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**University Examinations 2016/2017**

FOURTH YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE.

**STA 2442: FINANCIAL ECONOMICS FOR ACTUARIAL SCIENCE**

**DATE: DECEMBER, 2016 TIME: 2 HOURS**

**INSTRUCTIONS: -** *Answer question* ***one*** *and any other* ***two*** *questions*

**QUESTION ONE (30 MARKS)**

1. A investor wishes to measure the investment risk presented by an asset which has the following distribution

State Return Probability

1 10% 0.5

2 20% 0.3

3 50% 0.2

Evaluate tree measures of investment risk for this asset. Where necessary, you may use a benchmark return of 25% (6 marks)

1. State the assumptions underlying the Block-Scholes option formula. (4 marks)
2. Describe what is meant by an arbitrage opportunity (3 marks)
3. State how investors are assumed to make decisions in Modern Portfolio Theory (MPT) (2 marks)
4. State the martingale representation theorem including conditions for its application defining all terms? (4 marks)
5. List the assumptions used in mean-variance portfolio theory. (4 marks)
6. State the tree forms of market efficient hypothesis (3 marks)
7. Why is financial economics important in actuarial science study? (4 marks)

**QUESTION TWO (20 MARKS)**

Suppose that under the unique equivalent martingale measure, Q, for a term structure model, the SDE satisfied by the instantaneous interest rate v is;



Where are fixed parameters and, under Q, Z is a standard Brownian motion.

The process x is defined by 

Where the function b is given by

The function f is given by ,where is a differentiable function.

1. Apply Ito’s formula to  (8 marks)

Hint: first show that  where  and 

1. (i) find a differential equation which the function must satisfy for to be a martingale. (6 marks)

(ii) determine an additional condition on a which is necessary for a bond with unit payoff at time T to have a price given by the formula.  (6 marks)

**QUESTION THREE (20 MARKS)**

1. An investor is contemplating as investment with a return ksh R, where

Where is a uniform  random variable.

Calculate each of the following four measures of risk

1. Variance of the return (3 marks)
2. Downside semi-variance of return (2 marks)
3. Shortfall probability, where the shortfall level is kshs 100,000 (3 marks)
4. Value at risk at the 5% level (2 marks)
5. A bond investor has constructed a portfolio by two assets A and B with the following properties.

A B

Variance of return 24%% 12%%

Co-efficient of correlation between assets 0.25

1. Derive a formula and determine the composition of the investor’s minimum variance portfolio (6 marks)
2. Explain in general terms the benefits of diversification. (4 marks)

**QUESTION FOUR (20 MARKS)**

1. A market consists of three assets A, B and C. Annual returns on the three assets (RA,RB and RC) have the following characteristics

Assets expected return % standard deviation %

A 9 20

B 6 20

C 3 10

The correlation between the returns are as follows;

Corr (RA,RB)=-0.25, corr (RB,RC)=-0.50 and corr (RA,RC)=-0.50

1. Calculate the variance of the returns of each asset and covariances between the returns of each pair of assets. (7 marks)
2. Define an efficient portfolio for the corresponding mean-variance portfolio model. (3 marks)
3. Two assets are available for investment. Asset 1 returns a percentage 4B%, where B is a binomial random variable with parameter n=3, p=0.5. Asset 2 returns a percentage 2P%, where P is a poisson random variable with parameters ...=3. Assume a benchmark return of 3%.

Calculate the following three measures of investment risk for each asset

(i) Variance (4 marks)

(ii) Semi-variance (3 marks)

1. Short-fall probability (3 marks)

**QUESTION FIVE (20 MARKS)**

1. (i) State the general form of the equation used in multifactor models of secerity returns, defining any terms you may use. (4 marks)

(ii) Describe the different categories of factors that are used in these models and illustrate your answer using suitable examples. (6 marks)

1. Let be a stochastic process satisfying  where W is standard Brownian motion.

Let be a function, twice partially differentiable with respect to , once with respect to t.

1. State the stochastic differential equation for  (3 marks)
2. Prove that the solution of this stochastic differential equation is given by  (7 marks)