CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

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

BCOM 162: BUSINESS MATHEMATICS II

STREAMS: BCOM/BCOP/BEEM Y1S2 **TIME: 2 HOURS**

DAY/DATE: FRIDAY 12/4/2024 **2.30 P.M. – 4.30 P.M.**

INSTRUCTIONS: Answer question One and any other Two Questions

QUESTION ONE (30 MARKS)

(a) Explain the meaning of the following terms as used in probability field. In each case, give an example.

i) Mutually exclusive events (2 marks)

ii) Independent events (2 marks)

(b) The total cost function for a product is given by $c=0.02x^3-0.04x^2+500x$. Determine

i) The average cost of producing 10 units. (4 marks)

ii) The level of output at which average cost is minimized. (4 marks)

(c) In a toy manufacturing company, the product acceptance can either be good, fair or poor with probabilities 0.5, 0.2 and 0.3 respectively. A manager is considering three courses of action S1, S2 and S3. The payoffs (in Ksh.000) associated with the strategies are given in the table below:

		Courses of Action		
	Probability	S_1	S_2	S_3
Good	0.5	2,000	1,200	1,500
Fair	0.2	1,200	800	1,000
Poor	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) An analyst has developed the following matrix model for estimating production cost of three products M,N and Q.

$$50X_1 - 60X_2 + 40X_3 = 150$$

$$70X_1 + 40X_2 - 30X_3 = 190$$

$$20X_1 + 10X_2 + 60X_3 = 460$$

Where X_1, X_2 and X_3 represent production cost per unit (in sh.000) for product M, N and Q respectively.

Required:

Use matrix algebra to determine the value of the unknowns in the model. (6 marks)

QUESTION TWO (20 MARKS)

(a) Distinguish between "uncertain" and "risk" decision environments. (4 marks)

(b) In a large metropolitan area, the probability of a family owning a colour T.V., a computer or both is 0.86, 0.35 and 0.29 respectively. What is the probability that a family chosen at random during a survey will own a colour T.V and/or a computer? (4 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 for low, medium and high demand respectively. 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) Mwanjegetinge Welfare Group is organizing a luncheon party to be conducted at Green Park Restaurant in Ndangani. Invited guests have been categorized as "Associate" and "Executive" guests. The cost of hosting twelve (12) Executive and eighteen (18) Associate guests for the party is Sh.9900 while that of hosting ten (10) Executive and 12 Associate guests is Sh.7800. Using matrix algebra, determine the cost of hosting an Executive guest and an Associate guest at Green Park Restaurant. (6 marks)

(b) An economy has three industries T1,T2 and T3. The industries have the following technology matrix

$$A=\begin{bmatrix}0.2 & 0.2 & 0.1\\ 0.2 & 0.4 & 0.1\\ 0.1 & 0.2 & 0.3\end{bmatrix}$$

And $D=\begin{bmatrix}40\\ 45\\ 50\end{bmatrix}$ i.e the final demand in metric tonnes from sector T1, T2 and T3 respectively.

Determine:

(i). Determine the Leontief inverse matrix $(1-A)^{-1}$ (4 marks)

(ii).Determine the gross production matrix. (2 marks)

(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 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)

QUESTIO N 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 the daily profit and the maximum daily profit. (6 marks)

(b) The average revenue of a function is given by $AR = 0.006x^2 + 0.02x - 30 + \frac{500}{x}$ where *x* is the output.

i) Find the total revenue function. (2 marks)

ii) Find the marginal revenue function (2 marks)

iii) Determine the marginal revenue when 50 units are produced. (2 marks)

(c) The revenue function of a firm is R = $200x - 3x^2$ where *x* is the price per unit. The marginal cost function of a commodity produced by the firm is given as dC/dx= 80-2*x* where *x* is the quantity produced in units. The total cost is Ksh. 775 when 10 units of the commodity are produced.

Find:

i) The total cost function for the commodity. (4 marks)

ii) The break-even point of the firm (4 marks)

……..