.9335

      Find the market value of the swap from the perspective of the long party at that time.

4. (15 points) Suppose the current stock price is $30.58 and the continuously compounded risk-free interest rate is 6%. The stock pays dividend of $1.8 and $2.5 at the end of 3 months and at the end of 6 months respectively. You observe an 8-month forward contract with forward price $29.15. Is there an arbitrage opportunity on the forward contract? If so, describe the strategy to realize profit and find the accumulated arbitrage profits at the end of 8 months.

5. Two European put options expire in 9 months. The put options have the same underlying stock, but they have different strike prices and premiums.

Put Option	A	B
Strike	120	127
Premium	12	10

The continuously compounded annual risk-free interest rate is 11%.

a. (5 points) What no-arbitrage property is violated?

b. (3 points) What spread position would you use to effect arbitrage?

c. (12 points) Demonstrate that the spread position is an arbitrage.

End

Scratch Paper