Total No. of Printed Pages—7 6 SEM TDC DSE MTH (CBCS) 2 (H)

2024

(May)

MATHEMATICS

(Discipline Specific Elective)

(For Honours)

Paper : DSE-2

(Linear Programming)

Full Marks : 80 Pass Marks : 32

Time : 3 hours

he figures in the margin indicate full marks for the questions

a) Define slack and surplus variables in a linear programming problem.

(b) Solve by simplex method

 $\begin{array}{l} \text{Min } Z = x_1 - 3x_2 + 2x_3 \\ \text{subject to} \end{array}$

 $3x_1 - x_2 + 3x_3 \le 7$ -2x_1 + 4x_2 \le 12 -4x_1 + 3x_2 + 8x_3 \le 10 and x_1, x_2, x_3 \ge 0

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(2)

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Or

Explain the various steps of the simplex method involved in the computation of an optimum solution to a linear programming problem.

(c) Answer any two :

8×2=16

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- (i) Solve the following linear programming problem by twophase simplex method : Min $Z = x_1 + x_2$ subject to
 - $2x_{1} + x_{2} \ge 4$ $x_{1} + 7x_{2} \ge 7$ and $x_{1}, x_{2} \ge 0$

(ii) Use Big-M method to solve the following Linear Programming Problem : Max $Z = x_1 + 2x_2 + 3x_3 - x_4$

subject to

 $\begin{array}{c} x_1 + 2x_2 + 3x_3 = 15\\ 2x_1 + x_2 + 5x_3 = 20\\ x_1 + 2x_2 + x_3 + x_4 = 10\\ \text{and} \qquad x_1, x_2, x_3, x_4 \ge 0 \end{array}$

(iii) Solve the Linear Programming Problem : Min $Z = 5x_1 + 3x_2$ subject to $2x_1 + 4x_2 \le 12$ $2x_1 + 2x_2 = 10$ $5x_1 + 2x_2 \ge 10$ where $x_1, x_2 \ge 0$ by Big-M method.

- 2. (a) If the objective of the primal is to maximize, then write the objective of the dual.
 - (b) Write the dual of the following linear programming problem :

 $\begin{array}{ll} \text{Max} \quad Z = x_1 - x_2 + 3x_3 \\ \text{subject to} \end{array}$

 $x_1 + x_2 + x_3 \le 10$ $2x_1 - x_2 - x_3 \le 2$ $2x_1 - 2x_2 - 3x_3 \le 6$ and $x_1, x_2, x_3 \ge 0$

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- (c) Answer any two from the following : 5×2=10
 - (i) Write the mathematical formulation of the dual linear programming problem in symmetrical form.

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- (ii) Prove that the dual of a dual is primal.
- (iii) Give an economic interpretation of dual variables.
- **3.** (a) Write the necessary and sufficient condition for a feasible solution to a transportation problem.
 - (b) Write the conditions for a nondegenerate basic feasible solution. 2
 - (c) Answer any two :

8×2=16

2

- (i) Describe the computational procedure of the MODI method in a transportation problem.
- (ii) Find the initial basic feasible solution using Vogel's Approximation method and find the optimal solution :

	D	D2	D 3	D ₄	Supply
S ₁	19	30	50.	10	.7
. S ₂	70	30	40	60	9
S_3	40	8 ·	70	20	18
Demand	5	8	7	14	

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(iii) A department of a company has five employees with five jobs to be performed. The time (in hours) that each man takes to perform each job is given in the effectiveness matrix :

Employees

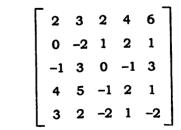
	I	П	Ш	IV	V		
A	10	5	13 18 2 9	15	16		
B C	3	9	18	13	6		
С	10	7	2	2	2		
D	7	11	9	7	12		
E	7	9	10	4	12		

How should the jobs be allocated, one per employee, so as to minimize the total man hours?

4. (a) What is a strictly determine game in game theory?

Jobs

- (b) Answer any two : $5 \times 2 = 10$
 - (i) Solve the following game stating the optimal strategies and the saddle point :



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(ii) Find the value of the 2×2 game algebraically by using mixed strategies :

5

5

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$$\begin{array}{c}
 B_1 & B_2 \\
 B_1 & B_2 \\
 A_1 & 2 & 3 \\
 A_2 & 4 & -1 \\
 \end{array}$$

(iii) Solve the following 2×4 game geometrically :

Player B

(c) Solve the game problem by using LP

Player B

$$B_{1} \quad B_{2} \quad B_{3}$$

Player A
 $A_{1} \begin{bmatrix} 1 & 0 & -2 \\ 0 & 3 & 2 \end{bmatrix}$

Or

(7)

State the modified dominance property. Reduce the following game to 2×2 game by using dominance and modified dominance property and then solve the game :

Player B *B*₃ B_1 B_2 B_4
 1
 2
 -2
 2

 3
 1
 2
 3

 -1
 3
 2
 1
 A A₂ A₃ Player A 0 -3 2

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