



UNIVERSITY EXAMINATIONS: 2013/2014

EXAMINATION FOR THE MASTERS OF SCIENCE (MSC) IN COMMERCE

MSF 505 DERIVATIVE PRICING (WEEKEND)

DATE: APRIL, 2014

TIME: 3 HOURS

INSTRUCTIONS: Answer Question One and Any Other Three Questions

QUESTION ONE

- (a) What is the most critical variable in the Black-Scholes-Merton model? Explain how it is computed
- (b) Define the term European type option
- (c) Consider an asset that trades at 100 today. Call and put options on this asset are available with an exercise price of 120. The option expires in 280 days, and the volatility is 0.25. The continuously compounded risk-free interest rate is 5%.
 - (i) Using Black-Scholes-Merton model, calculate the value of call and put options.
 - (ii) Calculate the value of the European call and put options using Black-Scholes-Merton model. Assume that the continuous dividend yield is 1.0%.
- (d) Explain the term stochastic process
- (e) Define the term Markov processes and give two examples

QUESTION TWO (23 MARKS)

- (a) Suppose that S follows equation $dS = \mu Sdt + \sigma SdZ$. Use Itô's lemma to find the process followed by $C(S) = \ln(S)$
- (b) Suppose that $S(0) = \text{KES } 100$, $r = 0.06$, $\sigma_s = 0.4$ and $Z(0) = 0$. Find the price of the underlying asset whose trajectory is described by $dS = rSdt + \sigma SdZ$.

QUESTION THREE (23 MARKS)

- (a) Write down and explain the characteristics of a derivative
- (b) Consider a put option on an index with 6 months to expiration and a strike price of 1200. Suppose the future value of the index is 1100 and suppose that the risk-free interest rate is 4% over one year. Assume that the premium of the index is 98.2. Compute the payoff and profit of both written call and put options for spot price between 500 and 1200

QUESTION FOUR (23 MARKS)

- (a) What is the principle benefit of a binomial option pricing model?
- (b) Consider a two-period binomial model in which the underlying is at 30 and can go up by 14 percent or down by 11 percent. The risk-free interest is 3 percent.
 - (i) Determine the price of a European call option expiring in two periods with exercise price of 30
 - (ii) Find the number of units of the underlying that would be required at each point in the binomial tree to construct a risk-free hedge using 10,000 calls.

QUESTION FIVE (23 MARKS)

- (a) Define the price volatility of an asset and state how it is calculated
- (b) An analyst wants to study the trend and fluctuation of price of an asset in a given market. The following is the sequence of the daily price on the asset for last month:

Month	Price
0	100
1	102
2	90
3	95
4	100
5	103
6	110
7	105
8	108
9	104

10	105
11	110
12	104

The analyst is required to advice using on the mean return and the historical volatility. Estimate these parameters and advice accordingly.

QUESTION SIX (23 MARKS)

- (a) Define the two styles of options, European and American (6 Marks)
- (b) Consider the following information: The price of underlying asset ranges between 72 and 128, strike price of the option is 100, the time-to-maturity is six months, the risk-free rate is 5%, and the volatility is 20%.
- (i) Form a table of stock prices versus call and put options values,
- (ii) Plot stock prices against call and put options. (17 Marks)