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MAMT-10

Mathematical Programming

MA/M.Sc. Mathematics (TVIAMT/MSCMT)

2nd Year Examination, 2023 (June)

Time : 2 Hours] **Max. Marks : 70**

Note : This paper is of Seventy (70) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein. Candidates should limit their answer to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

SECTION–A
(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Nineteen (19) marks each. Learners are required to answer any Two (02) questions only.

(2×19=38)

1. Solve the following L.P.P. using revised simplex method :

$$\begin{aligned} \text{Max} \quad & z = 3x_1 + 6x_2 + 2x_3 \\ \text{s.t.} \quad & 3x_1 + 4x_2 + x_3 \le 2 \\ & x_1 + 3x_2 + 2x_3 \le 1 \\ & x_1, x_2, x_3 \ge 0 \end{aligned}$$

2. Use branch and bound method to solve following L.P.P.:

Maximize $Z = 7x_1 + 9x_2$

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

$7x_1 + x_2 \leq 35$

$x_2 \geq 7$

3. Write the Kuhn-Tucker necessary and sufficient conditions for the following non linear programming problem :

Min. $f(x_1, x_2) = x_1^2 - 2x_1 - x_2$

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

$2x_1 + x_2 \leq 4,$

$x_1, x_2 \geq 0$

4. Define

(i) Bellman's Principle of Optimality.

(ii) Stage.

(iii) State.

(iv) Transition function.

5. Test the nature of following quadratic form $Q(X) = X' A X$ where

(i) $A = \begin{bmatrix} 3 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $X = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$.

(ii) $A = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix}$ and $X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$.

SECTION–B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Eight (08) marks each. Learners are required to answer any Four (04) questions only. (4×8=32)

1. Show that $f(x) = x^2$ is a convex function.

2. Define

(i) Integer Programming Problem (I.P.P.)

(ii) Mixed Integer Programming Problem (I.P.P.)

3. Write the following quadratic form in matrix form

(i) $x_1^2 - x_2^2$

(ii) $x_1 x_2$

4. Obtain the necessary condition for the following nonlinear programming problem.

Minimize $f(X) = 3x_1^2 + x_2^2 + 2x_1x_2 + 6x_1 + 2x_2$

Subject to $2x_1 - x_2 = 4$

$x_1, x_2 \geq 0.$

5. Define Quadratic Programming Problems with example.

6. Derive the dual of the quadratic programming problem:

$$\text{Min } f(x) = C^T X + \frac{1}{2} X^T G X$$

Subject to $AX \geq b$.

Where A is an $m \times n$ real matrix and G is an $n \times n$ real positive semidefinite a symmetric matrix.

7. Prove that every local maximum of the general convex programming problem is its global maximum.

8. Solve by dynamic programming

Max $.z = x_1 + 9x_2$

Subject to $2x_1 + x_2 \leq 25$

$x_2 \leq 11$ and $x_1 \geq 0, x_2 \geq 0$.