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D 50668 **(Pages : 4)** **Name.......................................**

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

FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2023

Mathematics

MTS 5B 08—LINEAR PROGRAMMING

(2020 Admission onwards)

Time : Two Hours Maximum : 60 Marks

Section A

Answer any number of questions.
Each question carries 2 marks.
Ceiling is 20.

1. Define polyhedral convex set. Give an example of a polyhedral convex set in $\mathbb{R}^2$.

2. Convert the following linear programming problem into canonical form :

   Maximize $f(x, y) = -2y - x$ subject to

   $$2x - y \geq -1$$
   $$3y - x \leq 8$$
   $$x, y \geq 0.$$

3. Define canonical slack maximization linear programming problem.

4. Pivot on 5 in the canonical maximimum tableau given below :

x_1	x_2	-1		
1	2	3	=	$-t_1$
4	5	6	=	$-t_2$
7	8	9	=	f

5. Define negative transpose.

6. If a canonical maximization linear programming problem is unbounded, prove that the dual canonical minimization linear programming problem is infeasible.

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7. Explain the following terms :

   a) Two person zero sum game ;

   b) Pay off matrix ; and

   c) Domination in matrix game.

8. State Von Neumann minimax theorem.

9. Let $x, y \in \mathbb{R}$ and consider the matrix game given below :

$$\begin{array}{c} \quad \text{I I} \\ \text{I}\begin{bmatrix} x & 0 \\ 0 & y \end{bmatrix}. \end{array}$$

   Determine a necessary and sufficient condition for the matrix game above to reduce by domination to a single entry.

10. Distinguish between balanced and unbalanced transportation problem.

11. Explain briefly the north west corner method to obtain the initial basic feasible solution in transportation problem.

12. Define cycle in a tableau of a bounded transportation problem and give an example.

Section B

Answer any number of questions.
Each question carries 5 *marks.*
Ceiling is 30.

13. Using graphical method to solve the following linear programming problem :

   Maximize $f(x, y) = x + y$ subject to

$$x - y \leq 3$$
$$2x + y \leq 12$$
$$0 \leq x \leq 4$$
$$0 \leq y \leq 6.$$

14. Write the simplex algorithm for maximum tableaus.

15. Solve the noncanonical linear programming problem given below :

Maximize $f(x, y, z) = 2x + y - 2z$ subject to

$$x + y + z \leq 1$$
$$y + 4z > 2$$
$$x, y, z \geq 0.$$

16. Prove that a pair of feasible solutions of dual canonical linear programming problems exhibit complementary slackness if and only if they are optimal solutions.

17. Solve the dual canonical linear programming problem given below :

	x_1	x_2	-1		
y_1	-1	-1	-3	=	$-t_1$
y_2	1	1	2	=	$-t_2$
-1	2	-4	0	=	f
	$= s_1$	$= s_2$	$= g$		

18. Find the von Neumann value and the optimal strategy for each player in the matrix game given below :

	II		
I	2	-3	2
	-3	4	-3
	2	-3	6

19. Solve the following transportation problem :

2	1	2	40
9	4	7	60
1	2	9	10
40	50	20	

Turn over

Section C

Answer any **one** *question.*
The question carries 10 *marks.*

20. Apply simplex algorithm to solve the following maximum tableau :

x_1	x_2	-1		
-1	-2	-3	=	$-t_1$
1	1	3	=	$-t_2$
1	1	2	=	$-t_3$
-2	4	0	=	f

21. Write the Hungarian algorithm. Using this algorithm solve the following assignment problem;

4	6	5	10
10	9	7	13
7	11	8	13
12	13	12	17

(1 × 10 = 10 marks)