

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF COMMERCE

BCOM 162: BUSINESS MATHEMATICS 2

STREAMS: BCOM Y1S2 (ODEL)

TIME: 2 HOURS

DAY/DATE: WEDNESDAY 06/10/2021

2.30 P.M – 4.30 P.M.

INSTRUCTIONS:

- Answer question ONE and any other TWO questions
- Do not write on the question paper

QUESTION ONE

- (a) Distinguish between the following concepts as applied in probability theory
- (i) Equiprobable events and Dependent events. (3 marks)
 - (ii) Sample point and sample space (3 marks)

- (b) A firm has analysed its operating condition prices and costs and have developed the following total revenue and total cost functions.

$$TR = 400q - 4Q^2 \text{ and}$$

$$TC = Q^2 + 10Q + 30 \text{ where } Q \text{ is the number of units produced and sold.}$$

Required

- (i) What quantity should be sold so as to maximize profit? (4 marks)
 - (ii) What would be the price at the profit maximization level? (3 marks)
- (c) Pharmaco hospital is administering Covid-19 vaccines from three suppliers, Pfizer, Moderna and Janssen. The vaccine is administered based on the client's preference among the three suppliers. On a particular day the hospital administer vaccines from the three suppliers comprising of 25%, 40% and 35% from Pfizer, Moderna and Janssen

respectively. Based on past experience 6% of Pfizer, 4% of Moderna and 8% of Janssen clients developed headache side effects a day after vaccination. On 13th January 2021 a random client was vaccinated. (N.B. This is just a hypothetical scenario for examination purposes only and does not reflect in any way the side effects of any of the Covid-19 vaccines).

Required:

- (i) A probability tree diagram presenting the joint probabilities. (3 marks)
- (ii) Probability that a randomly vaccinated client developed some headache a day after vaccination. (3 marks)
- (iii) The probability that a randomly administered vaccine would be from Pfizer or Janssen. (2 marks)
- (iv) The probability that administered vaccine was Pfizer given that the client developed some headache a day after vaccination. (3 marks)
- (d) Use matrix algebra to solve the following system of simultaneous equations

$$\begin{aligned} 2x + 4y - 3z &= 12 \\ 3x - 5y + 2z &= 13 \\ -x + 3y + 2z &= 17 \end{aligned}$$

QUESTION TWO

- (a) An economy has two sectors, mining and construction, whereby the two sectors are interdependent. To produce 1 unit of mining output, it requires 0.4 units of mining itself and 0.3 units from construction. To produce 1 unit of construction output, it requires 0.2 units from mining and 0.1 units from construction itself. Given that the final demand in the economy would 100 and 120 metric tonnes of mining and construction outputs respectively.
 - (i) Derive the technology matrix (2 marks)
 - (ii) Determine the gross production in the economy so as to satisfy both intermediate and final demands. (6 marks)
 - (iii) Determine the primary inputs. (3 marks)
 - (iv) Account for the sources of construction sector inputs. (3 marks)

- (b) Discuss three types of environments in a contemporary decision making process. (6 marks)

QUESTION THREE

- (a) Define the following concepts as applied in matrix theory
- (i) Identify matrix (2 marks)
 - (ii) Null matrix (2 marks)
 - (iii) Singular matrix (2 marks)
- (b) The total cost and total demand functions for a particular product are:
 $TC = 5,000,000 - 250q + 0.02q^2$ and $p = 1,250 - 0.005q$ where q is the quantity produced and sold. Determine:
- (i) The total revenue function for the product (2 marks)
 - (ii) The production level at which price would be maximum (5 marks)
 - (iii) Price per unit at the maximum profit (2 marks)
- (c) Maridadi bakers produces two types of cake, Queen cakes and Blackforest. The cost of baking 130 Queencakes and 104 blackforests is Sh. 52,780 while that of 52 Queencakes and 91 Blackforests is 36,920. Using matrix algebra, determine the cost of producing a Queencake and a Blackforest. (5 marks)

QUESTION FOUR

- (a) Mazigira Ltd is trying to set the selling price for one of its products whereby three prices are under consideration. The prices are Sh. 4.00, Sh. 6.00 and Sh. 8.00 and the payoff matrix in Million shillings is as provided below

Conditions	Strategies/alternatives		
	Sh. 4.0	Sh. 6.0	Sh. 8.0
Best possible	12,000	12,200	10,000
Most likely	8,000	8,750	8,800
Worst possible	0	-1600	-5600

Required

Providing reasons in each case advise the management of the company on the most optimal price based on the following criteria

- (i) Maximax criterion (2 marks)
- (ii) Laplace criterion of rationality (3 marks)
- (iii) Hurwicz principles ($\alpha = 0.7$) (3 marks)
- (iv) Savage principle (3 marks)

(v) Expected Monetary Value (EMV) given that the probabilities of Best, Most likely and Worst possible states of nature are 0.2, 0.5 and 0.3 respectively. (3 marks)

(b) The average cost 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)
