G-4/431/21

Roll No. .....

M.Sc. IV Semester Examination, 2021

MATHEMATICS

Paper IV

(Operation Research-II)

Time : 3 Hours] [Max. Marks : 80

Note : *All questions are compulsory. Question Paper comprises of 3 sections. Section A is objective type/multiple choice questions with no internal choice. Section B is short answer type with internal choice. Section C is long answer type with internal choice.*

SECTION A **1×10=10**

(Objective Type Questions)

Choose the correct answer :

1. Dynamic programming determines the solution of n variable problem by decomposing it into :

(a) $n + 1$ stages (b) $n - 1$ stages

(c) n stages (d) None of the above.

2. Dynamic Programming can be solved using :

(a) Bellman's principle of optimality

(b) Transportation Problem Algorithm

(c) Hungarian algorithm

(d) None of the above.

P.T.O.

3. A game is said to be fair if both the lower and upper value of the game are :

(a) equal to zero (b) less than zero

(c) greater than zero (d) None of these.

4. In a mixed strategy game, each player uses :

(a) a fixed strategy (b) A random strategy

(c) Both (a) and (b) (d) None of the above.

5. A linear programming problem in which all the decision variables are restricted to take the values 0 or 1 is called :

(a) Mixed integer programming problem

(b) Zero-one integer programming problem

(c) All integer programming problem

(d) None of the above.

6. In integer programming problem, the situation of multiple solution arises in :

(a) branch and bound technique

(b) Zero-one Additive Method

(c) Cutting Plane Method

(d) None of the above.

7. The first crude oil refinery of India is located at :

(a) Naharkatiya (b) Digboi

(c) Kochi (d) Madras.

8. The rent for the stores where materials are kept falls under :

(a) Ordering cost (b) Setup cost

(c) Holding cost (d) None of the above.

9. Every Non-Linear Programming Problem can be solved using :

(a) An separable programming problem

(b) A quadratic programming problem

(c) Both (a) and (b)

(d) None of the above.

10. Quadratic Programming techniques provides the solution to an NLPP :

(a) exact (b) approximate

(c) Both (a) and (b) (d) None of these.

SECTION B **4×5=20**

(Short Answer Type Questions)

Note : Attempt all questions from each unit with internal choice.

Unit-I

1. Solve the following problem using dynamic programming

$$\text{Min } z_1 = x_1^2 + x_2^2 + x_3^2 + x_4^2$$

subject to $x_1 x_2 x_3 x_4 = 16$

and $x_1, x_2, x_3, x_4 \geq 0.$

Or

Use the principle of optimality to find the minimum value of

$$z = b_1 x_1 + b_2 x_2 + b_3 x_3 + \ldots + b_n x_n$$

when $x_1 + x_2 + x_3 + \ldots + x_n = c$

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

$b_1 > 0, b_2 > 0, b_n > 0.$

Unit-II

2. Define the following :

(i) Mixed strategy,

(ii) Competitive game.

Or

Solve the following game using the dominance principle :

Player B

Player A	1	2	3	4	5
1	3	5	4	9	6
2	5	6	3	7	8
3	8	7	9	8	7
4	4	2	8	5	3

Unit-III

3. Find the all integer solution to the following Integer Programming Problem :

$$\text{Max } z = 3x_1 + 2x_2$$

Subject to

$$x_1 + x_2 \leq 4$$

$$x_1 - x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

and integers.

Or

Define the following :

(i) Mixed Integer Programming Problem,

(ii) All Integer Programming Problem.

Unit-IV

4. What is Input-Output Analysis ?

Or

Explain economic interpretation of duality.

Unit-V

5. Obtain the set of necessary conditions for the Non-linear programming problem :

$$\text{Max } z_1 = x_1^2 + 3x_2^2 + 5x_3^2$$

subject to the constraints

$$x_1 + x_2 + 3x_3 = 2$$

$$5x_1 + 2x_2 + x_3 = 5$$

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

Or

For the Quadratic Programming Problem

$$\text{Max } z = f(x) = \sum_{j=1}^{n} c_j x_j + \frac{1}{2} \sum_{j=1}^{n} \sum_{k=1}^{n} c_{jk} x_j x_k$$

subject to the constraints

$$\sum_{j=1}^{n} a_{ij} x_j \leq b_i \text{ and } x_j \geq 0$$

$$(i = 1, \ldots\ldots m, j = 1, 2, \ldots. n)$$

where $c_{jk} = c_{kj} \; \forall \; j$ and k (for ϕ is symmetric) and where $b_i \geq 0 \; \forall \; i = 1, \ldots\ldots m$.

Construct KUHN-TUCKER conditions.

SECTION C **10×5=50**

(Long Answer Type Questions)

Note : Attempt all questions.

Unit-I

1. Use dynamic programming to solve L.P.P.

$$\text{Max } z = 10x_1 + 8x_2$$

subject to

$$2x_1 + x_2 \leq 25$$

$$3x_1 + 2x_2 \leq 45$$

$$x_2 \leq 10$$

and $x_1, x_2 \geq 0.$

Or

Solve the following problem by using dynamic programming

$$\text{Min } z = x_1^2 + x_2^2 + x_3^2$$

subject to $x_1 + x_2 + x_3 \geq 10$

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

Unit-II

2. Solve the following (2 × 3) game graphically

		B		
		I	II	III
A	I	1	3	11
	II	8	5	2

Or

Solve the following game using the dominance principle

		Player B			
		1	2	3	4
Player A	1	8	10	9	14
	2	10	11	8	12
	3	13	12	14	13

Unit-III

3. Find the optimum all integer solution to the following IPP

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

subject to

$$2x_2 \leq 7$$

$$x_1 + x_2 \leq 7$$

$$2x_2 \leq 11$$

$x_1, x_2 \geq 0$ and integers.

Or

Solve the following MIPP

$$\text{Max } z = 4x_1 + 6x_2 + 2x_3$$

subject to

$$4x_1 - 4x_2 \leq 5$$

$$-x_1 + 6x_2 \leq 5$$

$$-x_1 + x_2 + x_3 \leq 5$$

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

and x_2 is an integer.

Unit-IV

4. Write short notes on Indecomposable and Decomposable economics.

Or

Explain how to determine an optional product mix ?

Unit-V

5. Use Wolfe's Modified Simplex method to solve the following QPP :

$$\text{Max } z = 2x_1 + 3x_2 - 2x_1^2$$

subject to

$$x_1 + 4x_2 \leq 4$$

$$x_1 + x_2 \leq 2$$

and $x_1, x_2 \geq 0$.

Or

Use Beal's method of solve the following NLPP :

$$\text{Min } z = 6 - 6x_1 + 2x_1^2 - 2x_1x_2 + 2x_2^2$$

subject to

$$x_1 + x_2 \leq 2$$

and $x_1, x_2 \geq 0$.

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