

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

RESITS/SPECIAL

FIRST YEAR UNIVERSITY RESIT EXAMINATIONS FOR DEGREE OF BACHELOR OF COMMERCE

BCOM 162: BUSINESS MATHEMATICS II

STREAMS: BCOM (Y1S2)

TIME: 2 HOURS

DAY/DATE: TUESDAY 02/02/2021

11.30 A.M. – 10.30 A.M.

INSTRUCTIONS: Answer Question ONE and any other TWO Questions

QUESTION ONE (30 MARKS)

- (a) Explain the meaning of the following decision theory terms
- (i) States of nature (2 marks)
 - (ii) Laplace criterion (2 marks)
- (b) Given the total cost function $C = 0.002 X^3 - 0.04 X^2 + 5 X + 1500$. Determine the rate of change in marginal cost with respect to x (2 marks)
- (c) A firm considers production of either product A, B or C to be strategies while the likely demands for the products are considered as states of nature. The payoffs (sh.000) associated with the products are given in the table below:

Demand	Strategies		
	A	B	C
High	350	250	180
Moderate	150	225	150
Low	120	100	150

Use the table to determine the best production strategy using the following criteria

- (i) Maximin (3 marks)
- (ii) Hurwicz (Take $\alpha = 0.8$) (3 marks)

- (iii) Laplace (3 marks)
- (iv) Suppose the states of nature are believed to occur with probabilities 0.3, 0.5 and 0.2 for Low, Medium and High respectively, which product should the firm produce? (3 marks)
- (d) 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 water company line do not have water. A plumber selects at random one tap from the 500 taps available and turns it on.
- (i) If it is found to have water, find the probability that it was connected to line X (3 marks)
- (ii) Find the probability that the tap has water given that the tap selected was connected to line Y (3 marks)
- (e) Use method of determinants or otherwise to solve the following system of simultaneous equations
- $$4x + y - 5z = 8$$
- $$-2x + 3y + z = 12$$
- $$3x - y + 4z = 5$$
- (6 marks)

QUESTION TWO (20 MARKS)

- (a) Explain areas of application of calculus (4 marks)
- (b) A car selling firm has determined through regression analysis that its level of sales (Z) is a function of advertising (measured in units) in two different media. This is given by the following relationship: $Z = 200x + 100y - 10x^2 - 20y^2 + 20xy$ where x = newspapers, and y = magazines

Required:

- (i) Evaluate $\frac{\partial Z}{\partial x}$ and $\frac{\partial Z}{\partial y}$ (4 marks)
- (ii) What are the values of X and Y that maximize level of sales? (2 marks)
- (a) The following system of equations represents the inter-sector demand and final demand of the sectors in a given economy

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 $D = \begin{bmatrix} d_1 \\ d_2 \\ d_3 \end{bmatrix}$. If the gross production matrix $X = \begin{pmatrix} 40 \\ 45 \\ 50 \end{pmatrix}$ where $d_1, d_2, \wedge d_3$ are the final

demands in metric tonnes from sector sector 1, 2 and 3 repectively.

Required:

- (i) Explain the meaning of a closed leontief model (2 marks)
- (ii) Determine the Leontief inverse matrix $(1 - A)^{-1}$ (4 marks)
- (iii) Solve for D (final demand) column vector in the matrix equation $X - AX = D$ (4 marks)

QUESTION THREE (20 MARKS)

- (a) The average cost function for a company is given by $AC = \frac{3}{4}x^2 - 7x + 27$. Find (i) the total cost function (2 marks) (ii) The level of output for which Marginal Cost = Average Cost (4 marks)

- (b) A firm has analyzed their operating conditions, prices and costs and has developed the following functions: Revenue: $R = 400Q - 4Q^2$ and Marginal Cost: $\frac{dC}{dQ} = 2Q + 10$ where Q is the number of units sold. The firm will incur a total cost of Sh.30 when there is zero production. The firm wishes to maximize profit. Assume that all output produced is sold.

- (i) What quantity should be sold? (6 marks)
- (ii) What will be the amount of maximum profit? (2 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 400kg from P and 800kg from Q. If Ambani, Kimathi and Mutiso individually spent a total of 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)

QUESTION FOUR (20 MARKS)

- (a) Explain the difference between a sample point and a sample space in the probability field (2 marks)
- (b) A retailer of motorized bicycles has examined cost data and has determined the average cost function which expresses the annual cost of purchasing, owning, and maintaining inventory as a function of the size (number of units) of each order it places for the bicycles. The average cost function is,

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$$AC(x) = x^3 - \frac{615x^2}{2} + 15750 + 18000$$
 where x the number of cycles equals

ordered each time the retailer replenishes the supply. Determine the order size, which minimizes average inventory cost. (6 marks)

- (c) A water processing plant is experiencing low output and as a result, the firm's management is considering three strategies: A1, A2 and A3. The first strategy A1 will cost the firm Ksh.15, 000; A2 will cost Ksh.33, 000 while A3 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. 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)
