C 3550 (Pages : 3) Name

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

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, JUNE 2016

(CUCSS)

Mathematics

MT 4E 05—OPERATIONS RESEARCH

Time : Three Hours Maximum : 36 Weightage

Part A

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

1. Briefly describe the minimum path problem.
2. For any feasible flow $\{x_i\}$, i = 1, 2, ... m in the graph, prove that the flow x_0 in the return are is not greater than the capacity of any cut in the graph.
3. State the problem of maximum potential difference in a network.
4. Describe the effect of deletion of Variables on the optimal solution of an LP problem.
5. What is goal programming.
6. Let $f(x)$ be a real-valued function in E_n, G (X) a vector function consisting of real valued functions $g_i(x)$, i = 1, 2, ... m as components and F (X, Y) = $f(x)$ + Y' G (X) where Y is a vector in E_m. If F (X, Y) has a saddle point (X_0, Y_0) for every Y 0, prove that X_0 is a minimum off (x) subject to the constraints G (X) 0.
7. Write Kuhn-Tucker conditions for the problem :

$$\text{Minimize } 16(x_1 - 2)^2 + (4x_2 - 9)^2$$

$$\text{subject to } x_1 - x_2^2 \geq 0$$

$$x_1 + x_2 \leq 6,$$

$$x_1, x_2 \geq 0.$$

8. What is the advantage of solving the dual problem in geometric programming problems.
9. Write the general form of a geometric programming problem.
10. Define the decision variables and the state variables in a dynamic programming problem.
11. Explain the difference between forward recursion and backward **recursion** in dynam programming.

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12. Show that the function $f(x) = x^2, 0 < x$ **1 is** unimodal in (0, 2).

13. What is meant by a sequential search plan.

14. Find the minimal point of $x^3 - 3x + 2, 0 < x < 3$, taking $\varepsilon = 0.01$ by the method of false position.

(14 x 1 = 14 weightage)

Part B

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

15. Briefly describe an algorithm to find the spanning tree of minimum length if the length of each arc of the graph is given as a non-negative number.

16. A project consists of activities A, B, C, ——M. In the following data X – Y = C means Y can start after C days of Work on X. A, B, C can start simultaneously. K and M are the last activities and take 14 and 13 days respectively. A – D = 4, B – F = 6, B – E = 3, C E = 4, D – H = 5, D – F = 3, E – F = 10, F – G = 4, G – I = 12, H – I = 3, H – J = 3, J – K = 8, I – K = 7, I – L = 7, L – M = 9. Find the least time of completion of the project.

17. For the problem :

Maximize $f = x_1 - x_2 + 2x_3$

subject to $-x_2 + x_3 \leq 4,$

$x_1 + x_2 - x_3 < 3$

$2x_1 - 2x_2 + 3x_3$ 15

$x_1, x_2, x_3 \geq$.

assuming x_4, x_5, x_6 respectively as the slack variables for the three constraints, the optimal table is the following :

Basis	Values	x_1	x_2	x_3	x_4	x_5	x_6
x_3	21	4		1		2	1
x_4	7	2			1	1	0
x_2	24	5	1			3	1
$-f$	18	2				1	1

Carry out sensitivity analysis when the coefficient of x_1 in the objective function changes to 2.

.8. Minimise $f = x_1^2 + x_2^2$

subject to $(x_1 - 1)^3 - x_2^2 > 0.$

9. Mention briefly an algorithm for solving a quadratic programming problem.

). Explain the terms weight functions and normalised weight functions in geometric programming problems.

21. Describe a method of dynamic programming to solve the problem $z = \sum_{j=1} f_j (u_j)$

subject to $\sum_{=1} a_j u_j$

$a_j, b \in R, a \geq 0, b > 0$

22. Mimimize $+ u2 + u_3$
subject to $u_1 + u_2 + u_3$ 10, u_1, u_2, u_3 O

by forward recursion.

23. Briefly describe the computational algorithm for Fibonacci search plan.

24. Find the point of minimum of $f(x) = e^{x} + x^2$ in the interval (0, 1) using golden section method.

(7 x 2 = **14** weightage)

Part C

Answer any two questions.
Each question has weightage 4.

25. Find the maximum non-negative flow in the network described below, arc (V_j, V_k) being denoted as *(j, k)*, V_a is the source and V_b is the sink.

Arc	(a, 1)	(a, 2)	(1, 2)	(1, 3)	(1, 4)	(2, 4)	(3, 2)	(3, 4)	(4, 3)	(3, *b*)	(4, *b*)
Capacity	8	10	3	4	2	8	3	4	2	10	9

26. Minimize $f(X) = (1 + X) x_1 + (-2 - 2?.) x_2 + (1 + 5?) x_3$,
subject to $2x_1 - x_2 + 2x_3$ S 2,
$x_1 - x_2$ 3
$x + 2x_2 - 2x_3$ 4
$x\ x_2, x_3$.

27. Minimise $x_2^2 x_3 - 5x_1$
subject to 5x, $- 3x_2\ x_3^2 < 2$

the variables being all positive.

28. Maximize $\sum_{n=1}^{4} \left(4u_n - nu_n\right)$

subject to $\sum_{n=1}^{4} u_n = 10, u_n$ O.

(2 x **4** = **8** weightage)