MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS

2018/2019 ACADEMIC YEAR

***FOURTH* YEAR *SECOND* SEMESTER**

SCHOOL OF SCIENCE
BACHELOR OF SCIENCE IN APPLIED STATISTICS WITH COMPUTIONG

COURSE CODE: STA 428

COURSE TITLE: MATHEMATICAL APPLICATION IN FINANCE

DATE: APRIL 2019 **TIME:**

INSTRUCTIONS TO CANDIDATES

1. Answer Question **ONE** and any other **TWO** questions
2. Show all your working and be neat
3. Do not write on the question paper

*This paper consists of **FIVE** printed pages. Please turn over.*

QUESTION ONE (30 MARKS)

a) Briefly explain the following terms

  i) Over The Counter (1mark)

  ii) Arbitrage (1mark)

  iii) Swaps (1mark)

  iv) Options (1mark)

b) Describe briefly the different players in financial markets (3marks)

c) Assume that $t > T$ and that the zero coupon bond price $Z(t,T)$ is known at the present time 0. Then, for any random variable X whose outcome is known at time t

d) $E^{(t)}(X) = E^{(T)}(X)$. Prove (5 marks)

e) Assume that call currency option enable to buy of dollar for Ksh. 50.00 while it is quoted at Ksh. 50.70 in the spot market, and premium paid for call currency option is Ksh. 1.00. Calculate the intrinsic value of the call? (3marks)

f) Consider a contract that gives the random payoff X at time T. The forward price $G_t^{(T)}, \leq t < T$, of this contract at time t is a random variable whose outcome is determined at time t. Provide a clear prove. (5marks)

QUESTION TWO (20 MARKS)

a) Briefly discuss the relations between Present, Forward and Futures Prices (4marks)

b) Proof the following theorem and show whether the following relations hold

  i) P, G and F_0 are linear functions, i.e., if X and Y are random payments made at time T, then for any constants a and b
  $P^{(T)}(aX + bY) = aP^{(T)}(X) + bP^{(T)}(Y)$ similarly for G and G_0. (3 marks)

  ii) $G^{(T)}[1] = 1$, $F_0^{(T)}[1] = 1$ and $P^{(T)}[1] = Z_T$ (3 marks)

  iii) $P^{(T)}[X] = Z_T G^{(T)}[X]$ (2 marks)

  iv) $P^{(T)}\left[Xe^{R(0,T)}\right] = F_0^{(T)}[X]$ (2 marks)

  v) $P^{(T)}[X] = F_0^{(T)}\left[Xe^{-R(0,T)}\right]$ (2 marks)

QUESTION THREE (20 MARKS)

a) Explain the following terms

i) Forward prices (1 marks)

ii) Forward Rate Agreements (2 marks)

iii) Asset Price Dynamics (2marks)

b) Proof that if we choose the coefficients β_i such that $Cov(F_t^i, e) = 0$ for $i = 1, \ldots, n$ then the variance $Var(e)$ is minimized. (5marks)

c) Briefly discuss the features of financial derivatives in mathematical finance

. (5marks)

d) The futures prices $\{F_j\}$ have the martingale property w.r.t. the futures measure

$F_j = \hat{E}_{tj}[F_k]$ for all $j < k$. In particular, the futures price F_0 is the expected value w.r.t. the futures measures of X, the spot price at delivery (5marks)

QUESTION FOUR (20 MARKS)

a) Explain the following terms

i) Bond (1 marks)

ii) Money Market Account (1 marks)

iii) Zero coupon bonds (1 marks)

b) If the sample space is finite and the market is arbitrage free, then there exists a random variable U such that $U > 0$, and for any pay off X it holds that $P(X) = E[XU]$. Give a clear proof (5 marks)

c) Briefly explain the Black's Model and compute the price of a European derivative on some underlying asset with value X at maturity (5 marks)

d) Consider a portfolio of bonds that gives the payment 1'000 after one year, 1'000 after two years and 2'000 after three years. Assume that $Z_1 = 0.945$, $Z_2 = 0.890$ and $Z_3 = 0.830$. Calculate the present value of the portfolio (4 marks)

e) Describe the uses and functions of derivatives (3marks)

******* END *******