S-1058

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MAMT-10

Mathematical Programming

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

2nd Year Examination, 2022 (Dec.)

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.

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 LPP by the revised simplex method:

Maximize $z = 2x_1 + x_2$

s.t. $3x_1 + 4x_2 \leq 6$

$6x_1 + x_2 \leq 3$

$x_1, x_2 \geq 0.$

2. Find the optimum integer solution to I.P.P

Maximize $z = x_1 + x_2$

s.t. $2x_1 + 5x_2 \leq 16$

$6x_1 + 5x_2 \leq 30$

$x_1, x_2 \geq 0$

and x_1, x_2 are integers.

3. (a) Write the following quadratic form in matrix form

(i) $Q(x) = 3x_1^2 + 5x_2^2 - 8x_1x_2$

(ii) $Q(x) = x_1^2 + 2x_2^2 - 7x_3^2 - 4x_1x_2 + 6x_1x_3 - 5x_2x_3$

(b) Determine the sign of definiteness for each of the following matrices.

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

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

(iii) $\begin{bmatrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 3 \end{bmatrix}$

4. Solve the following quadratic programming problem using Wolfe's Method

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

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

$2x_1 + x_2 \leq 4$

$x_1, x_2 \geq 0.$

5. Use Bellman's optimality principle to divide a positive quantity '*b*' into *n* parts in such a way that their product is maximum.

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. Prove that a hyperplane is a closed set.

2. Show that $f(x) = 2x_1^2 + x_2^2$ is convex function over R^2.

3. Solve the following I.P.P by branch and bound technique.

Max $z = x_1 + x_2$

s.t. $3x_1 + 2x_2 \leq 12$

$x_2 \leq 2$

$x_1, x_2 \geq 0$ and integers.

4. Use method of Lagrangian multipliers to solve the following nonlinear programming problem :

Optimize $f(X) = 2x_1^2 + x_2^2 + 3x_3^2 + 10x_1 + 8x_2 + 6x_3 - 100$

s.t $\quad x_1 + x_2 + x_3 = 20;$

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

Does the solution maximize or minimize the objective function?

5. Write the Kuhn-Tucker necessary and sufficient conditions for the following nonlinear programming problem to have on optional solution.

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

s.t. $\quad 2x_1 + 3x_2 \leq 6$

$\quad 2x_1 + x_2 \leq 4$

$\quad x_1 + x_2 \geq 0$

6. Prove that the set of all optimum solutions (global maximum) of the general convex programming problem is a convex set.

7. Define :

(a) Stage.

(b) Dynamic Programming.

(c) Bellman's Principle of Optimality.

(d) Transition Function.

8. Obtain the necessary conditions for the optimum solution of the following non-linear programming problem:

Min. $Z = f(x_1, x_2) = 3e^{2x_1+1} + 2e^{x_2+5}$

Subject to the constraints : $x_1 + x_2 = 7$ and $x_1, x_2 \geq 0$.