16P304 (Pages:2) Name…………………..

Reg. No………………..

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, OCTOBER 2017

(Regular/Supplementary/Improvement)

(CUCSS - PG)

CC15P MT3 C14 - LINEAR PROGRAMMING AND ITS APPLICATIONS

(Mathematics)

(2015 Admission Onwards)

Time : Three Hours Maximum : 36 Weightage

PART A

Answer **All** Questions. Each question has weightage 1

1. Find convex hull of half line $x_2 = 0, x_1 \geq 0$ and $x_2 \geq 0, x_1 = 0$ in E_2
2. Prove that a vertex is a boundary point, but not all boundary points are vertices.
3. Find $H(x)$ of $f(x) = 6x_2^2 - 18x_2x_3 - 6x_3x_1 + 2x_1x_2 - 7x_1 + 5x_2 - 6x_3 - 4$
4. Find the unit vector in the direction of the steepest ascent of
   $f(x) = x_1^2 + 2x_1x_2 + x_3x_1 + x_4x_2 + x_4^2$ at the point $(1, 0, -1, 1)$
5. What is degeneracy in LP problem?
6. What is triangular basis in transportation problem?
7. Define generalized transportation problem
8. Write the dual of the LP problem

   Max $Z = 2x_1 + 2x_2 + 5x_3$

   subject to:- $2x_1 - 3x_2 - 5x_3 \leq 7,\quad 3x_1 + 6x_2 - x_3 \geq 5,\quad x_1 + 2x_2 - 3x_3 = 6$

   $x_1 \geq 0, x_3 \geq 0,\ x_2$ unrestricted
9. Define Transportation matrix with example.
10. Assignment problem is a particular case of transportation problem. Justify
11. What is meant by loops in a transportation array?
12. Find the optimal strategy and value of the game $\begin{vmatrix} 1 & 3 & 6 \\ 2 & 1 & 3 \\ 6 & 2 & 1 \end{vmatrix}$
13. State fundamental theorem on rectangular game.
14. What is integer linear programming?

(14×1=14 Weightage)

PART B

Answer any **Seven** Questions. Each question has weightage 2.

15. Show that the linear function $f(X) = CX$ is both convex and concave.
16. Prove that the convex polyhedron is a convex set

17. Examine $f(x) = x_1^2 + 4x_2^2 + 4x_3^2 + 4x_1x_2 + 4x_1x_3 + 16x_2x_3$ for relative extrima.
18. Prove that a vertex of S_F is a basic feasible solution.
19. Prove that transportation problem has a triangular basis.
20. State and prove mini max theorem.
21. Prove that if the primal problem is feasible, then it has an unbounded optimum iff the dual has no feasible solution
22. Find the relative maxima and minima and saddle points, if any, of
 $f(x) = x_1^3 + x_2^3 - 3x_1 - 12x_2 + 25.$
23. Solve the game using notion of dominance $\begin{vmatrix} 0 & 5 & -4 \\ 3 & 9 & -6 \\ 3 & -1 & 2 \end{vmatrix}$.

24. Solve the transportation problem

$$\begin{array}{ccc|c} 4 & 5 & 2 & 30 \\ 4 & 1 & 3 & 40 \\ 3 & 6 & 2 & 20 \\ 2 & 3 & 7 & 60 \\ \hline 40 & 50 & 60 & \end{array}$$

(7×2=14 Weightage)

PART C

Answer any **Two** Questions. Each question has weightage 4.

25. Obtain the optimal strategies for both persons and the value of the game for zero sum two person game whose payoff matrix is as follows:

$$\begin{bmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & 1 \\ 2 & 2 \\ -5 & 0 \end{bmatrix}$$

26. Explain Cutting plane method. And solve Use cutting plane method to solve
 $Minimize\ z = -2x_1 - 3x_2$
 subject to:- $2x_1 + 2x_2 \le 7$, $0 \le x_1 \le 2$, $0 \le x_2 \le 2$
 x_1, x_2 are integers
27. Find the relative maximum, minimum and saddle points if any, of
 $f(x) = x_1^3 + x_2^3 - 3x_1 - 12x_2 + 25$
28. Solve, Maximize $5x_1 + 3x_2 + x_3$
 subject to:- $2x_1 + x_2 + x_3 = 3$, $-x_1 + 2x_3 = 4$ $x_1, x_2, x_3 \ge 0$.

(2×4=8 Weightage)

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