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OMDQ/M-20 **2421**

NON-LINEAR AND DYNAMIC PROGRAMMING

Paper–ST-403&ST-404(ii)

Time Allowed : 3 Hours] [Maximum Marks : 75

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. Question No. **1** is compulsory. All questions carry equal marks.

Compulsory Question

1. Describe the following :

   (a) What is an integer programming problem? How does the optimal solution of an integer programming problem compare with that of the linear programming problem? 5

   (b) Give the necessary conditions for optimization of NLPP with equality constraints. 3

   (c) What is fractional programming problem? 2

   (d) What are the essential characteristics of dynamic programming problem? 3

(e) How does quadratic programming problem differ from the linear programming problem? 2

UNIT–I

2. (a) Determine whether the following function is convex or concave : 10

$$f(x_1, x_2, x_3) = 4x_1^2 + 3x_2^2 + 5x_3^2 + 6x_1x_2 + x_1x_3 - 3x_1 - 2x_2 + 15 .$$

(b) Describe the graphical method for the solution of an NLPP. 5

3. Derive the Kuhn-Tucker conditions of the following problem and find the value of x_1 and x_2 for which these conditions are satisfied. Is the solution optimum? 15

Maximize : $f(x_1, x_2) = -x_1^2 + x_2^2 + x_1x_2 + 7x_1 + 4x_2$

Subject to : $\frac{2}{3}x_1 + x_2 \le 8$

$$-\frac{5}{12}x_1 + x_2 \le 2$$

$$x_2 \le 4, x_1, x_2 \ge 0 .$$

UNIT–II

4. (a) Solve the following Q.P.P. by Wolfe's method : 8

Maximize : $f(x_1, x_2) = -x_1^2 - x_2^2 + 2x_1 + 3x_2$

Subject to : $x_1 + x_2 \leq 2$

$2x_1 + x_2 \leq 3$

$x_1 + x_2 \geq 0$.

(b) Describe briefly Beale's method for solving Quadratic programming problem. 7

5. (a) Solve the following Fractional Programming Problem : 10

Maximize : $Z = \dfrac{2x_1 + 3x_2}{x_1 + x_2 + 7}$

Subject to : $3x_1 + 5x_2 \leq 15$

$4x_1 + 3x_2 \leq 12,\ x_1, x_2 \geq 0$.

(b) What is Separable Programming? Discuss the method to solve separable programming problem. 5

UNIT–III

6. (a) Solve the following integer L.P.P : 10

Maximize : $Z = 7x_1 + 9x_2$

Subject to : $-x_1 + 3x_2 \leq 6$

$7x_1 + 3x_2 \leq 35$

$x_1 + x_2 \geq 0$ are integers.

(b) Differentiate between pure and mixed integer programming problem. 5

7. (a) Use branch and bound technique to solve the following integer L.P.P : 10

Maximize : $Z = 2x_1 + 3x_2$

Subject to : $6x_1 + 5x_2 \leq 25$

$x_1 + 3x_2 \leq 10$

$x_1, x_2 \geq 0$ are integers.

(b) Explain one application of integer linear programming problem. 5

UNIT–IV

8. (a) Solve the following Linear programming problem by using Dynamic Programming : 10

Maximize : $Z = 5x_1 + 9x_2$

Subject to : $-x_1 + 5x_2 \leq 3$

$5x_1 + 3x_2 \leq 27$

$x_1, x_2 \geq 0$.

(b) What is dynamic recursive relation? Discuss the general process of backward recursion. 5

9. (a) Discuss briefly : 8

(i) The general similarities between dynamic programming and linear programming.

(ii) How dynamic programming differs conceptually from linear programming?

(b) Explain the application of dynamic programming in optional path problem. 7