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

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

P. Pages : 4 **GUG/W/22/13364**

Time : Three Hours * 2 2 9 5 * Max. Marks : 60

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

UNIT – I

1. a) Obtain 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) Express the following L.P. problem in the matrix standard form. **6**

Minimize : $Z = x_1 + 2x_2 + 3x_3$

Subject to : $3x_1 + 4x_3 \leq 5$

$5x_1 + x_2 + 6x_3 = 7$

$8x_1 + 9x_3 \geq 2$

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

OR

c) Put the following Linear program in its standard form with non-negative variables: **6**

Minimize : $Z = 25x_1 + 30x_2$

Subject to : $4x_1 + 7x_2 \geq 1$

$8x_1 + 5x_2 \geq 3$

$6x_1 + 9x_2 \geq 2$

With : x_1, x_2 unrestricted in sign.

d) Prove that Intersection of any two convex set is also a convex set. **6**

UNIT – II

2. a) Solve the following LP problem by simply method **6**

Maximize : $Z = 3x_1 + 4x_2$

Subject to : $2x_1 + x_2 \leq 6$

$2x_1 + 3x_2 \leq 9$

With : $x_1, x_2 \geq 0$

b) Use two phase method to solve the LPP. **6**

Minimize : $Z = x_1 + 2x_2$

Subject to : $x_1 + 3x_2 \geq 11$

$2x_1 + x_2 \geq 9$

With : $x_1, x_2 \geq 0$

OR

c) Solve the linear program by Big-M method. **6**

Maximize : $Z = 4x_1 + 5x_2 - 3x_3$

Subject to : $x_1 + x_2 + x_3 = 10$

$x_1 - x_2 \geq 1$

$2x_1 + 3x_2 + x_3 \leq 30$

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

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

Maximize : $Z = 5x_1 + 2x_2$

Subject to : $6x_1 + x_2 \geq 6$

$4x_1 + 3x_2 \geq 12$

$x_1 + 2x_2 \geq 4$

With : $x_1, x_2 \geq 0$

Also solve the dual directly and hence verify that if a dual problem has no feasible solution, then its primal have a feasible solution but not optimal.

UNIT – III

3. a) Determine an initial basic feasible solution to the following transportation problem using Vogel's method. **6**

	A	B	C	D	Supply	Diff.
I	21	16	25	13	11	3
II	17	18	14	23	13	3
III	32	27	18	41	19	9
Demand	6	10	12	15		
Diff.	4	2	4	10		

b) Determine an initial basic feasible solution to the following transportation problem using north – west corner rule. **6**

	D_1	D_2	D_3	D_4	Supply
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
Demand	6	10	15	4	35

OR

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

Warehouse → / Factory ↓	W_1	W_2	W_3	W_4	Factory Capacity
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Warehouse requirement	5	8	7	14	34

d) Determine an initial basic feasible solution to the following transportation problem. Using Vogel's approximation method. **6**

Origin \ Destination	A_1	B_1	C_1	D_1	E_1	Supply
A	2	11	10	3	7	4
B	1	4	7	2	1	8
C	3	9	4	8	12	9
Demand	3	3	4	5	6	21

UNIT – IV

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

b) Find all local and global optima for $f(x) = x + \frac{1}{x}$ on $(0, \infty)$. **6**

OR

c) Define concave function **6**

Show that $f(x) = x^3 - 6x^2 + 9x + 6$ is strictly concave on $(-\infty, 2)$ and strictly convex on $(2, \infty)$

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

Subassembly \ Contractors	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. Attempt **any six.**

a) Write general form of LPP. **2**

b) Define surplus variable. **2**

c) Obtain the symmetric dual of LPP. **2**

Maximize : $Z = 12x_1 + 26x_2 + 80x_3$

Subject to : $2x_1 + 6x_2 + 5x_3 \geq 4$

$4x_1 + 2x_2 + x_3 \geq 10$

$x_1 + x_2 + 2x_3 \geq 6$

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

d) What is the condition for optimality in simplex table? **2**

e) Define feasible solution to Transportation problem. **2**

f) State the mathematical formulation of transportation problem. **2**

g) Define global maximum. **2**

h) What is an assignment problem? **2**

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