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

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

P. Pages : 3 **GUG/S/25/13364**

Time : Three Hours * 1 7 2 9 * Max. Marks : 60

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

UNIT – I

1. a) Rewrite the following LPP in standard form. **6**

Minimize $z = 2x_1 + x_2 + 4x_3$

Subject to constraints $-2x_1 + 4x_2 \le 4$

$x_1 + 2x_2 + x_3 \ge 5$

$2x_1 + 3x_3 \le 2$

with $x_1, x_2 \ge 0$ and x_3 is unrestricted in sign.

b) Prove that the set of feasible solutions to a LPP is a convex set. **6**

OR

c) Use graphical method to solve the following LPP. **6**

Maximize : $z = 2x_1 + 3x_2$

Subject to constraints : $x_1 + x_2 \le 3,\ x_1 - x_2 \ge 0,\ x_2 \ge 3$

$0 \le x_1 \le 20$ and $0 \le x_2 \le 12$

with $x_1,\ x_2 \ge 0$

d) Define : **6**

i) Convex Set
ii) Separating hyperplane
iii) Supporting hyperplane

UNIT – II

2. a) Solve the following LPP problem by simplex method. **6**

Maximize : $Z = x_1 + x_2$

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

$2x_1 + x_2 \le 4$

with $x_1,\ x_2 \ge 0$

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

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

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

$x_1 - x_2 \ge 1$

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

With $x_1, x_2, x_3 \ge 0$

OR

c) Solve the following LPP by two-phase method **6**

Minimize : $Z = x_1 + 2x_2$

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

$2x_1 + x_2 \geq 9$

with $x_1, x_2 \geq 0$

d) Prove that the dual of the dual is the primal. **6**

UNIT – III

3. a) Explain North-West corner rule method for determining initial basic feasible solution to a transportation problem. **6**

b) Use 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
A	19	30	50	10	7
B	70	30	40	60	9
C	40	8	70	20	18
Demand	5	8	7	14	

OR

c) Use Vogel's Approximation Method to obtain an initial basic feasible solution of the transportation problem. **6**

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Requirement	200	225	275	250	

d) Obtain an initial basic feasible solution to the following transportation problem using the matrix minima method. **6**

	D_1	D_2	D_3	D_4	Capacity
O_1	1	2	3	4	6
O_2	4	3	2	0	8
O_3	0	2	2	1	10
Demand	4	6	8	6	

UNIT – IV

4. a) Explain the Hungarian method for the solution of the assignment problem. **6**

b) A departmental head has four subordinates and four tasks have to be performed. The subordinates differ in efficiency and the tasks differ in their intrinsic difficulty. His estimate of the time each man would take to perform each task is given in the matrix below How the tasks be allocated to each person so as to minimize the total man-hours? **6**

Tasks \ Men	E	F	G	H
A	18	26	17	11
B	13	28	14	26
C	38	19	18	15
D	19	26	24	10

OR

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

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

5. Solve **any six.**

a) Define surplus variables. **2**

b) Write the matrix standard form of LPP. **2**

c) Define basic feasible solution of an LPP. **2**

d) Write dual of the programme **2**
Maximize : $z = 5x_1 + 3x_2$
Subject to : $3x_1 + 5x_2 \le 15, \quad 5x_1 + 2x_2 \le 10$
with $x_1, x_2 \ge 0$.

e) What do you understand by balanced and unbalanced transportation problem. **2**

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

g) Define convex functions. **2**

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

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