17P407 (Pages: 2) Name…………………….

Reg. No………………..

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2019

(CUCSS - PG)

(Mathematics)

CC17P MT4 E10 – ADVANCED OPERATIONS RESEARCH

(2017 Admission)

Time: Three Hours Maximum: 36 Weightage

PART A

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

1. Define convex programming.
2. Write the general form of Quadratic Programming.
3. Define separable programming.
4. If $F(X, Y)$ has a saddle point (X_0, Y_0) for every $Y \geq 0$, then prove that X_0 is a minimal point of $f(x)$ subject to the constraints $G(X) \leq 0$
5. What is the necessary condition for Kuhn-Tucker theorem?
6. Show that K.T. Conditions fails for Minimize $f = x_1^2 + x_2^2$

   subject to $(x_1 - 1)^2 - x_2^2 \geq 0$
7. Define Posynomial in GP with example.
8. Explain weight functions and normalized weight functions.
9. What is the characteristic of GP?
10. Write the most general form of GP for mixed signs.
11. Define Recursive Optimization
12. State Bellman's Principle of optimality.
13. Check whether the function $\varphi_3 = f_3 f_2 + f_1$ is separable or not. Justify.
14. Define backward and forward recursion.

$(\mathbf{14 \times 1 = 14\ Weightage})$

PART B

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

15. Find the minimum of $f(X) = (x_1 + 1)^2 + (x_2 - 2)^2$

$$\text{subject to } g_1(X) = x_1 - 2 \leq 0$$
$$g_2(X) = x_2 - 1 \leq 0$$
$$x_1, x_2 \geq 0$$

16. If the Lagrangian function $F(X, Y)$ has a saddle point (X_o, Y_o) for every $Y \geq 0$ then prove that $G(X_0) \leq 0, Y_o' G(X_o) = 0$

17. Prove that $f(X) = \boldsymbol{P}X + X'CX$ has an unbounded minimum if $X'CX$ is positive semi-definite and $\boldsymbol{P} \neq 0$

18. Solve:

$$\text{Maximize } f(x_1, x_2) = 2x_1 + 3x_2^4 + 4$$
$$\text{Subject to } g_1(x_1, x_2) = 4x_1 + 2x_2^2 \leq 16, \quad x_1, x_2 \geq 0$$

19. Explain the general form of GP problem.

20. Solve:

$$\text{Maximize } 5x_1 - x_2^2 x_3^4$$
$$\text{Subject to } -5x_1 x_2^{-2} + 3x_3 x_2^{-1} \geq 2, \quad x_1, x_2, x_3 > 0$$

21. 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.

22. Briefly describe the computational economy in DP.

23. Explain DP model for Single additive constraint and additively separable return.

24. Explain serial multistage model in DP.

$(\mathbf{7 \times 2 = 14\ Weightage})$

PART C

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

25. Solve by method of quadratic programming:

$$\text{Minimize } 6x_1 + 2x_1^2 - 2x_1 x_2 + 2x_2^2$$
$$\text{Subject to } x_1 + x_2 \leq 2,$$
$$x_1, x_2 \geq 0$$

26. How does K-T theory leads to the primal dual concept in the optimization theory? Explain.

27. Solve:

Minimize $f(X) = \frac{c_1}{x_1 x_2 x_3} + c_2 x_2 x_3 + c_3 x_1 x_3 + c_4 x_1 x_2$, $c_i > 0, x_j > 0, c_1 = c_2 = 40$, $c_3 = 20, c_4 = 10$

28. Solve:

$$\text{Maximize } \sum_{n=1}^{4} (4u_n - n u_n^2) \text{ subject to } \sum_{n=1}^{4} u_n = 10, \quad u_n \geq 0$$

$(\mathbf{2 \times 4 = 8\ Weightage})$

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