

QP CODE 2117600802

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DMI-ST. EUGENE UNIVERSITY
ZAMBIA

DEGREE EXAMINATION – DECEMBER 2023

Semester: VIII
Time: 3:00 Hours

760MA08 LINEAR PROGRAMMING

Max. Marks: 100

Answer any FIVE Questions (5 x 20 = 100 Marks)

1. a) Find the graphical solution of the following LP problem Maximize $Z = 5x + 10y$
Subject to $2x + y \geq 8$; $3x + 4y \leq 24$; $y \geq 2$, $x, y \geq 0$. **(10 Marks)**
- b) Find the graphical solution to the problem Minimize $Z = 14x + 28y$, Subject to
constraints $2x + 3y \geq 6$; $6x + 2y \geq 9$; $x, y \geq 0$. **(10 Marks)**
2. a) Find the total cost of the following by using Vogel's Approximation Method of
transportation Problem.

				Supply
	1	2	6	7
	0	4	2	12
	3	1	5	11
Demand	10	10	10	

(10 Marks)

- b) Find the total cost of the following by using Vogel's Approximation Method of
transportation Problem.

				Supply
	0	2	1	6
	2	1	5	7
	2	4	3	7
Demand	5	5	10	

(10 Marks)

3. a) Find the sequence of the salesman's visit so that the cost is minimum.

	A	B	C	D	E
A	∞	2	5	7	1
B	6	∞	3	8	2
C	8	7	∞	4	7
D	12	4	6	∞	5
E	1	3	2	8	∞

(10 Marks)

- b) Find the Hamiltonian path for the travelling salesman visiting five villages from A through E. The distance matrix is as follows

	A	B	C	D	E
A	∞	8	11	7	8
B	8	∞	10	7	8
C	11	10	∞	11	9
D	7	7	11	∞	11
E	8	8	9	11	∞

(10 Marks)

4. a) Apply dominance principle and find the saddle point.

$$A = \begin{bmatrix} 2 & 3 & 7 & 10 \\ 1 & 4 & 10 & -1 \\ 3 & 1 & 5 & 11 \\ 3 & 7 & 12 & 11 \end{bmatrix}$$

(10 Marks)

- b) Solve the following pay-off matrix and find the value of the game.

$$A = \begin{bmatrix} 5 & 4 & -6 & 8 \\ 3 & 7 & 1 & 2 \\ 5 & 9 & 4 & 6 \\ 2 & 1 & 4 & 7 \end{bmatrix}$$

(10 Marks)

5. a) The inter-arrival distribution of customers at a gas station during non-busy hours is as follows.

Time between two successive customers in arrivals (minutes)	Number of customers
02	15
03	20
04	40
05	20
06	05

The service time for the customers has the following distribution

Service time	Number of customers
5	25
10	45
12	20
20	10

The gas station starts its operation at 6:00 a.m. You are required to simulate for first five customers and find the average waiting time. You may use the following random numbers: 95, 79, 52, 37, 12, 01, 37, 49, 51, 93. (10 Marks)

- b) A furniture making factory has two processing departments, say A and B. Average distribution of processing time for the assembly line timing is given as below.

Time (minutes)	30	35	40	45
Frequency (Depart A)	20	30	40	10
Frequency (Depart B)	15	25	40	20

Production items go through department A and then only to the department B. You are required to simulate the work for next five items. Also, find the total waiting time for

department B. Use the following random numbers. (You may begin the simulation from 8.00 am)

Random numbers:

A: 22, 87, 66, 87, 35

B: 56, 87, 45, 94, 34

(10 Marks)

6. a) A merchant has two types of tea type A and type B. He makes two types of tea mix regular type and special type. Each kilogram of regular type consumes 40% of type A and 60% of type B. while the special type requires 60% of type A and 40% of type B. the merchant has 48 kilograms of type A and 60 kilograms of type B. Regular type of tea fetches a profit of K 24 per kg while special type fetches a profit of K18 per kg. Perform the followings

- i. Make an LPP to earn maximum profit.
- ii. Find the graphical solution to the primal (given) problem
- iii. Write the dual of the problem.
- iv. Find the graphical solution of the dual problem.

(10 Marks)

b) Find the graphical solution of the L.P.P Maximize $f(x) = 2x + 3y$
Subjects to the Constraints

$$4x + 6y \leq 24$$

$$5x + 3y \leq 15$$

$$x + y \geq 2$$

$$x, y \geq 0$$

(10 Marks)

7. a) Given assignment techniques and maximization problem to find out the total cost of Assignment Problem.

	D ₁	D ₂	D ₃	D ₄	D ₅
S ₁	125	99	103	110	105
S ₂	120	110	98	104	106
S ₃	130	120	98	110	110
S ₄	120	125	97	104	100
S ₅	120	110	99	100	102

(10 Marks)

b) Solve the following allocation problem for maximization problem to find out the total cost of Assignment Problem.

	D ₁	D ₂	D ₃	D ₄	D ₅
S ₁	225	199	203	210	205
S ₂	220	210	198	204	206
S ₃	230	220	198	210	210
S ₄	220	225	197	204	200
S ₅	220	210	199	200	202

(10 Marks)