

Max Marks: 10

Max Time: 45 minutes

Name:

Entry Number:

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- Any unfair means will cancel your exam.
  - Write the answers on the provided answer sheet neatly.
  - Write the final numerical answer (up to three decimal precision) in the box against each question. Be more accurate in your answers. An error of  $\pm 0.2$  is the maximum allowed in each answer.
  - You must submit the answer sheet and question paper with answers in the box.
  - The numerical answer in the box will only be checked.
  - If the numerical answer is not carried from the answer sheet to the box in the question paper, then the question is treated as unanswered, and zero marks will be given for such a question.
  - If you fill the answer in the box and its working is not adequately displayed in a readable form in the answer sheet then it will be considered a case of copy and zero marks will be awarded in that full question (even when only one part of a question is found of such a type in your quiz paper).
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1. (1 mark  $\times$  5) Different options are available on the same underlying stock  $S$  in the market. Let the risk-free interest be 4% per annum (compounded annually) and  $S(0) = 20$ . The price of  $S$  may go up or down by 25% for the next 3 semesters (each semester = 6 months). Answer the following:

(a) Determine the RNPM.

0.5396

(b) Evaluate the European call option price with a strike of 18 and maturity of 18 months.

5.182

(c) What is the value of the European put with a strike of 18 and maturity of 18 months?

2.1536

(d) At  $t = 0$ , you buy 8 calls and 1 put option, as specified in (a) and (b), how many shares of  $S$  you will be able to buy assuming a fraction of shares can not be purchased?

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- (e) Compute the profit (or loss) of the portfolio created in (d) above, with cash (if any) deposited in risk-free instrument, if we assume that the stock price traces the path of growth in the first two semesters and then decreases in one semester.

7.0937

2. (1 mark  $\times$  5) Consider a non-dividend stock  $S$  with the current price  $S(0) = 16$ , volatility 40% per annum, risk-free rate 4% per annum continuously compounded. Answer the following using the BS-formula:

- (a) Compute the price of a European call option with a strike of 18 and maturity of one year.

2.041

- (b) Suppose now, in 6-month time,  $S$  share price  $S(0.5) = 16.4$ . What is the price of the same call option (as in (a)) if bought at this time point (at 6 months)?

1.3541

- (c) In lieu of (a) and (b) above, suppose the investor decides not to buy the call at  $t = 0$ , wait, and then buys it at 6-months when  $S(0.5) = 16.4$ . What is the gain/loss on call price to the investor on taking the “wait till 6 months” strategy?

0.7279

- (d) Now, consider the European call option with a strike of 18, maturity of one year but written on a stock  $\hat{S}$  with the same data on current price, volatility, risk-free return, as in the stem of the question, but assuming that  $\hat{S}$  is paying discrete dividends of 2 in four-months and 4 in eight months. What is the price of this call option? (Notice that the price of a call on dividend-paying stock is less than that of without dividend-paying stock when every other parameter remains the same.)

0.21913

- (e) What is the price of the European put option with strike 18 and maturity one year on the dividend stock  $\hat{S}$ ?

7.38164