Roll No. .....

(05/25)

15235

M.Sc. Mathematics (2Year)

EXAMINATION

(For Batch 2021 & Onwards)

(Fourth Semester)

OPERATION RESEARCH

MSC/MATHS/4/DSC14

Time : Three Hours *Maximum Marks :* 70

Note : It is compulsory to answer all the questions (2 marks each) of Part A in short. Answer any *four* questions from Part B in detail selecting *one* question from each Unit. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) What do you mean by an LPP ? What are its limitations ? 2

(b) How do you identify the presence of alternative optima in Simplex Method. 2

(c) Define duality with suitable example. 2

(d) Define the mathematical formulation of an assignment problem. 2

(e) What is a zero-sum two-person game ? 2

Part B

Unit I

2. (a) Solve the following LPP using Graphical Method : 8

Max. $z = 120x + 100y$

$10x + 5y \leq 80$

$$6x + 6y \leq 66$$

$$4x + 8y \geq 24$$

$$5x + 6y \leq 90$$

$$x, y \geq 0$$

(b) Solve the following LPP by Simplex method : 7

$$\text{Max. } z = 2x_1 + 5x_2$$

Subject to the constrains :

$$x_1 + 3x_2 \leq 3,$$

$$3x_1 + 2x_2 \leq 6$$

$$x_1, x_2 \geq 0$$

3. (a) Solve the following LPP by Big-M method : 8

$$\text{Min. } z = 4x_1 + 8x_2 + 3x_3$$

Subject to the constrains :

$$x_1 + x_2 \geq 2$$

$$2x_1 + x_3 \geq 5$$

and $$x_1, x_2, x_3, \geq 0$$

(b) Solve the following LPP by Two-Phase method : 7

Min. $z = x_1 + x_2$

Subject to the constrains :

$$2x_1 + x_2 \geq 4$$

$$x_1 + 7x_2 \geq 7$$

$$x_1, x_2 \geq 0$$

Unit II

4. Using the Dual Simplex method solve the following LPP : 15

Min. $z = x_1 + 2x_2 + 3x_3$

Subject to the constraints :

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

$$x_1 + x_2 + 2x_3 \geq 8$$

$$x_2 - x_3 \geq 2$$

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

5. State and prove Fundamental Duality Theorem. 15

Unit III

6. Find the optimal solution of the following transportation problem and initial basic feasible solution by Vogel's approximation method : 8

From	To D_1	D_2	D_3	D_4	Available
I	23	27	16	18	30
II	12	17	20	51	40
III	22	28	12	32	53
Demand	22	35	25	41	123

7. (a) Solve the following cost minimizing assignment problem : 8

Job→ Operator ↓	A	B	C	D
I	10	12	9	11
II	5	10	7	8
III	12	14	13	11
IV	8	15	11	9

(b) Explain the principle of dominance in game theory and solve the following game : 7

Player A/Player B→ ↓	B_1	B_2	B_3	B_4	B_5
A_1	10	4	2	9	1
A_2	7	6	5	7	8
A_3	3	5	4	4	9
A_4	6	7	3	3	2

Unit IV

8. (a) There are 5 jobs each of which must go through the 2 machines A and B in the order AB. Processing times are given in table below : 8

Processing Time (hours)

Job	1	2	3	4	5
Time for A	5	1	9	3	10
Time for B	2	6	7	8	4

Determine a sequence for 5 jobs that will minimize the elapsed time.

(b) Solve the following non-linear programming problem graphically : 7

Min. $z = x_1^2 + x_2^2$ subject to the constraints :

$$x_1 + x_2 \geq 4,$$

$$2x_1 + x_2 \geq 5$$

$$x_1, x_2 \geq 0.$$

9. Determine x_1, x_2, x_3 so as to maximize 15

$$z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$$

Subject to the constraints :

$$x_1 + x_2 \leq 2$$

$$2x_1 + 3x_2 \leq 12$$

and $$x_1, x_2 \geq 0.$$

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