**MFE5130 – Financial Derivatives**

**First Term, 2015-16**

**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.
4. (20 points) Three European put options expire in 1 year. The put options have the same underlying asset, but they have different strike prices and premiums.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Put Option | A | B | C |
|  | Strike | $50.00 | $55.00 | $61.00 |
|  | Premium | $3.00 | $7.00 | $11.00 |

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

A profit-maximizing arbitrageur constructs an arbitrage strategy.

If the stock price is $52 at the end of the year, then the arbitrage profit at the end of 1 year is $*X*.

If the stock price is $60 at the end of the year, then the arbitrage profit at the end of 1 year is $*Y*.

Calculate 

1. (15 points) You are given:
2. The current exchange rate is $0.011/¥.
3. A four-year dollar-denominated European put option on yen with a strike price of $0.008 sells for $0.0005.
4. The continuously compounded annual risk-free interest rate on dollars is 3%.
5. The continuously compounded annual risk-free interest rate on yen is 1.5%.

Calculate the price of a four-year yen-denominated European put option on dollars with a strike price of ¥125.

1. (15 points) Using the information in the following table, find the gas forward prices for each of the 4 quarters.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| End of the quarter | 1 | 2 | 3 | 4 |
| Gas swap price | 3.25 | 3.52 | 3.41 | 3.34 |
| Zero-coupon bond price with the face value of $1 | 0.9712 | 0.9655 | 0.9508 | 0.9312 |

1. (15 points) The current price of stock XYZ is $50. Trudy is bearish on the stock and creates a synthetic short forward position using one call and one put on the stock, each with a strike price of $55 and a six-month to expiration.

The price of the put option is $5.83 and the price of the call option is $1.90.

The continuously compounded annual risk-free interest rate is 3.92%.

The continuous dividend yield on the stock is 0%.

Let *S*0.5 be the price of stock XYZ at time six months.

Construct a table to show the payoff and profit of this synthetic short forward position at time six months for different ranges of *S*0.5.

1. (15 points) The S&R index spot price is 1,100, the continuously compounded annual risk-free interest rate is 5%, and the continuous dividend yield on the index is 3%. Suppose you observe a 1-year forward price of 1,118. What arbitrage would you undertake?
2. Assume the continuously compounded annual risk-free interest rate is 6%. Here is the forward price curve for widgets:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Year 0 | Year 1 | | | | Year 2 | |
| Dec. | Mar. | June | Sept. | Dec. | Mar. | June |
| 3.000 | 3.075 | 3.152 | 2.750 | 2.822 | 2.894 | 2.968 |

For both (a) and (b) below, use the December Year 0 forward price as a proxy for the spot price in December Year 0.

* 1. (10 points) Suppose that you want to borrow a widget beginning in December of Year 0 and ending in June of Year 1. Find the amount of lease payment to make the transaction fair to both the widget lender and widget borrower.
  2. (10 points) Suppose that you want to borrow a widget beginning in December of Year 0 and ending in March of Year 2. Find the amount of lease payment to make the transaction fair to both the widget lender and widget borrower.

*End*

**Scratch Paper**