18P403 (Pages: 2) Name: ……………………….

Reg. No…………….………

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2020

(CUCSS-PG)

Mathematics

CC17P MT4 E10 / CC18P MT4 E10 - ADVANCED OPERATIONS RESEARCH

(2017 Admission onwards)

Time: Three Hours Maximum: 36 weightage

PART A

Answer ***all*** questions. Each question carries 1 weightage.

1. What do you mean by separable programming?
2. State the Kuhn-Tucker theorem.
3. Solve graphically:

   Minimize $f = (x_1 - 2)^2 + x_2{}^2$

   subject to $x_1{}^2 + x_2 - 1 \leq 0,$

   $x_1 \geq 0, x_2 \geq 0.$
4. Write the general form of a Quadratic programming problem.
5. Explain the term posynomial with a suitable example.
6. Convert the following problem into the form of a geometric programming problem:

   Find the dimensions of a rectangle of maximum area inscribed in a circle of radius r .
7. Write the standard form of a geometric programming problem.
8. Explain the primal-dual concept in geometric programming.
9. What is serial multistage model in dynamic programming?
10. Define the term forward recursion used in dynamic programming.
11. State Bellman's principle of optimality.
12. Explain the constraint with negative terms in geometric programming problem.
13. Define the term decision variables and state variables in a dynamic programming problem.
14. Define decomposability in an optimization problem.

(14 x 1 = 14 Weightage)

PART B

Answer any ***seven*** questions. Each question carries 2 weightage.

15. Describe how a non linear function can be approximated in a domain by a piecewise linear function.
16. Write the orthogonality conditions in a general geometric programming problem.
17. Discuss how the geometric programming problem can be generalized through Kuhn Tucker Theory.

18. If X_0 is a solution of the convex programming problem, Minimize $f(X), X \in E_n$ subject to $g_i(X) \leq 0, i = 1,2, \ldots, m, X \geq 0$ and if the set of points X such that $G(X) < 0$ is non empty, then prove that there exists a vector $Y_0 \geq 0$ in E_m such that $f(X) + Y_0' G(X) \geq f(X_0)$.
19. Minimize $f(X) = (x_1 + 1)^2 + (x_2 - 2)^2$

    subject to $x_1 - 2 \leq 0,$

    $x_2 - 1 \leq 0,$

    $x_1, x_2 \geq 0.$
20. Explain the terms weight functions and normalized weight functions in geometric programming problems.
21. Discuss the computational economy in dynamic programming.
22. Determine $\max(u_1^2 + u_2^2 + u_3^2)$ subject to $u_1 u_2 u_3 \leq 6$ where u_1, u_2, u_3 are positive integers.
23. Describe a method in dynamic programming to solve the problem:

    Minimize $\sum_{j=1}^{n} f_j(u_j)$

    subject to $\sum_{j=1}^{n} a_j u_j \geq b$

    $u_j, a_j \geq 0, j = 1,2, \ldots . n, b > 0.$
24. What are the essential features of dynamic programming problem?

(7 x 2 = 14 Weightage)

PART C

Answer any ***two*** questions. Each question carries 4 weightage.

25. Solve by the method of quadratic programming:

    $Minimize\ -6x_1 + 2x_1^2 - 2x_1x_2 + 2x_2^2$ subject to $x_1 + x_2 \leq 2, x_1, x_2 \geq 0.$
26. Solve the geometric programming problem:

    Minimize $f(X) = \frac{c_1}{x_1x_2x_3} + c_2\, x_2x_3$ subject to $g_1(X) = c_3\, x_1x_3 + c_4x_1x_2 = 1$ and $c_i > 0, x_j > 0, i = 1,2,3,4,\ j = 1,2,3.$
27. Maximize $\sum_{n=1}^{4}(4u_n - nu_n^2)$ subject to $\sum_{n=1}^{4} u_n = 10, u_n \geq 0.$
28. Prove that in a serial two stage minimization or maximization problem if (i) the objective function $\emptyset_2$ is a separable function of stage returns $f_1(X_1, U_1)$ and $f_2(X_2, U_2)$, and (ii) $\emptyset_2$ is a monotonic non decreasing function of f_1 for every feasible value of f_2, then the problem is decomposable.

(2 x 4 = 8 Weightage)

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