DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES
INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

END-AUTUMN SEMESTER EXAMINATION-2017

PAPER HS40091: DERIVATIVES

Max Marks: 50

Date: NOVEMBER, 2017

GENERAL INSTRUCTIONS

- ✓ Answer all the questions.
- ✓ Time is 180 minutes.
- ✓ Marks for each question is indicated against it.
- ✓ Use of non-programmable calculators is permitted.
- ✓ The cumulative standard normal distribution table can be used.
- ✓ Clarification on any part of the question paper will not be entertained.

1. At the end of one day a clearing house member is long 100 contracts, and the settlement price is $50,000 per contract. The original margin is $2,000 per contract. On the following day the member becomes responsible for clearing an additional 20 long contracts, entered into a price of $51,000 per contract. The settlement price at the end of this day is $50,200. How much does the member have to add to its margin account with the exchange clearing house? Futures Daily Settlement Cycle (2)

2. The spot price of silver is $15 per ounce. The storage costs are $0.24 per ounce per year payable quarterly in advance. Assuming that interest rates are 10% per annum for all maturities, calculate the futures price of silver for delivery in nine months. (2) Futures Pricing

3. The price of a non-dividend paying stock is $19 and the price of a 3-month European call option on the stock with a strike price of $20 is $1. The risk free rate is 4% per annum what is the price of a 3-month European put option with a strike price of $20? (2) Option Pricing

4. Assume that the risk free interest rate is 9% per annum with continuous compounding and that the dividend yield on a stock index varies throughout the year. In February, May, August and November dividends are paid at a rate of 5% per annum. In other months, dividends are paid at a rate of 2% per annum. Suppose that the value of index on July 31 is 1300. What is the futures price for a contract deliverable on December 31of the same year? Futures Price (2)

5. Company X wishes to borrow U.S dollars at a fixed rate of interest. Company Y wishes to borrow Japanese yen at a fixed rate of interest. The amounts required by the two

companies are roughly the same at the current exchange rate. The companies have been quoted the following interest rates, which have been adjusted for the impact of taxes:

	Yen	Dollars
Company X	5.0%	9.6%
Company Y	6.5%	10.0%

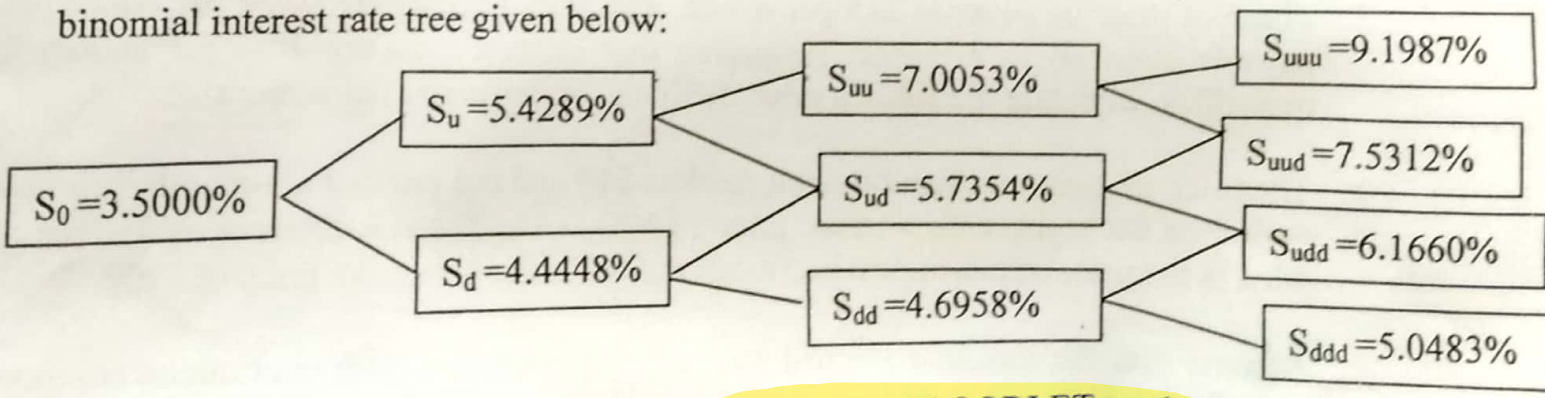
Design a swap that will net a bank, acting as intermediary, 50b.p per annum. Make the swap equally attractive to the two companies and ensure that all foreign exchange risk is assumed by the bank. SWAPs (3)

6. A credit default swap requires a semiannual payment at the rate of 60b.p per year. The principal is $300 million and the credit default swap is settled in cash. A default occurs after four years and two months, and the calculation agent estimates that the price of the cheapest deliverable is 40% of its face value shortly after the default. List the cash flows and their timing for the seller of the credit default swap. Cash Flows in SWAP (3)

7. A currency swap has a remaining life of 15 months. It involves exchanging interest at 10% on £20 million for interest at 6% on $30 million once a year. The term structure of interest rates in both United Kingdom and the United States is currently flat, and if the swap were negotiated today the interest rates exchanged would be 4% in dollars and 7% in sterling. All interest rates are quoted with annual compounding. The current exchange rate (dollars per pound sterling) is 1.8500. What is the value of the swap to the party paying sterling. What is the value of the swap to the party paying dollars? SWAP Value (4)

8. Derive the profit equations for a put bull spread. Determine the maximum and minimum profits and the breakeven stock price at expiration. Spread - Profit Equation (4)

9. The strike rate of a 3-year 4.80% FLOOR is 4.80%. The notional amount is $10,000,000 and the payment frequency is annual. The reference rate is the one-year rates in the binomial interest rate tree given below:



Based on the above, determine the value of FLOOR using FLOORLET method. Floors (5)

10. (A) Consider a 2-year European put with a strike price of $52 on a stock whose current price is $50. Over each of the next two time steps of 1 year and in each time step the stock price either moves up by 20% or moves down by 20%. The risk-free interest rate is 5% per annum with continuous compounding. Calculate the value of a 2-year European put option using Binominal option pricing model. Binomial Option Pricing (5)

(OR)

(B) The stock price of a European PUT option on a non-dividend paying stock is $69, the exercise price is $70, the risk-free interest rate is 5% per annum, the volatility is 35% per annum and the time to maturity is SIX-months. Calculate the price of the put using Black Scholes option pricing Model (5)

Black Scholes Option Pricing

11. Three put options on a stock have the same expiration date and strike prices of $55, $60 and $65. The market prices are $3, $5 and $8 respectively. Explain how BUTTERFLY SPREAD can be created? Construct a table showing the profit from the strategy. For what range of stock prices would the butterfly spread lead to loss? (8)

Profit Table on Spread

12. A financial institution has just sold 1,000 7-month European call options on the Japanese yen. Suppose that the spot exchange rate is 0.80 cent per yen, the exercise price is 0.81 cent per yen, the risk-free interest rate in the United States is 8% per annum, the risk-free interest rate in Japan is 5% per annum and the volatility of the yen is 15% per annum. Calculate the Delta, Gamma, Vega, Theta, and Rho of the financial institution's position. Interpret each number. (10)