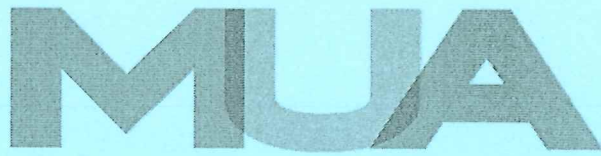


The
Management
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UNDERGRADUATE UNIVERSITY EXAMINATIONS

SCHOOL OF MANAGEMENT AND LEADERSHIP

DEGREE OF BACHELOR OF MANAGEMENT AND LEADERSHIP

BML 303 : OPERATIONS RESEARCH

DATE: 19TH JULY 2022

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. Given the primal program as follows

$$\text{Max } Z = 1000X_1 + 800 X_2$$

s.t

$$6X_1 + 2X_2 \leq 12 \dots\dots\dots R_1$$

$$10X_1 + 4X_2 \leq 24 \dots\dots\dots R_2$$

$$X_1, X_2 \geq 0$$

Suppose optimal solution is $X_1 = 1$, $X_2 = 2$ and maximum profit is 8,000. Also, suppose R_1 increases by 10% and R_2 decreases by 20%. Illustrate whether the new product mixes are feasible. (5 marks)

- b. State any four assumptions used in game theory (4 marks)
- c. State any two assumptions underlying assignment models (2 marks)
- d. Explain briefly the three techniques in transportation models used to determine the initial feasible solution. (3 marks)
- e. Customers arrive at a service counter of a commercial bank at a mean arrival rate of 35 per minute. The mean service rate is 40 per minute. Calculate
- i. Average number of customers in the commercial bank hall (2 marks)
 - ii. The queue length (2 marks)
 - iii. Probability that the customer will have to wait (2 marks)
- f. Find the optimum strategies and the value of the game from the following pay off matrix concerning two person game (5 marks)

Player y	X_1	X_2
Y_1	2	5
Y_2	4	1

QUESTION TWO

A company, which has five factories at various locations, wishes to supply four main distribution centres with their products. The distances in kilometers between the factories and the distribution centres are given in the table below:

		Distribution Centres				
		V	W	X	Y	Z
Factories	A	160	130	176	190	200
	B	135	120	130	160	175
	C	140	110	155	170	185
	D	50	50	80	80	110
	E	55	35	70	80	105

- i. Determine the optimum allocation which will minimize the distance travelled (12 marks)
- ii. Calculate the total distance of the final assignment (3 marks)

QUESTION THREE

A person wants to decide the constituents of a diet, which will fulfill his daily requirements of proteins, fats and carbohydrates. The choice is to be made from four different types of foods.

Food Type	Proteins	Fats	Carbohydrates	Cost
A	3	2	6	45
B	4	2	4	40
C	8	7	7	85
D	6	5	4	65
Minimum required	800	200	700	

Required

- a. Formulate the linear programming model (5 marks)
- b. Obtain the dual program (4 marks)
- c. Using simplex method and starting from the answer obtained in b above, perform the second, third and fourth steps towards obtaining optimal diet mix (6 marks)

QUESTION FOUR

Consider the following transportation table for a minimization problem

		Destinations					Total Supply
		W1	W2	W3	W4	W5	
Sources	S1	10	4	8	6	6	50
	S2	6	2	2	1	7	45
	S3	2	11	6	7	5	35
	S4	8	15	5	9	1	50
Total Demand		45	25	40	32	38	180

Required:

Determine the initial basic feasible solution using:

- i. Least Cost Method (LCM) (4 marks)
- ii. North West Corner Rule (4 marks)
- iii. Vogel's Approximation Method (VAM) (7 marks)

QUESTION FIVE

- a. Explain the following terms as used in operations research
 - i. Duality (1 mark)
 - ii. Sensitivity analysis (1 mark)
 - iii. Transportation model (1 mark)
 - iv. Surplus variables (1 mark)
 - v. Unbound solution (1 mark)
- b. A dental surgery has two operation rooms. The service times are assumed independent, exponentially distributed with mean 15 minutes. Andrew arrives when both operation rooms are empty. Bob arrives 10 minutes later while Andrew is still under medical treatment. Another 20 minutes later Caroline arrives and both Andrew and Bob are still under treatment. No other patient arrives during this 30- minute interval.
 - i. What is the probability that Andrew will be ready before Bob? (1 Mark)
 - ii. What is the probability that Caroline will be ready before Andrew?(1 Mark)
 - iii. What is the probability that Caroline will be ready before Bob? (2 Marks)
- c. Explain the six phases of operations research (6 marks)

QUESTION SIX

- a. Identify and explain three types of decision-making environments. **(4 marks)**
- b. Topcom Kenya International Limited (TKIL) is a telecommunications company situated in Nakuru. Recently, the company was faced with a workers strike, which necessitated a renegotiation of the workers' salaries through their union. The management with the help of a consultant has prepared the pay-off matrix shown below:

		Pay-off matrix				
		Workers union strategies				
		U ₁	U ₂	U ₃	U ₄	
Company strategies		C ₁	+ 2.5	+ 2.7	+ 3.5	- 0.2
		C ₂	+ 2.0	+ 1.1	+ 0.8	+ 0.8
		C ₃	+ 1.4	+ 1.2	+ 1.5	+ 1.3
		C ₄	+ 3.0	+ 1.0	+ 1.9	0

A positive sign represents a wage increase while a negative sign represents a wage decrease.

Required:

- i. Advise the management on the best strategies. **(6 marks)**
- ii. The value of the game **(2 marks)**
- c. Briefly explain the limitations of the use of game theory in decision-making. **(3 marks)**

