



INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
Mid-Autumn Semester 2018-19

Date of Examination: 24/09/2018 Session (FN/AN): FN Duration: 2 Hours Full Marks 30

Subject No.: HS40091 Subject Name: DERIVATIVES

Department/Center/School: Humanities and Social Sciences

Specific charts, graph paper, log book etc., required: None

Special Instructions (if any): (i) Answer all the questions. (ii) Use of non-programmable calculator is permitted. (iii) While answering all the necessary steps/calculations should be clearly shown. (iv) This question paper contains 2 printed pages.

1. The risk of spot prices on gold as measured from its standard deviation is placed at Rs 120. Similarly the price risk of the 3-m futures contract on gold is estimated to be Rs 150. The coefficient of correlation between the two is placed at 0.85. In order to hedge spot position on gold what ratio of futures contract would be optimal? (2)
2. What does a stop order to sell at \$2 mean? When might it be used? What does a limit order to sell at \$2 mean? When might it be used? (2)
3. Suppose ABC company shares are trading at \$25 and pay no dividends and that the risk-free interest rate is 5% per annum. The forward price for delivery in 1 year's time is \$28. Draw the payoff and profit diagrams for a long position for this contract. (2)
4. The risk free continuously compounded interest rates in USA and Japan are estimated at 8% and 3% respectively for 3 month maturity. If the spot rate in Japan is JY 102/\$, what is the likely price for 3-m futures contract? (2)
5. "If the minimum-variance hedge ratio is calculated as 1.0, the hedge must be perfect." Is this statement true? Explain your answer. (2)
6. Assume that a bank in India has offered exchange rate for US dollar and Euro at Rs 48.00 and 78.00 for a 2 month forward contract respectively. An American bank has quoted 2-m forward rate of US \$ 1.70 per Euro. If you are allowed to book any contract can you take advantage of the rates offered by bank in India and the American bank? (2)
7. Consider a stock currently worth \$100 per share with the risk-free interest rate 2% per annum. The futures price for a 1-year contract is worth \$104. Show that there exists an arbitrage opportunity by entering into a short position in this futures contract. (3)
8. A trader in gold holds stock of 1 Kg valued at Rs 15 lacs at the spot price of Rs 15,000 per 10 gms. The 3-m futures contract for size of 100 gms on gold is Rs 15,400 per 10 gms. In order to protect against the fall in value of the gold the trader decides to sell 10 contracts in gold for 3-m delivery. However after one month the trader is required to sell the stock of gold at Rs 14,500 and therefore also cancels his position in futures at Rs 14,700. Find out the price the trader realized. (3)

9. Consider the price of a futures contract $F(t, T)$ with delivery time T on a stock with price S_t at time t ($t < T$). Suppose the stock does not pay any dividends. Show that under the no-arbitrage condition the futures contract price is

$$F(t, T) = S_t e^{r(T-t)}$$

where r is the risk-free interest rate.

(4)

10. Assume that on Friday, August 1, you sell one Chicago Board of Trade September Treasury bond futures contract at the opening price of \$116,843.75. The initial margin requirement is \$5,940, and the maintenance margin requirement is \$4,400. You maintain your position every day through Friday, August 15, and then buy back the contract at the opening price on Monday, August 18. Show the daily cash flows and performance bond calls on short investor's account for the September Treasury bond futures contract. What is the investor's cumulative gain/loss? (4)

Date	Settlement Price (\$)
8/1	116,406.25
8/4	116,781.25
8/5	115,578.13
8/6	115,218.75
8/7	116,156.25
8/8	119,671.88
8/11	121,031.25
8/12	119,781.25
8/13	122,390.63
8/14	120,781.25
8/15	120,796.88
8/18	120,500.00

11. Consider a long put option with strike price $K = \$100$. The current stock price is $S_t = \$80$ and the put premium is \$5. What is the intrinsic value of the put option at time t ? Find the payoff and profit if the spot price at the option expiration date T is $S_T = \$75$. Draw the payoff and profit diagrams. (4)

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