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MAMT-10

Mathematical Programming

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

2nd Year Examination, 2022 (June)

Time : 2 Hours] **Max. Marks : 80**

Note : This paper is of Eighty (80) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION–A
(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Twenty (20) marks each. Learners are required to answer any Two (02) questions only.

(2×20=40)

1. Using the bounded Variable technique, solve the following linear programming problem.

Max. $z = 2x_1 + x_2$

s. t. $x_1 + 2x_2 \leq 10$

$x_1 + x_2 \leq 6$

$x_1 - x_2 \leq 2$

$x_1 - 2x_2 \leq 1$

and $0 \leq x_1 \leq 3$, $0 \leq x_2 \leq 2$.

2. Using Lagrangian multiplier method to solve the following non-linear programming problem.

Min. $z = 2x_1^2 + x_2^2 + x_3^2 - 24x_1 - 8x_2 - 12x_3 + 10$

Subject to $x_1 + 2x_2 = 11$

$x_1, x_2, x_3 \geq 0.$

3. Solve the following quadratic programming problem by Wolfe's Method.

Max. $z = 2x_1 + x_2 - x_1^2$

s. t. $2x_1 + 3x_2 \leq 06$

$2x_1 + x_2 \leq 4$

$x_1, x_2 \geq 0.$

4. Solve the following L.P.P. by using dynamic programming.

Max. $z = 3x_1 + 5x_2 - 5x_2$

s. t. $x_1 \leq 4$

$x_2 \leq 6$

$3x_1 + 5x_2 \geq 18$

and $x_1, x_2 \geq 0$

5. Define the following with examples :

(a) Set of points.

(b) Neighborhood of a point.

(c) Interior and boundary points.

(d) Quadratic form.

SECTION–B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Ten (10) marks each. Learners are required to answer any Four (04) questions only. (4×10=40)

1. Prove that a hyper plane is a convex set.

2. Using Branch and bound Method to solve the following I.P.P.:

Max. $z = 4x_1 + 3x_2$

Subject to $5x_1 + 3x_2 \geq 30$

$x_2 \leq 4$

$x_2 \leq 6$

$3x_1 + 5x_2 \leq 18$

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

3. Determine the sign of definiteness for each of the following matrices.

(a) $\begin{bmatrix} 3 & 1 & 2 \\ 1 & 5 & 0 \\ 2 & 0 & 2 \end{bmatrix}$

(b) $\begin{bmatrix} 2 & 1 & 2 \\ 1 & -3 & 3 \\ 2 & 0 & -5 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 1 & 0 \\ 3 & 2 & 1 \\ 1 & 2 & 4 \end{bmatrix}$

(d) $\begin{bmatrix} 1 & -2 & 1 \\ -4 & 2 & -1 \\ 1 & -1 & 0 \end{bmatrix}$

4. If (X_0, λ_0) is a saddle point of the function $F = (X, \lambda)$ $\forall \geq 0$, then prove that X_0 is a minimal point of $f(x)$ subject to constraints $G(X) \leq 0$.

5. Define :

(a) General non-linear programming problem.

(b) Kunh-Tucker Conditions.

(c) Quadratic programming problem.

(d) Dynamic programming.

6. Use Kunh-Tucker Conditions to solve the following non-linear programming problem:

Max. $z = 8x_1 + 10x_2 - x_1^2 - x_2^2$

Subject to $3x_1 + 2x_2 \leq 0$

$x_1, x_2 \geq 0$

7. Prove that the set of all optimum solutions (Global Maximum) of the general Convex programming problem is a convex set.

8. Find maximum value of the product of $x_1, x_2, \dots \dots \dots x_n$ when $x_1 + x_2 + \dots \dots \dots + x_n = b, x_1, x_2, \dots \dots \dots x_n \geq 0$ using dynamic programming.