B.Sc DEGREE (CBCS) EXAMINATIONS, OCTOBER 2021

First Semester

B.Sc Mathematics Model II Computer Science

Complementary Course - MM1CMT02 - MATHEMATICS - OPERATIONS RESEARCH - LINEAR PROGRAMMING

2017 Admission Onwards

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Time: 3 Hours   Max. Marks : 80

Part A

*Answer any **ten** questions.*

*Each question carries **2** marks.*

1. Define the term linear combination of vectors.

2. Define vector space.

3. Find the Euclidean norm of the vector $[2 \ -3 \ 4]'$, and the inner product of the vectors $[2 \ -3 \ 4]'$ and $[4 \ -2 \ -3]'$

4. Explain the term convex linear combination of two points.

5. Define a line and half line in E_n.

6. What you mean by generating hyperplanes of a polytope.

7. Distinguish between separating and supporting hyperplanes

8. Define saddle point of a function $f(\mathbf{X}, \mathbf{Y})$

9. Define a convex function.

10. Explain general linear programming problem.

11. State the theorem relating to optimal solution of an LP problem.

12. Explain Surplus variable in a linear programming problem.

(10×2=20)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. Determine wheter the following set is a basis for $\mathbf{R}^3$.or not

$$\{[1 \quad 2 \quad 3], [4 \quad 5 \quad 6], [0 \quad 0 \quad 0]\}$$

14. Which of the following are convex sets in E_n
    1. $S_1 = \{\mathbf{X}; |\mathbf{X}| = 1\}$
    2. $S_1 = \{\mathbf{X}; |\mathbf{X}| < 1\}$
    3. $S_1 = \{\mathbf{X}; |\mathbf{X}| \leq 1\}$

15. Indicate the following form is positive definite or negative definite
    $$x_1^2 + 8x_1 x_2 + 16x_2^2 - 3x_3^2$$

16. Classify different types quadratic forms with examples.

17. Prove that sum of two convex functions is a convex function

18. Define a feasible solution.

19. Solve graphically

    Maximize $x_1 + x_2$

    subject to $x_1 - x_2 \geq 0$, $\quad -3x_1 + x_2 \geq 3$, $\quad x_1, x_2 \geq 0$

20. Solve by simlex method
    Maximize $f = 2x_1 + x_2$
    Subject to
    $x_1 - 3x_2 \leq 3$
    $x_1 \leq 8$
    $2x_1 + x_2 \leq 20$
    $x_1 + 3x_2 \leq 30$
    $-x_1 + x_2 \leq 6$
    $x_1 \geq 0, x_2 \geq 0$

21. Use simplex method to solve

    Maximize $f = 2x_1 + 4x_2 + x_3 + x_4$
    Subject to
    $x_1 + 3x_2 + x_4 \leq 4$
    $2x_1 + x_2 \leq 3$
    $x_2 + 4x_3 + x_4 \leq 3$
    $x_1, x_2, x_3, x_4 \geq 0$

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **15** marks.*

22.

Find the eigen values of the matrix of the quadratic form $2x_1^2 + 4x_1x_2 + 2x_2^2 + x_3^2$ and determine the nature of the form.

23. Solve graphically

Maximize f=$4x_1 + 2x_2$

Subject to

$x_1 + x_2 \leq 8$

$x_1 = 4$

$x_1 \geq 0, x_2 \geq 0$

24. Show that the following quadratic form is positive definite

$$3x_1^2 + 2x_1x_2 + x_2^2$$

25. Solve

Minimize $f = 2x_1 - 3x_2 + 6x_3$

Subject to

$3x_1 - 4x_2 - 6x_3 \leq 2$

$2x_1 + x_2 + 2x_3 \geq 11$

$x_1 + 3x_2 - 2x_3 \leq 5$

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

(2×15=30)