

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF COMMERCE, BACHELOR OF COOPERATIVE MANAGEMENT AND BACHELOR OF ENTREPRENEURSHIP & ENTERPRISE MANAGEMENT

BCOM 162: BUSINESS MATHEMATICS II

STREAMS: BCOM/BCOP/BEEM (Y1S2)

TIME: 2 HOURS

DAY/DATE: FRIDAY 26/03/2021

11.30 A.M. – 1.30 P.M.

INSTRUCTIONS: Answer question ONE and any other TWO questions

QUESTION ONE (30 MARKS)

- (a) Explain the meaning of the following decision environments
- (i) Uncertain [2 marks]
 - (ii) Risk [2 marks]
- (b) A firm has analyzed their operating conditions, prices and costs and has developed the following functions: selling price per unit, $p=300-2x$ and total cost, $C=2x+1000$ where x is the number of units sold. Costs and revenues are measured in (ksh.). The firm wishes to maximize profit. Assume that all output produced is sold.
- (i) Determine the total revenue function [2 marks]
 - (ii) What quantity should be sold to maximize profit [4 marks]
 - (iii) What will be the amount of maximum profit? [2 marks]
- (c) A water bottling company is deciding whether to construct a large plant (strategy 1), construct a small plant (strategy 2) or maintain status quo (strategy 3). The return on this investment depends on whether the economy experiences inflation, recession, or no change at all with probabilities of 0.5, 0.2 and 0.3 respectively.

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The payoff (in ksh. 000) associated with the strategies are given in the table below:

		Strategies		
	Probability	Large plant	Small plant	Maintain status Quo
Inflation	0.5	2,000	1,200	1,500
Recession	0.2	1,200	800	1,000
No change	0.3	1,500	1,000	1,800

Use the table to recommend the best alternative using the following criteria

- (i) Maximin [3 marks]
 - (ii) Hurwicz (Take $\alpha = 0.75$) [3 marks]
 - (iii) Laplace [3 marks]
 - (iv) Expected monetary value [3 marks]
- (d) Use matrix algebra to solve the following system of simultaneous equations
- $$\begin{aligned}x_1 + 2x_2 + 3x_3 &= 3 \\ 2x_1 + 5x_2 + 4x_3 &= 4 \\ 3x_1 + 5x_2 + 6x_3 &= 8\end{aligned}$$
- [6 marks]

QUESTION TWO (20 MARKS)

- (a) Distinguish between a “sample space” and “an event” in the probability field [4 marks]
- (b) Explain the following criteria in decision theory
 - (i) Hurwicz [2 marks]
 - (ii) Laplace [2 marks]
- (c) A water processing plant is experiencing low output and as a result, the firm’s management is considering three strategies: A_1 , A_2 and A_3 . The first strategy A_1 will cost the firm ksh. 15,000; A_2 will cost Ksh.33,000 while A_3 will require investment of Ksh.58,000. The correct choice depends largely upon the future demand, which may be low, medium, or high. By consensus, management ranks the respective demand probabilities as 0.10, 0.50 and 0.40.

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A cost analysis reveals effect upon the profits (in Ksh.) as shown in the table below:

Demand	Course of action		
	A_1	A_2	A_3
Low (L)	10,000	-20,000	150,000
Medium (M)	50,000	60,000	20,000
High (H)	50,000	100,000	200,000

Show this decision situation in the form of a decision tree and indicate the most preferred decision and its corresponding expected net monetary value. [12 marks]

QUESTION THREE (20 MARKS)

- (a) Ambani, Kimathi and Mutiso purchased rice from two supermarkets P and Q. Ambani purchased 1000 kg from P and 700 kg from Q. Kimathi purchased 500 kg from P and 600 kg from Q. Mutiso purchased 400 kg from P and 800 kg from Q. If Ambani, Kimathi and Mutiso individually spent ksh. 75,000, 50,000 and 56,000 respectively, use matrix model to determine the cost of one kg of rice in P and Q. [6 marks]
- (b) An economy has two industries T1 and T2. The industries have the following technology matrix $A = \begin{pmatrix} 0.4 & 0.2 \\ 0.3 & 0.1 \end{pmatrix}$ and $D = \begin{pmatrix} 10 \\ 12 \end{pmatrix}$. Determine the gross production for each industry
- (c) A university has 200 taps connected to X water company line and 300 taps connected to Y water company line. It is known that on any given day, 5% of the taps connected to X and 10% of those connected to Y do not have water. A plumber selects at a random one tap from the 500 taps available and turns on the tap.
- (i) Represent this information using a probability tree [2 marks]
- (ii) If it is found to have water, find the probability that it was connected to line X [4 marks]
- (iii) Find the probability that the tap has water given that the tap selected was connected to line Y [2 marks]

QUESTION FOUR (20 MARKS)

(a) A one-product firm estimates that its daily total cost function (in suitable units) is $c(X) = x^3 - 6x^2 + 13x + 15$ and its total revenue function is $R(X) = 28x$. Find the value of x that maximizes that daily profit and the maximum daily profit. [6 marks]

(b) The average cost of a function is given by $AC = 0.006x^2 + 0.02x - 30 + \frac{500}{x}$

Where x is the output

(i) Find the total cost function [2 marks]

(ii) Find the marginal cost function [2 marks]

(iii) Determine the marginal cost when 50 units are produced [2 marks]

(c) The demand function faced by a firm is $p = 200 - 3Q$ where p is the price per unit. The marginal cost function of a commodity is given as $MC = 80 - 2Q$ where Q is the quantity produced in units. The total cost is ksh. 775 when 10 units of the commodity are produced.

Find:

(i) The total revenue function for the commodity [2 marks]

(ii) The total cost function for the commodity [3 marks]

(iii) The break-even point of the firm [3 marks]