



WI-2-44-1-6

JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

UNIVERSITY EXAMINATIONS 2018/2019

THIRD YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE IN: ACTUARIAL SCIENCE AND OPERATIONS RESEARCH

STA 2310 DECISION THEORY

DATE APRIL 2019

TIME 2 HOURS

- Instructions
- Answer question one and any other two questions.
 - Strictly submit this question paper together with the answer booklet

QUESTION ONE (30 MARKS)

- a) An investment manager of JKUAT pension scheme is considering one out of the 3 available investment opportunities. That is stock, treasury bonds and mutual fund. The decision table below shows the expected returns in \$'000' for each investment under the three possible economic conditions.

Alternative	State of the Economy		
	Growing	Stable	Declining
Treasury Bonds	40	45	5
Stocks	70	30	-13
Mutual Fund	53	45	-5
Prior prob	0.3	0.5	0.2

Using expected monetary value criterion, advise the manager on the optimal investment option. Also find the expected value of perfect information.

(4 marks)

- b) Pizza Kings and Noble Greek are 2 competing restaurant. Both restaurants must determine simultaneously the price of each pizza sold. Pizza Kings believes that Noble Greek price is a random variable Y with a probability distribution $P(Y = \$6) = 0.25$, $P(Y = \$8) = 0.5$ and $P(Y = \$10) = 0.25$. If Pizza Kings charges a price x and Noble Greek charges a price y , Pizza Kings will sell $100 + 25(y - x)$ pizzas. It costs Pizza Kings \$4 to make a pizza. Pizza Kings is considering charging \$5, \$6, \$7, \$8 or \$9 for a pizza. Construct a payoffs table for Pizza Kings hence using Laplace and Hurwicz criterion with 45% optimism, determine the price Pizza Kings should charge for a pizza in order to maximize profit?

(7 marks)

[6 marks]

- (d) Differentiate between systematic and unsystematic risk. [2 marks]
- (e) Highlight the distinguishing feature between exponential and quadratic types of utility functions. [2 marks]
- (f) Suppose project M has an expected value of Ksh.470 and a standard deviation of Ksh.255, and project N has an expected value of Ksh.875 and a standard deviation of Ksh.175. Using coefficient of variation which project is preferable? [4 marks]

Question Two (20 Marks)

- (a) The initial outlay of a product is Ksh.100,000 and it can generate cash inflow of Ksh.40,000 after first year, Ksh.30,000 after second year, Ksh.50,000 after third year and Ksh.20,000 after fourth year, before adjustments. Assuming that the rate of discount is 10% and risk free rate is 8%. Determine whether this project is profitable using;
 - i. Profitability index [4 marks]
 - ii. Internal rate of return [6 marks]
- (b) Suppose that the initial capital of an insurer is 10 units, the claim inter-arrival time and the claim losses are exponentially distributed with parameters 0.5 and 0.2 respectively. Assuming that the relative safety loading factor is 0.5.
 - i. What is the upper bound probability of ruin for this insurer? [7 marks]
 - ii. What will be the probability of ruin in case the initial capital is zero? [3 marks]

Question Three (20 Marks)

- (a) State and prove Panjer's recursion theorem. [4 marks]
- (b) Suppose the loss random variable S is such that $S = X_1 + X_2 + X_3 + \dots + X_N$, with claim probability distributed as follows $Pr(X = 1, 2, 3) = 0.25, 0.25, 0.5$ and claim frequency distributed as $N \sim Poisson(10)$. Find the probability that $S = 2$ [10 marks]
- (c) An individual is facing a random loss, X, that is uniformly distributed on [0, 200]. The individual can buy partial insurance cover against this loss under which the individual would pay $Y = \min(X, 100)$, so that the individual would pay the loss in full if the loss was less than 100, and would pay 100 otherwise. The individual makes decisions using the utility function $u(x) = x^{2/5}$. Is the individual prepared to pay 80 for this partial insurance cover if the individual's wealth is 300? [6 marks]

$$\sum_{k=1}^{\infty} p_k (T_{k+1})$$