+3(5th Sem) — Math (H)
DSE – I (NC)

2021

Time : 3 hours

Full Marks : 80

The figures in the right-hand margin indicate marks.

*Answer **all** questions.*

1. Answer **all** questions serially : 1×12 = 12

   (a) The variables of LPP make sense and corresponds to real world problem is assured by _____ condition of the variables of LPP.

   (b) In simplex method, the element in the intersection of departing row and introducing column is called _____.

   (c) In the optimal table of simplex method of $Z_j - C_j = 0$ for all j, indicates LPP has _____ solutions.

   (d) In every iteration of simplex method for maximization problem replace a variable of the basis with another variable of non-basis which corresponds to _____ value of $Z_j - C_j$

   (e) For maximization problem of big-M method the coefficient of artificial variable of the objective function is _____

   (f) In a n × m transportation problem a feasible solution is basic feasible solution if the number of feasible solution is _____

   (g) n × m transportation problem is called balanced of _____

   (h) Dual of Dual LPP is called _____ LPP

   (i) The number of constraint equations of the Primal LPP is equal to number of _____ of the Dual LPP

   (j) The optimal values of Primal LPP and Dual LPP are _____

(k) When the sum of gains of one player is equal to sum of losses to another player in a game ? Then the game is known as _____.

(l) The value of the game with the pay off matrix $\begin{bmatrix} 4 & -4 \\ -4 & 4 \end{bmatrix}$ is _____.

Part – II

2. Answer any **eight** questions : 2×8 = 16

(a) Max Z = 2x + 4y

subject to

$x + 3y \leq 7$, $2x + y \leq 6$, x is unassigned, $y \geq 0$ change this LPP to a standard LPP.

(b) Max Z = 3x + 4y

subject to

$x + y \leq 7$; $x + 4y \leq 12$, $x \geq 0$, $y < 0$

Change the LPP to a standard maximization LPP.

(c) Max Z = 3x + 4y

s. t

$2x_1 + y \geq 5$; $3x + 2y \geq 10$, $x_1, x_2 \geq 0$

write the its dual LPP.

(d) Min Z = 3x – 5y

s.t.

$2x + 3y \geq 7$; $x_1 + 6x_2 \geq 12$, x is unassigned, $y \geq 0$ write its dual LPP.

(e) Max Z = 6x + 7y

s.t.

$2x + 3y \leq 5$; $4x + 7y \leq 30$, $x \geq 0$, $y \geq 0$

write the initial simplex table of the LPP and find introducing column.

(f)

	O_1	O_2	O_3	O_4	Supply
D_1	8	9	11	12	30
D_2	9	10	12	15	40
D_3	8	7	6	5	50
Demand	40	40	50	20	

Transfer it to a balanced transportation problem.

(g) The profit matrix of the assignment problem is :

	A	B	C	D
J_1	10	15	20	24
J_2	8	10	22	20
J_3	7	12	25	18
J_4	9	11	13	17

Find the loss matrix of the assignment.

(h) Solve the game and find the value of the game :

		Player B	
		B_1	B_2
Player A	A_1	3	−3
	A_2	−3	3

(i) Solve the game and find the value of the game :

		Player B	
		B_1	B_2
Player A	A_1	1	1
	A_2	4	−3

(j) Max Z = 4x + 5y

s.t.

2x + 3y = 7 ; x + 4y = 10 ; x ≥ 0, y ≥ 0

Write the initial simplex table.

Part – III

3. Answer any **eight** questions of the following : 3×8 = 24

(a) Solve the LPP by Simplex Method :

Max Z = 5x – 7y

s.t. 3x + 4y ≤ 12 ; x + 6y ≤ 18, x, y ≥ 0.

(b) Solve the transportation problem and find total cost of transportation using North-West Corner rule :

	0_1	0_2	0_3	Supply
D_1	10	12	13	15
D_2	9	8	7	15
D_3	11	9	10	10
Demand	20	18	2	

(c) Solve the transportation problem and find total cost of transportation using Vogel's method :

	O_1	O_2	O_3	Supply
D_1	8	7	9	20
D_2	10	9	11	15
D_3	11	10	12	15
Demand	25	15	10	

(d) Solve the assignment problem and find total cost of assignment :

$$\begin{array}{c} \\ J_1 \\ J_2 \\ J_3 \end{array} \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{bmatrix} 7 & 5 & 8 \\ 8 & 5 & 4 \\ 10 & 11 & 6 \end{bmatrix} \end{array}$$

(e) Solve the assignment problem and find total cost of assignment :

$$\begin{array}{c} \\ J_1 \\ J_2 \\ J_3 \end{array} \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{bmatrix} 10 & 12 & 6 \\ 15 & 8 & 10 \\ 7 & 14 & 12 \end{bmatrix} \end{array}$$

(f) Prove that, dual of the dual LPP is the Primal LPP.

(g) Write the Dual LPP of the LPP :

Min $Z = 2x + 4y$

s.t. $2x + y \geq 5$; $3x + 2y = 12$, $x, y \geq 0$.

(h) Solve the game with the pay off matrix :

$$\begin{array}{c} \\ \text{Player A} \end{array} \begin{array}{c} \begin{array}{cc} \text{Player B} & \\ & \end{array} \\ \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix} \end{array}$$

and find the value of the game.

(i) Solve the game with pay off matrix :

$$\begin{array}{c} \\ \text{Player A} \\ \\ \end{array} \begin{array}{c} \begin{array}{ccc} \text{Player B} & & \\ \text{I} & \text{II} & \text{III} \end{array} \\ \begin{array}{c} \text{I} \\ \text{II} \\ \text{III} \end{array} \begin{bmatrix} 1 & 7 & 2 \\ 6 & 2 & 7 \\ 5 & 2 & 6 \end{bmatrix} \end{array}$$

and find value of the game.

(j) Solve the game with the pay off matrix :

$$\begin{array}{c} \\ \text{Player A} \\ \\ \end{array} \begin{array}{c} \begin{array}{cc} \text{Player B} & \\ \text{I} & \text{II} \end{array} \\ \begin{array}{c} \text{I} \\ \text{II} \end{array} \begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix} \end{array}$$

and find value of the game.

4. Answer **all** questions : $4 \times 7 = 28$

(a) Solve the LPP using Simplex Method :

$$\text{Max } Z = 2x + 3y$$

s. t. $3x + 2y \leq 12$; $4x + 2y \leq 14$; $5x - 3y \leq 8$

$x, y \geq 0$.

OR

Solve the LPP using Big-M, method

$\text{Max } Z = 4x_1 + 2x_2$

s.t. $2x_1 + x_2 \geq 3$; $3x_1 + 2x_2 \geq 8$, $x_1, x_2 \geq 0$.

(b) Find the dual LPP of the LPP

$\text{Max } Z = 3x + 2y + 3z$

s.t.

$x + 3y + 4z = 18$

$2x + y + 5z \geq 8$

$5x + 4z \leq 6$

x, y unassigned, $Z \geq 0$.

OR

State and prove Fundamental theorem of duality.

(c) Using the following profit matrix, determine the optimum profit for the assignment problem :

Machine	Job 1	2	3	4
A	10	5	7	8
B	12	10	15	12
C	13	15	18	20
D	14	17	16	20

OR

Using lowest cost entry rule find the total transportation cost of :

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

(d) Solve the game using graphical method :

$$\begin{bmatrix} 1 & 3 & -1 & 4 & 2 & -5 \\ -3 & 5 & 6 & 1 & 2 & 0 \end{bmatrix}$$

OR

Solve the game whose pay off matrix is :

		Player B		
		I	II	III
Player A	I	3	−2	4
	II	−1	4	2
	III	2	2	6

and find value of the game.