MAT–510

Mathematical Programming

M. Sc. MATHEMATICS (MSCMAT–12)

Second Year, Examination, 2017

Time : 3 Hours **Max. Marks : 80**

Note : This paper is of **eighty (80)** marks containing **three (03)** Sections A, B and C. Learners are required to attempt the questions contained in these Sections according to the detailed instructions given therein.

Section–A

(Long Answer Type Questions)

Note : Section 'A' contains four (04) long answer type questions of nineteen (19) marks each. Learners are required to answer *two* (02) questions only.

1. Using bounded variable simplex method, solve the L. P. P.

   Maximize :

$$Z = 3x_1 + x_2 + x_3 + 7x_4$$

   Subjected to the constraints :

$$2x_1 + 3x_2 - x_3 + 4x_4 \leq 40$$

$$-2x_1 + 2x_2 + 5x_3 - x_4 \leq 35$$

$$x_1 + x_2 - 2x_3 + 3x_4 \leq 100$$

$$x_1 \geq 2,\ x_2 \geq 1,\ x_3 \geq 3,\ \ x_4 \geq 4\ .$$

2. Use dynamic programming to solve :

   Minimize :

$$z = y_1^2 + y_2^2 + y_3^2$$

   Subjected to the constraints :

$$y_1 + y_2 + y_3 \geq 15$$

$$y_1 \geq 0, \quad y_2 \geq 0 \text{ and } y_3 \geq 0.$$

3. Use Branch and bound technique to solve the following problem :

   Max. :

$$Z = 7x_1 + 9x_2$$

   Subject to :

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

$$7x_1 + x_2 \leq 35$$

$$0 \leq x_1, x_2 \leq 7$$

   x_1, x_2 are integers.

4. Find the necessary and sufficient condition for saddle point in non-linear programming problem.

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 *four* (04) questions only.

1. A hyperplane is given by the equation :

$$3x_1 + 2x_2 + 4x_3 + 7x_4 = 8$$

   Find in which half spaces do the points (– 6, 1, 7, 2) and (1, 2, – 4, 1) lie.

2. Write the advantages and disadvantages of revised simplex method over the original simplex method.
3. Explain quadratic programming.
4. Solve by Kuhn-Tucker condition :

   Max :

$$z = 10x_1 + 4x_2 - 2x_1^2 - x_2^2$$

   Subject to :

$$2x_1 + x_2 \leq 5$$

   and $x_1, x_2 \geq 0$.

5. Explain Bellaman's optimality principle.
6. Write a short note on non-linear programming problem.
7. Use dynamic programming to solve to L. P. P. :

   Max. :

$$z = x_1 + 9x_2$$

   s. t. :

$$2x_1 + x_2 \leq 25$$

$$x_2 \leq 11$$

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

8. What is convex separable programming ?

Section–C

(Objective Type Questions)

Note : Section 'C' contains ten (10) objective type questions of one (01) mark each. All the questions of this Section are compulsory.

Write True/False in the following questions :

1. Intersection of two convex sets is also a convex set.

2. In revised simplex method if the problem is of minimization then there is no need to convert it into maximization problem.
3. Dual of the dual of a given primal, is the primal itself.
4. Integer programming problem is a special class of linear programming problem.
5. A systematic procedure for solving all integer programming problems was first developed by George Dentzig.

Fill in the blanks in the following questions.

6. Branch and bound method is also known as .....
7. Dynamic programming is a technique for solving a ..... decision problem.
8. A basic solution is called degenerate basic solution if one or more the basic variables are .....
9. A function $f(x)$ is strictly concave if $-f(x)$ is strictly .....
10. A set of non-negative values of the variables which satisfies the given equation is called a .....