B.Sc.-III (CBCS Pattern) Semester - VI

021B - DSE-VII : Mathematics-III
Linear Programming and Transportation Problems

P. Pages : 3 **GUG/S/23/13364**

Time : Three Hours * 1 9 1 0 * Max. Marks : 60

Notes : 1. Solve all **five** questions.
2. All questions carry equal marks.

UNIT – I

1. a) Find an initial feasible solution of the following. **6**

$2x_1 + x_3 \geq 5$

$5x_1 - 2x_3 \geq -3$

$3x_1 + x_2 - 7x_3 = 16$

b) Put the following program in matrix standard form **6**

Maximize : $Z = 4x_1 + 2x_2$

Subject to : $3x_1 + x_2 \geq 27$

$x_1 + x_2 \geq 21$

$x_1 + 2x_2 \geq 30$

with : $x_1, x_2 \geq 0$

OR

c) Solve the L. P. P. graphically **6**

Maximize : $Z = 3x_1 + 2x_2$

Subject to : $x_1 + x_2 \leq 20$

$x_1 \leq 15$

$x_1 + 3x_2 \leq 45$

$-3x_1 + 5x_2 \leq 60$

with : $x_1, x_2 \geq 0$

d) Determine whether the set $\left\{[-1,2,1]^T, [3,0,-1]^T, [-5,4,3]^T\right\}$ is linearly dependent **6**

UNIT – II

2. a) Solve following L. P. P. by simplex method. **6**

Maximize : $Z = x_1 + x_2$

Subject to : $x_1 + 5x_2 \leq 5$

$2x_1 + x_2 \leq 4$

with : $x_1, x_2 \geq 0$

b) Solve the following LPP by two phase method **6**

Maximize : $Z = 80x_1 + 60x_2$

Subject to : $0.20x_1 + 0.32x_2 \leq 0.25$

$x_1 + x_2 = 1$

with : $x_1, x_2 \geq 0$

OR

c) Solve the following LPP by Big-M method. **6**

Maximize : $Z = 3x_1 + 2.5x_2$

Subject to : $x_1 + 2x_2 \geq 20$

$3x_1 + 2x_2 \geq 50$

with : $x_1, x_2 \geq 0$

d) Determine the dual of L.P.P. **6**

Maximize : $Z = 6x_1 + 5x_2 - 7x_3$

Subject to : $7x_1 + 11x_2 + 3x_3 \leq 25$

$2\ x_1 + 8x_2 + 6x_3 \leq 30$

$6x_1 + x_2 + 7x_3 \leq 35$

with : $x_1, x_2, x_3 \geq 0$

UNIT – III

3. a) Use the north-west corner rule to obtain an initial basic feasible solution to the transportation problem. **6**

	D_1	D_2	D_3	D_4	Supply
0_1	19	30	50	10	7
0_2	70	30	40	60	9
0_3	40	8	70	20	18
Demand	5	8	7	14	

b) Explain the steps of determining initial basic feasible solution to transportation problem by Vogel's Approximation method. **6**

OR

c) Find the initial basic feasible solution of the transportation problem using least cost entry method. **6**

		Destination				
		A	B	C	D	Supply
	I	1	5	3	3	34
	II	3	3	1	2	15
Origin	III	0	2	2	3	12
	IV	2	7	2	4	19
Demand		21	25	17	17	

d) Determine the optimal solution of the following transportation problem using Vogel's approximation method for initial basic solution. **6**

	W_1	W_2	W_3	W_4	Capacity
F_1	11	20	7	8	50
F_2	21	16	10	12	40
F_3	8	12	18	9	70
Requirement	30	25	35	40	

UNIT – IV

4. a) Maximize: $Z = x(5\pi - x)$ on $[0, 20]$. **6**

b) Use three-points search to approximate the location of the maximum of $f(x) = x(5\pi - x)$ on $[0, 20]$ to within $\in = 1$ **6**

OR

c) Prove that optimum assignment schedule remains unaltered if we add (substract) a constant to (from) all the elements of the row or column of the assignment cost matrix. **6**

d) HMT Ltd. decides to make four sub assemblies through four contractors. Each contractor is to receive only one sub assembly. The cost of each sub assembly is determined by the bids submitted by each contractor and is shown in the following table in hundreds of rupees. Assign the different sub assemblies to the contractors to minimize the total cost. **6**

Contractor

Sub assembly	1	2	3	4
1	15	13	14	17
2	11	12	15	13
3	13	12	10	11
4	15	17	14	16

5. Solve **any six**.

a) Define Optimization problem. **2**

b) Transform the constraint $4x_1 + 5x_2 + 3x_3 \le 1800$ into an equation using slacker surplus variables. **2**

c) In simples method when solution under test is optimal. **2**

d) Write dual of the programme. **2**

$$\text{Minimize}: Z = \bar{C}^T \bar{X}$$
$$\text{Subject to}: A\bar{X} \le \bar{B}$$
$$\text{with}\ : \bar{X} \ge 0$$

e) Define basic feasible solution to transportation problem. **2**

f) Write mathematical formulation of transportation problem. **2**

g) If for an assignment $c_{ij} \ge 0$, then prove that an assignment schedule (x_{ij}) which satisfies $\Sigma\Sigma\ x_{ij}\ c_{ij} = 0$ must be optimal. **2**

h) Define Convex functions. **2**

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