**17P404** (Pages: 2) Name…………………….

Reg. No………………..

**FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2019**

(CUCSS - PG)

(Mathematics)

**CC15P MT4 E05 – OPERATIONS RESEARCH**

(Improvement/Supplementary)

(2015 & 2016 Admissions)

Time: Three Hours Maximum: 36 Weightage

## PART A

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

1. Define strongly connected graph with example.
2. Give an example to show that the spanning tree of minimum length need not be unique.
3. Write the problem of Potential difference.
4. Show that if $\{x_i\}$and $\{y_i\}$ are two flows in a graph, then $\{ax_i + by_i\}$ is also a flow. Where a, b are real constants.
5. Define sensitivity analysis.
6. What is meant by parametric linear programming?
7. Show that K.T. Conditions fails for Minimize $f = x_1^2 + x_2^2$

   subject to $(x_1 - 1)^2 - x_2^2 \geq 0$
8. Define a quadratic programming problem.
9. Define Dynamic Programming.
10. Define unimodal function of one variable.
11. State Bellman's Principle of optimality.
12. Check whether the function $\varphi_3 = f_3 f_2 + f_1$ is separable or not. Justify.
13. Write the general problem of linear goal programming.
14. Write the computational steps for Method of steepest descent.

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

## PART B

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

15. State and prove max low min cut theorem.
16. Describe the effect of parametric variation in $b_i$ in the optimal solution of an LP problem.

17. Prove that If $F(X,Y)$ has a saddle Point $(X_o, Y_o)$ for every $Y \geq 0$ then $G(X_0) \leq 0$,

$$Y_o' G(X_o = 0)$$

18. Explain K-T condition leads to the primal dual concept in the optimization theory.
19. Determine minimize $(u_1^2 + u_2^2 + u_3^2)$ subject to $u_1 + u_{2+} u_3 \geq 10$ where $u_{1,} u_2, u_3 \geq 0$
20. Describe the computational economy of Dynamic Programming.
21. Describe the algorithm for maximum flow problem.
22. Briefly describe the computational algorithm of golden section search plan.
23. Describe the computational steps for Rosenbrock method.
24. What is the effect of deletion of a variable in LP problem?

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

## PART C

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

25. Solve:

Minimize $f(\lambda) = (1+\lambda)x_1 + (-2-2\lambda)x_2 + (1+5\lambda)x_3$

Subject to $2x_1 - x_2 + 2x_3 \leq 2$

$$x_1 - x_2 \leq 3$$

$$x_1 + 2x_2 - 2x_3 \leq 4$$

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

26. Solve:

Minimize $f(x) = x_1 + x_2 + x_3 + \frac{1}{2}(x_1^2 + x_2^2 + x_3^2)$

Subject to $g_1(x) = x_1 + x_2 + x_3 - 1 \leq 0$

$$g_2(x) = 4x_1 + 2x_2 - \frac{7}{3} \leq 0,$$

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

27. Solve:

Minimize $f(X) = \frac{c_1}{x_1 x_2 x_3} + c_2 x_2 x_3$, $g_1(x) = c_3 x_1 x_3 + c_4 x_1 x_2 = 1$

$$c_i > 0, x_j > 0, c_1 = c_2 = 40, c_3 = \frac{1}{2}, c_4 = \frac{1}{4}$$

28. Solve

Minimize $x_1^2 + 3x_2^2 - 2x_1x_2 - 4x_2 + 5$ by the method of axial directions starting from (4.2, -2.0). Take $\in = 0.1$, $\lambda = 1$, $\mu = 1$

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

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