

## FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, MARCH 2020

(CUCSS)

Mathematics

## MT 4E 10—ADVANCED OPERATIONS RESEARCH

Time : Three Hours

Maximum : 36 Weightage

## Part A

*Answer all the questions.**Each question has weightage 1.*

1. Distinguish between linear programming and non-linear programming.
2. Define convex function and give an example for a convex function.
3. Define Lagrange multipliers.
4. Write the general form of a convex programming problem.
5. State the condition under which the function  $F(X, Y)$  has a saddle point.
6. Write the Kuhn-Tucker conditions for the saddle points of a function.
7. Write the general form of a quadratic programming problem.
8. When do we say that a programming problem is separable ?
9. Write the general form of geometric programming problem.
10. Write the model of a serial multistage problem.
11. When do we say that an optimization problem is decomposable ?
12. Define decision variables in dynamic programming.
13. What is meant by return function ? Illustrate using an example.
14. Describe the forward recursion procedure.

(14 × 1 = 14 weightage)

Turn over

## Part B

Answer any seven questions.

Each question has weightage 2.

15. Mark on graph the feasible solutions of  $(x_1 - 1)(x_2 - 1) \leq 1, x_1 + x_2 \geq 6, x_1 \geq 0, x_2 \geq 0$ .
16. If  $F(X, Y)$  has a saddle point  $(X_0, Y_0)$  for every  $Y \geq 0$ , then with usual notations prove that  $G(X_0) \leq 0, Y_0' G(X_0) = 0$ .
17. Describe how the Kuhn-Tucker theorem is derived from a convex programming problem.
18. Write the Kuhn-Tucker conditions to minimize  $f = x_1^2 + x_2^2$  subject to  $g = (x_1 - 1)^2 - x_2^2 \geq 0$ .
19. Discuss the primal-dual concept in geometric programming.
20. Maximize  $x^4$  subject to  $-\frac{1}{2} \leq x \leq 1$ .
21. Justify the name geometric programming to problems involving polynomials.
22. Describe a minimum path problem in Dynamic programming.
23. Describe the computational economy in Dynamic programming.
24. What is the serial multistage model in dynamic programming? Discuss.

(7 × 2 = 14 weightage)

## Part C

Answer any two questions.

Each question has weightage 4.

25. Minimize  $f = 2x_1 - 3x_2$  subject to  $4x_1^2 + 9x_2^2 \leq 36, x_1 \geq 0, x_2 \geq 0$  using separable programming technique.
26. By the method of quadratic programming, minimize  $-6x_1 + 2x_1^2 - 2x_1x_2 + 2x_2^2$  subject to  $x_1 + x_2 \leq 2, x_1 \geq 0, x_2 \geq 0$ .
27. Use geometric programming to find the dimensions of a rectangle of maximum area inscribed in a circle of radius  $r$ .
28. Maximize  $\sum_{n=1}^4 (4u_n - nu_n)^2$  subject to  $\sum_{n=1}^4 u_n = 10, u_n \geq 0$ .

(2 × 4 = 8 weightage)