**15P404** (Pages: 2) Name....................

Reg. No..................

**FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, MARCH 2017**

(CUCSS - PG)

(Mathematics)

**CC15P MT4 E05 – OPERATIONS RESEARCH**

(2015 Admission)

Time: Three Hours Maximum: 36 Weightage

## PART A

(Answer *all* Questions. Each question has weightage 1)

1. Define path, chain, cycle and circuit with example.
2. Give an example to show that the spanning tree of minimum length need not be unique.
3. Write the problem of maximum flow in the generalized form.
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 you meant by parametric linear programming?
7. Show that K-T. Conditions fails for
$$Minimize\ f = x_1^2 + x_2^2$$
$$subject\ to\ \ g = (x_1 - 1)^3 - x_2^2 \geq 0$$
$$x_1, x_2 \geq 0$$
8. Define a quadratic programming problem.
9. Explain the term posynomial in Geometric 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 conjugate gradient method.

## PART B

(Answer *any seven* Questions. Each question has weightage 2)

15. Find the maximum potential difference between $v_1\ and\ v_4$ in the graph G(V,U) where

| | | | | | | |
|---|---|---|---|---|---|---|
| $V$ | 1 | 2 | 3 | 4 | | |
| $U$ | (1,2) | (1,3) | (2,3) | (3,4) | (4,2) | (1,4) |

Subject to the constraints

$$-2 \leq f_2 - f_1 \leq 3,\ \ 6 \leq f_3 - f_2 \leq 10,\ \ f_4 - f_3 \leq -2,$$
$$-2 \leq f_2 - f_4,\quad 1 \leq f_4 - f_1 \leq 6,\quad f_3 - f_1 \leq 7$$

16. Describe the effect of deletion of the variables in the optimal solution of an LP problem.
17. If the Lagrangian function $F(X,Y)$ has a saddle point $(X_o, Y_o)$ for every $Y \geq 0$ then prove that $G(X_0) \leq 0,\ Y_0' G(X_o) = 0)$.
18. Prove that $f(X) = \bar{P}X + X'CX$ cannot have an unbounded minimum if either $X'CX$ is positive definite or $\bar{P} = 0$ .
19. 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.
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 Method of steepest descent.

**PART C**

(Answer ***any two*** Questions. Each question has weightage 4)

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

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

$$x_1 - x_2 \leq 3,$$

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

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

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

$$f(X) = \frac{c_1}{x_1 x_2 x_3} + c_2 x_2 x_3 + c_3 x_1 x_3 + c_4 x_1 x_2, c_i > 0,\ x_j > 0\ for\ i\ 1,2,3,4\ and\ j = 1,2,3.$$

Complete the solution for $c_1 = c_2 = 40,\ c_3 = 20, c_4 = 10$

27. *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 $\in = 0.1,\ \lambda = 1,\ \mu = 1$

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