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(5th Semester)

MATHEMATICS

Paper : MATH–354(A)

(Operations Research)

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The questions are of equal value

Answer **five** questions, selecting **one** from each Unit

UNIT—I

1. The manager of an oil refinery must decide on the optimal mix of two possible blending processes of which the inputs and outputs per production run are as follows :

Process	*Input*		*Output*	
	Crude A	*Crude B*	*Gasoline X*	*Gasoline Y*
1	5	3	5	8
2	4	5	4	4

The maximum amounts available in crude *A* and crude *B* are 200 units and 150 units respectively. Market requirements show that at least 100 units of gasoline *X* and 80 units of gasoline *Y* must be produced. The profits per production run from process 1 and process 2 are ₹ 300 and ₹ 400 respectively. Formulate an LPP and solve it for maximization of profit.

2. The standard weight of a special purpose brick is 5 kg and it contains two ingredients *A* and *B*. *A* costs ₹ 5 per kg and *B* costs ₹ 8 per kg. Strength considerations dictate that the brick contains not more than 4 kg of *A* and a minimum of 2 kg of *B*. Since the demand for the product is likely to be related to the price of the brick, find the minimum cost of the brick satisfying the above conditions. Use the graphical method.

UNIT—II

3. Solve the following LPP using simplex method :

Maximize $Z \quad 5x_1 \quad 7x_2$

subject to the constraints

$$x_1 \quad x_2 \quad 4$$
$$3x_1 \quad 8x_2 \quad 24$$
$$10x_1 \quad 7x_2 \quad 35$$
$$x_1,\ x_2 \quad 0$$

4. Solve the following LPP by Big-M method :

$$\text{Maximize } Z \quad x_1 \quad x_2 \quad x_3$$

subject to the constraints

$$x_1 \quad 4x_2 \quad 2x_3 \quad 5$$
$$3x_1 \quad x_2 \quad 2x_3 \quad 4$$
$$\text{and } x_1, x_2, x_3 \quad 0$$

UNIT—III

5. Use duality to solve the following LPP :

$$\text{Maximize } Z \quad 3x_1 \quad x_2$$

subject to the constraints

$$2x_1 \quad 3x_2 \quad 2$$
$$x_1 \quad x_2 \quad 1$$
$$x_1, x_2 \quad 0$$

6. Given x_{13} 50 units, x_{14} 20 units, x_{21} 55 units, x_{31} 30 units, x_{32} 35 units and x_{34} 25 units. With the cost of transportation as

	D_1	D_2	D_3	D_4	Supply
S_1	6	1	9	3	70
S_2	11	5	2	8	55
S_3	10	12	4	7	90
Demand	85	35	50	45	

is it an optimum solution to the transportation problem? If not, find the optimum solution.

UNIT—IV

7. Use Gomory's cutting plane method to solve the following LPP :

$$\text{Maximize } Z \quad 3x_1 \quad 4x_2$$

subject to the constraints

$$3x_1 \quad 2x_2 \quad 8$$
$$x_1 \quad 4x_2 \quad 10$$
$$x_1, x_2 \quad 0 \text{ and integers}$$

8. Use the branch and bound technique to solve the following LPP :

$$\text{Maximize } Z \quad x_1 \quad x_2$$

subject to the constraints

$$2x_1 \quad 5x_2 \quad 16$$
$$6x_1 \quad 5x_2 \quad 30$$
$$x_1, x_2 \quad 0 \text{ and } x_2 \text{ integer}$$

UNIT—V

9. Using dominance rule and graphical method, solve the two-person zero-sum game, whose payoff matrix is given below :

Player B

Player A

1	2	3	1
2	2	1	5
3	1	0	2
4	3	2	6

10. Reduce the following two-person zero-sum game to an LPP and then solve it using simplex method :

Player B

Player A	3	2	4	0
	3	4	2	4
	4	2	4	0
	0	4	0	8

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MATH/V/08a

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(5th Semester)

MATHEMATICS

Paper : MATH–354(A)

(Operations Research)

(PART : A—OBJECTIVE)

(*Marks* : 25)

SECTION—A

(*Marks* : 10)

Each question carries 1 mark

Put a Tick ☑ mark against the correct answer in the box provided :

1. A constraint in an LPP is expressed as

(a) an equation with = sign ☐

(b) an inequality with sign ☐

(c) an inequality with sign ☐

(d) None of the above ☐

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2. A feasible solution to an LPP should satisfy

(a) all the constraints and x_i 0 ☐

(b) all the constraints and x_i 0 ☐

(c) all the constraints only ☐

(d) None of the above ☐

3. In an LPP with m constraints and n unknowns (m n), the number of basic variables will be

(a) n ☐

(b) m ☐

(c) m n ☐

(d) None of the above ☐

4. If there is a negative value in solution values (x_B) of the simplex method, then

(a) the basic solution is optimum ☐

(b) the basic solution is infeasible ☐

(c) the basic solution is unbounded ☐

(d) None of the above ☐

5. The right-hand side constant of a constraint in a primal problem appears in the corresponding dual as

(a) a coefficient in the objective function ☐

(b) a right-hand side constant of a constraint ☐

(c) a value of the objective function ☐

(d) None of the above ☐

6. If there are n workers and n jobs in an assignment problem, there would be

(a) n solutions ☐

(b) n^2 solutions ☐

(c) $n!$ solutions ☐

(d) None of the above ☐

7. In cutting plane algorithm, each cut involves the introduction of

(a) an equality constraint ☐

(b) a less than or equal to constraint ☐

(c) an artificial variable ☐

(d) a greater than or equal to constraint ☐

8. Branch and bound method divides the feasible solution space into smaller parts by

(a) enumerating ☐

(b) bounding ☐

(c) branching ☐

(d) None of the above ☐

9. A game is said to be strictly determinable, if

(a) minimax value is greater than maximin value ☐

(b) minimax value is equal to maximin value ☐

(c) minimax value is less then maximin value ☐

(d) None of the above ☐

10. The size of a payoff matrix of a game can be reduced by using the principle of

(a) dominance ☐

(b) rotation reduction ☐

(c) game inversion ☐

(d) None of the above ☐

SECTION—B

(*Marks* : 15)

Each question carries 3 marks

1. Solve the following LPP by graphical method :

Maximize $Z \quad 2x_1 \quad x_2$

subject to

$$3x_1 \quad 5x_2 \quad 15$$
$$3x_1 \quad 4x_2 \quad 12$$
$$x_1, \, x_2 \quad 0$$

2. Using simplex method, solve the following simultaneous equations :

$$5x \quad y \quad 11$$
$$2x \quad 3y \quad 1$$

3. Find the optimal assignment to find the minimum cost for the following problem :

	J_1	J_2
W_1	3	9
W_2	2	11

4. Use cutting plane method to solve the following integer linear programming problem :

$$\text{Maximize } Z \quad 2x_1 \quad x_2$$

subject to

$$x_1 \quad 8x_2 \quad 24$$

$$x_1 \quad 4$$

$$x_1, x_2 \quad 0 \text{ and integers}$$

5. For what value of , the game with the following payoff matrix is strictly determinable?

		B	
		6	2
A	– 1		0
	2	4	

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