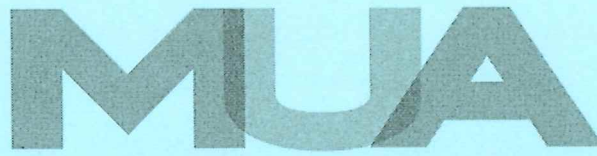


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**UNDERGRADUATE UNIVERSITY EXAMINATIONS**  
**SCHOOL OF MANAGEMENT AND LEADERSHIP**  
**DEGREE OF BACHELOR OF MANAGEMENT AND LEADERSHIP/**  
**BACHELOR OF COMMERCE**

**BML 202/ BCM 126 :        QUANTITATIVE TECHNIQUES**

**DATE:                            16<sup>TH</sup> DECEMBER 2024**

**DURATION:    2 HOURS**

**MAXIMUM MARKS: 70**

**INSTRUCTIONS:**

1. Write your registration number on the answer booklet.
2. **DO NOT** write on this question paper.
3. This paper contains **SIX (6)** questions.
4. Question **ONE** is compulsory.
5. Answer any other **THREE** questions.
6. Question **ONE** carries **25 MARKS** and the rest carry **15 MARKS** each.
7. Write all your answers in the Examination answer booklet provided.

**QUESTION ONE**

- a) The Revenue function of a firm is given by:

$$R = 4C - 10T - 2TC + T^2 + 2C^2$$

where T = Technology and C = Capital.

Determine the level of Technology and Capital needed to maximize revenue and find the maximum revenue. **(7 Marks)**

- b) An economic analyst has compiled the information related the relationship which exist between Agriculture and construction sector and has compiled the report below:

PRODUCTION	CONSUMPTION		
	Agriculture	Construction	Consumer Demand
Agriculture	22	45	54
Construction	30	42	44

Determine the technical coefficients and hence the output to satisfy the demand which may change to 30 and 50 for Agriculture and construction respectively **(6 Marks)**

- c) Explain six steps involved in decision making, in a chronological manner **(3 Marks)**  
 d) Highlight any four assumptions for Economic order quantity **(2 Marks)**  
 e) A consultancy firm dealing with rehabilitation of drug addicts present the following activities which has to take place as per the proceedings given. The management of the firm have indicated the duration for each activity during the implementation.

Activity	Immediate Predecessor	Time (Weeks)
A	-	2
B	-	1
C	A	7
D	B	3
E	A	5
F	D, E	4
G	B	6
H	C, F	1
I	G, H	2

**Required:**

- i. Draw the network diagram **(3 Marks)**  
 ii. Identify the critical path and project duration **(4 Marks)**



**QUESTION TWO**

- a) At Mjomba Food distributors customers prefer Githeri or Matoke. The production of two kind of food, requires machine and labour hours as indicated in the table below. 'Githeri' has a cost of Ksh. 300 per unit and 'Matoke' Ksh. 400 per unit. The production data is as follows:

PRODUCT	MACHINE HOURS	LABOUR	MATERIAL
Githeri	4	4	1
Matoke	2	6	3
Total available hours	100	180	140

**Required:**

- i. Formulate the Linear programming model **(3 Marks)**
  - ii. Solve for optimal product mix using graphical methods **(5 Marks)**
- b) Your firm has recently stated to give economic advice to your client acting as a consultant. You have estimated the demand function to be  $AR = 200 - 8X$  where AR is the average revenue per unit and X is the output. Investigation of the client cost profile the marginal cost is given by  $MC = X^2 - 28X + 211$

Further investigation has shown that the firm's cost when not producing output are 10 thousand.

Determine the level of maximum profit **(7 Marks)**

**QUESTION THREE**

- a) A company dealing with the supply of construction materials has the price structure for their items as indicated in the table below. Purchase cost per order is Sks. 25, cost per unit is Ksh. 10, Annual Demand is 950 units and carrying cost is 18 percent of the unit price.

UNITS	UNITS PRICE
0 - 199	10
200 - 399	9
400 - 599	8
600 and above	7

Determine the optimal units to reduce the total cost involved. **(10 Marks)**

b) Explain three uses of input-output analysis and two uses of Markovian analysis **(5 Marks)**

#### QUESTION FOUR

Consider a project whose activities, their predecessor(s) and durations are given in the table below:

Activity	Preceding Activity	DURATION (WEEKS)		
		Optimistic time	Most likely time	Pessimistic time
A	None	3	4	5
B	None	2	5	6
C	None	4	5	6
D	A, B	1	3	4
E	A, B, C	5	7	8
F	D	3	4	6
G	D, E	2	3	4
H	E	5	6	8
I	G, H	3	5	7
J	I, F	2	4	5
K	J	3	5	7
L	K	4	6	6

**Required to:**

- Present the data in a network diagramme **(3 Marks)**
- Calculate the expected duration for each activity **(4 Marks)**
- Obtain the project duration and critical path **(5 Marks)**
- Determine the probability of completing the project in more than 35 weeks **(3 Marks)**



**QUESTION FIVE**

- a) The marginal cost function for a company is  $Y = 16 - 0.04X$  where  $X$  is the number of units produced. It has been found that the company incurs an expenditure of Shs 800 when 400 units are made. Find the fixed cost and hence the cost function for the company **(7 Marks)**
- b) Suppose a situation where a decision maker has four possible alternatives  $D_1, D_2, D_3$  and  $D_4$ , where the outcome of each of them can be affected by the occurrence of any one of the four conditions  $C_1, C_2, C_3$  and  $C_4$ . The monetary payoffs of each combination of  $D_i$  and  $C_j$  are given in the following table:

ALTERNATIVES	CONDITION S			
	$C_1$	$C_2$	$C_3$	$C_4$
$D_1$	27	12	14	26
$D_2$	45	17	34	20
$D_3$	52	36	27	15
$D_4$	41	22	29	12

**Required:**

Advice on the optimal alternative a decision maker can choose using:

- i. Optimistic Approach **(1 Mark)**
- ii. Minimax criterion **(2 Marks)**
- iii. Hurwicz criterion,  $\alpha = 0.4$  **(3 Marks)**
- iv. Laplace criterion **(2 Marks)**

**QUESTION SIX**

- a) Suppose an economy consists of three industries X, Y, Z and suppose that each one produces a single product. The data below gives information about the three industries.

PRODUCTION	CONSUMPTION			
	X	Y	Z	Consumer Demand
X	50	30	40	90
Y	20	10	20	100
Z	30	20	20	40

Suppose that the consumer demand changes to 90, 120, and 60 respectively.

**Required:**

- i. Obtain the input – output matrix **(3 Marks)**
  - ii. Determines gross outputs of the three sectors will meet this demand. **(8 Marks)**
- b) Explain any four roles of quantitative techniques in Business **(4 Marks)**

FORMULAS

$$EOQ = \sqrt{\frac{2 \times CO \times D}{Ch}}$$

$$Ch = Cc = i \times C / \text{Units}$$

$$\text{Number of orders} = \frac{\text{Demand}}{EOQ}$$

$$\text{Total Cost (TC)} = D \times C / \text{units} + \frac{EOQ}{2} \times Ch + \frac{\text{Demand}}{EOQ} Co$$

$$BEP_{(\text{units})} = \frac{\text{Fixed Cost}}{\text{Revenue} - \text{Variable per unit}}$$

$$\text{Activity variance} = \left[ \frac{p-o}{6} \right]^2$$

$$\text{Expected Time} = \frac{O+4M+P}{6}$$

$$Z = \frac{(x - \text{Mean})}{\text{project standard deviation}}$$

$$\text{Activity Standard Deviation} = \frac{P-O}{6}$$

$$\text{Input-Output Model, } X = (I_n - M)^{-1} \times d$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



