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6 SEM TDC DSE MTH (CBCS) 2 (H)

2022

(June/July)

MATHEMATICS

(Discipline Specific Elective)

(For Honours)

Paper : DSE–2

(Linear Programming)

Full Marks : 80
Pass Marks : 32

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. *(a)* Define basic feasible solution of a linear programming problem. 1

(b) Write the conditions of optimality of basic feasible solution. 2

(c) Define slack and surplus variables of a linear programming problem. 1

(d) Write the computational procedure of simplex method to solve an LPP. 4

(e) Show that the feasible solution $x_1 = 1$, $x_2 = 0$, $x_3 = 1$, $z = 6$ to the system

$$x_1 + x_2 + x_3 = 2$$
$$x_1 - x_2 + x_3 = 0$$
$$2x_1 + 3x_2 + 4x_3 = Z \text{ (min)}$$

is not basic. 3

(f) Solve the following LPP by simplex method : 5

Max $Z = 3x_1 + 2x_2$

subject to

$$2x_1 + x_2 \leq 5$$
$$x_1 + x_2 \leq 3$$

and $x_1, x_2 \geq 0$

(g) Solve the following LPP by two-phase method : 7

Min $Z = 5x_1 + 8x_2$

subject to

$$3x_1 + 2x_2 \geq 3$$
$$x_1 + 4x_2 \geq 4$$
$$x_1 + x_2 \leq 5$$

and $x_1, x_2 \geq 0$

(Continued)

Or

Solve the following LP problem by Big-M method :

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

subject to

$$2x_1 + x_2 \leq 18$$
$$3x_1 + 2x_2 \geq 30$$
$$x_1 + 2x_2 = 26$$

and $x_1, x_2 \geq 0$

(h) Write the advantages of two-phase method over Big-M method. 2

2. *(a)* What do you mean by the standard form of a primal problem? 1

(b) Write the three types of primal-dual problem. 3

(c) Write down the economic interpretation of dual problem. 3

(d) Write the dual of the following primal LP problem : 4

$$\text{Minimize } Z = x_1 + 2x_2$$

subject to the constraints

$$2x_1 + 4x_2 \leq 160$$
$$x_1 - x_2 = 30$$
$$x_1 \geq 10$$

and $x_1, x_2 \geq 0$

(Turn Over)

(e) Prove that dual of the dual is the primal itself. 4

3. (a) What do you mean by balanced transportation problem? 1

(b) Write a short note on any *one* of the following : 4

(i) North-West corner method

(ii) Least-cost method

(c) Obtain an initial BFS to the transportation problem given below using Vogel approximation method : 6

		Destination			
		D_1	D_2	D_3	*Supply*
Source	S_1	21	16	15	11
	S_2	17	18	14	13
	S_3	32	27	18	19
	Demand	6	6	8	

(d) What is an assignment problem? Write the mathematical formulation of an assignment problem. 1+2=3

(e) 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 :

Jobs \ Employees	I	II	III	IV	V
A	10	5	13	15	16
B	3	9	18	13	6
C	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? 6

Or

Solve the assignment problem :

Operators \	I	II	III	IV
A	10	12	9	11
B	5	10	7	8
C	12	14	13	11
D	8	15	11	9

4. *(a)* Write a short note on characteristics of game theory. 2

(b) What do you mean by zero-sum game? 1

(c) Write the assumptions made in the theory of games. 2

(d) Write a short note on any *one* of the following : 2

(i) Pay-off matrix

(ii) Maximin principle

(iii) Optimal strategy

(e) For the game with the following pay-off matrix

		Player B		
		B_1	B_2	B_3
Player A	A_1	–1	2	–2
	A_2	6	4	–6

determine the value of the game. Is the game fair? 5

(f) Use graphical method for solving the following game and find the value of the game : 8

		Player B			
		B_1	B_2	B_3	B_4
Player A	A_1	2	2	3	–2
	A_2	4	3	2	6

Or

For the following pay-off matrix, transform the zero-sum game into an equivalent LPP and solve it by using the simplex method :

		Player B		
		B_1	B_2	B_3
Player A	A_1	1	–1	3
	A_2	3	5	–3
	A_3	6	2	–2

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