25019385

QP CODE: 25019385

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS)) REGULAR/ IMPROVEMENT/ REAPPEARANCE / MERCY CHANCE EXAMINATIONS, FEBRUARY 2025

Fourth Semester

B.Sc Mathematics Model II Computer Science

Complementary Course - MM4CMT02 - MATHEMATICS - OPERATIONS RESEARCH - NON LINEAR PROGRAMMING

2017 Admission Onwards

6E221697

Time: 3 Hours Max. Marks : 80

Part A

*Answer any **ten** questions.*

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

1. Using graphical method, list all integer feasible solutions of $\text{Min } x_1 - x_2$ subject to $2x_1 + 3x_2 \leq 6, x_1, x_2 \geq 0 \text{ and } x_1, x_2 \text{ are integers}$
2. Define T_F and $[T]_F$ in Integer Programming Problem.
3. What are the advantages of cutting plane method?
4. Find a suiatable cutting plane for the ILP
   $Max\ x_1 + 2x_2$
   $Subject\ to\ 2x_2 \leq 7\ ,\ x_1 + x_2 \leq 7, 2x_1 \leq 11, x_1 \geq 0, x_2 \geq 0$
5. Give and example of a Nonlinear Programming problem.
6. Define Lagrangian Function.
7. State Kuhn-Tucker Theorem.
8. Write the Lagrangian function for Minimize $-2x_1 - 3x_2$ subject to $2x_1 + 2x_2 \leq 7, 0 \leq x_1 \leq 2, 0 \leq x_2 \leq 2, x_1, x_2 \geq 0$
9. Mark on the graph the set of feasible solutions of $(x_1 - 1)(x_2 - 1) \leq 1,\ x_1 + x_2 \geq 6,\ x_1, x_2 \geq 0$
10. What assumptions can be made when $P\ne0$ and $X^\prime CX$ is positive semidefinite in a Quadratic Programming Problem?
11. Give an example of a Quadratic Programming Problem in which $P \neq 0$ and $X'CX$ is positive semidefinite.
12. Show that $x_1^2 + x_2^2 - (3x_1 + x_2)$ is separable.

(10×2=20)

Part B

*Answer any **six** questions.*

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

13. Using Branch and Bound method solve
$Max\ x_1 + 2x_2$ subject to $x_1 + x_2 \leq 8, x_1 + 2x_2 \geq 4, x_1, x_2$ are non - negative integers

14. Solve by Cutting Plane Method
Maximize $x_1 + x_2$ subject to $2x_1 \leq 3, 2x_1 + 2x_2 \geq 5, -2x_1 + 2x_2 \leq 1, x_1, x_2$ non negative integers.

15. Solve by Branch and Bound Method
Minimise $9x_1 + 10x_2$ subject to $0 \leq x_1 \leq 10, 0 \leq x_2 \leq 8, 3x_1 + 5x_2 \geq 45$

16. Find the initial branches of the problem
Minimize $3x_1 - x_2$ subject to
$-10x_1 + 6x_2 \leq 15, 14x_1 + 18x_2 \geq 63, x_1, x_2$ non negative integers.

17. Solve graphically $x_1^2 + (x_2 - 3)^2,$ Subject to $x_1 + x_2 \leq 4, x_1 - x_2 \leq 2, x_1, x_2 \geq 0$

18. Write K-T conditions for the following Mathematical Programming problem
$\text{Max}\ x_1^2 - x_2^2$ subject to $x_1 - x_2 \leq 3, (x_1 - 4)^2 + (x_2 - 7)^2 \leq 9, x_1, x_2 \geq 0$

19. Solve by K-T conditions for the LP maximise $3x_1 + 2x_2$ subject to
$2x_1 - x_2 \leq 4, x_1 + x_2 \leq 8, x_1, x_2 \geq 0$

20. Solve $3x_1 + 6x_2 - 4x_1x_2 - 3x_1^2 - 2x_2^2$ subject to $3x_1 + 2x_2 \leq 4, x_1 + x_2 \leq 1, x_1, x_2 \geq 0$

21. Solve the following Separable Programming Problem
$\text{Max}\ 2x_1^2 + x_2^2,$ Subject to $x_1 + x_2 \leq 4, x_1 - 2x_2 \leq 6, x_1, x_2 \geq 0$

(6×5=30)

Part C

*Answer any **two** questions.*

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

22. Solve by Cutting Plane Method
Minimize $-2x_1 - 3x_2$ subject to $2x_1 + 2x_2 \leq 7, 0 \leq x_1 \leq 2, 0 \leq x_2 \leq 2, x_1, x_2$ integers.

23. Solve the two following problems bt K-T conditions and verify geometrically
a) Minimise x_1
b) maximise x_2 in each case subject to $(x_1 - 4)^2 + x_2^2 \leq 16, (x_1 - 3)^2 + (x_2 - 2)^2 = 13$

24. Solve by K-T conditions
$\text{Max}\ x_1 - x_2 - x_3$ subject to $2x_1 - x_2 + x_3 \leq 6, x_1 + 2x_2 + x_2 \leq 4, x_1, x_2\ x_3 \geq 0$

25. Solve Minimise $-x_1 - x_2 - x_3 + \frac{1}{2}(x_1^2 + x_2^2 + x_3^2)$
subject to$x_1 + x_2 + x_3 \leq 1, x_1 + 2x_2 \leq \frac{7}{3}, x_1, x_2, x_3 \geq 0$

(2×15=30)