



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

SEPTEMBER –DECEMBER 2021

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

REGULAR PROGRAMME

ACS 410: FINANCIAL MODELLING

Date: DECEMBER 2021

Duration: 2 Hours

INSTRUCTIONS: Answer Question ONE and any TWO Questions

Q1. On March 6, 2001, Cisco Systems was trading at \$13.62. We will attempt to value a July 2001 call option with a strike price of \$15, trading on the CBOT on the same day for \$2.00. The following are the other parameters of the options:

- The annualized standard deviation in Cisco Systems stock price over the previous year was 81.00%. This standard deviation is estimated using weekly stock prices over the year and the resulting number was annualized as follows: Weekly standard deviation = 1.556% Annualized standard deviation = $1.556\% \times 52 = 81\%$
- The option expiration date is Friday, July 20, 2001. There are 103 days to expiration.
- The annualized treasury bill rate corresponding to this option life is 4.63%. The inputs for the Black-Scholes model are as follows:

Current Stock Price (S) = \$13.62 Strike Price on the option = \$15.00 Option life = $\frac{103}{365} = 0.2822$ Standard Deviation in $\ln(\text{stock prices}) = 81\%$ Riskless rate = 4.63%

Calculate;

i) The value of d1 **(5 marks)**

ii) The value of d2 **(5 marks)**

iii) The value of the call **(6 marks)**

b) Discuss the limitations of the Black-Scholes model **(6 marks)**

c) The bond price dictates interest rates of financial instruments in the financial market. Discuss **(8 marks)**

Q2. a) If price changes remain larger as the time periods in the binomial are shortened, we can no longer assume that prices change continuously. This is an assumption of the jump process option pricing model. Discuss **(10 marks)**

b) Some options derive their value not from an underlying asset but from other options **(10 marks)**

Q3. a) Your friend Luciana is boasting that she is a big investor in the CBA options market. She states that that she owns 6000 of the 28th June 2020 CBA calls. However, you suspect that she might be exaggerating her investment. You look in the paper and see and the data below, which shows the 28th June 2020 CBA calls.

2020	Call				Put			
Expiry Date Year 2020	Strike	Last	Volume	Open Interest	Strike Last	Last	Volume	Open Interest
28 th April	50.50	0.335	1380	3553	46.00	0.235	514	1731
24 th May	49.00	1.53	134	3176	45.00	0.36	50	340
28 th June	50.00	1.45	1015	5609	40.00	0.24	1000	8138
20 th December	40.00	0		1410	40.00	1.025	560	3149

i) Is Luciana exaggerating her investment? **(4 marks)**

ii) If Luciana is telling the truth, what would her holding of call options be worth based on the information provided **(6 marks)**

b) Futures and options provide payoffs that depend in the values of other assets. Discuss **(6 marks)**

c) American options and the European options are preferred differently. Discuss **(4 marks)**

Q4. a) Future contracts have put options and a short position and call options and a long position. Discuss **(10 marks)**

b) If you place a stop loss order of to sell 100 shares of stock at \$55 when the current price is \$62 . How much will you receive if the price falls down to \$50. **(5 marks)**

c) You wish to sell 100 shares of XYZ co. Ltd stock. If the last two transactions were at \$34.12 followed by \$34.25. Calculate at what price would you sell the shares. **(5 marks)**

Q5. a) You have just decided upon your capital allocation for the next year, when you realize that you have underestimated both the expected return and the standard deviation of the risky portfolio by 4%. Would you increase, decrease or leave unchanged allocation to risk-free treasury notes. **(4 marks)**

b) Suppose your expectations regarding the share market are as follows;

State of Economy	Probability	HPR
Boom	0.3	44
Normal growth	0.4	14
Recession	0.3	-16

Calculate;

i) The mean on the HPR on the shares **(4 marks)**

ii) The standard deviation the HPR on the shares **(4 marks)**

iii) If shares of the business venture sell at \$40 a share. The dividend-payout and the end of year price depend on the state of the economy by end of the year as above. Calculate the expected HPR if the three scenarios are equally likely
(8 marks)

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END