D3BMC2206 (PAGES 4) **Reg. No:............................**

Name: ....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2023

COMPUTER SCIENCE & MATHEMATICS (DOUBLE MAIN)

GDMA3B05T: LPP AND APPLICATIONS

Time: 2 ½ Hours **Maximum Marks: 80**

SECTION A: Answer the following questions. Each carries *two* marks.

(Ceiling 25 Marks)

1. Explain a permutation set of zeros of an assignment tableau with an example.
2. Construct the matrix form of a dual canonical tableau.
3. Write the following as a Canonical Maximization LPP,

   Maximize; $f(x, y) = -2x - y$

   Subject to,

   $2x - y \geq -1$

   $3x - 8y \leq 8$

   $0 \leq x \leq 4$

   $y \geq 0$
4. When an LPP is said to be infeasible?
5. Draw the Tucker tableau for the canonical minimization LPP and mention the dependant and independent variables.
6. Pivot on the element 4 for the following tableau,

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

7. Write the dual of the following canonical LPP.

   Minimize; $f(x, y, z) = 2x - 3y + 5z$

   Subject to,

   $x + y + z \leq 5$

   $5x - 2y \geq 6$

   $2x + 3y - 4z \geq -1$

   $x, y, z \geq 0$
8. Define a Closed half-space of $\mathbb{R}^n$ and give an example in $\mathbb{R}^1$.
9. Define the feasibly solution of an LPP.

(PTO)

10. Find the dual of the following tableau;

y_1	2	4	2
y_2	4	-3	9
-1	5	0	-2
	$= s_1$	$= s_2$	$= g$

11. Distinguish between balanced and unbalanced transportation problems.

12. Obtain a basic feasible solution for the following transportation problem by applying minimum entry method,

	M_1	M_2	M_3	Supply
O_1	1	4	3	32
O_2	3	0	6	43
O_3	2	10	12	25
Demand	40	32	28	

13. Write the general form of a Canonical Minimization LPP.

14. Convert the following assignment tableau below to non-negative integers by using Hungarian algorithm,

-7	$1/3$	-0.5
3	0	-1
3.2	$3/4$	5

15. Illustrate the steps of the Hungarian algorithm by converting the assignment tableau below to non-negative integers,

$1/2$	0.5	1	0.6
5	0	$1/3$	7
$1/3$	$3/4$	3	0
0	$1/5$	0	8

SECTION B: Answer the following questions. Each carries *five* marks.

(Ceiling 35 Marks)

16. Solve the following LPP by graphical method,

Maximize; $f(x, y) = 5x + 2y$

Subject to, $x + 3y \leq 14$

$2x + y \leq 8$

$x, y \geq 0$

17. An appliance company manufactures heaters and air conditioners. The production of one heater requires 2 hours in the parts division of the company and 1 hour in the assembly division of the company.The production of one air conditioner requires 1 hour in the parts division of the company and 2 hours in the assembly division of the company. The parts division is operated for at most 8 hours per day and assembly division is operated for at most 10 hours per day. If the profit realized upon sale is $30 per heater and $50 per air conditioner, how many heaters and air conditioners should the company manufacture per day so as to maximize profit. Formulate the corresponding LPP and solve it by graphical method.

18. Solve the LPP represented by the following tableau using Simplex algorithm,

x_1	1	2	$\mathbf{3}$
x_2	$\mathbf{-1}$	4	$\mathbf{-2}$
$\mathbf{-1}$	$\mathbf{-2}$	$\mathbf{-3}$	0
	$= s_1$	$= s_2$	$= g$

19. Apply Simplex algorithm to solve the LPP represented by the following tableau,

x_1	x_2	$\mathbf{-1}$	
$\mathbf{-1}$	$\mathbf{1}$	1	$=-t_1$
1	$\mathbf{-1}$	3	$=-t_2$
1	2	0	$=f$

20. State and prove the Duality theorem.

21. Prove that for any pair of feasible solutions of dual canonical linear programming problem for $f = g$ are optimal solutions.

22. Explain the general balanced transportation problem.

23. Find a basic feasible solution for the following transportation problem,

	D_1	D_2	D_3	D_4	D_5	Supply
O_1	10	20	15	6	0	15
O_2	26	30	30	20	16	10
O_3	28	29	25	13	8	15
O_4	15	20	25	5	5	16
Demand	9	15	9	15	8	

SECTION C: Answer any *two* questions. Each carries *ten* marks.

24. Solve the following canonical maximum LPP by using Simplex algorithm,

Maximize; $\boldsymbol{f(x,y) = x}$

Subject to,

$\boldsymbol{x + y \leq 1}$

$\boldsymbol{x - y \geq 1}$

$\boldsymbol{y - 2x \geq 1}$

$\boldsymbol{x, y \geq 0}$

25. A firm manufactures two types of products A and B and sells them at a profit of Rs.2 on type A and Rs.3 on type B. each product is processed on two machines M_1 and M_2. Type A requires 1 minute of processing time on M_1 and 3 minutes on M_2. Type B requires 1 minute on M_1 and 1 minute on M_2. The machine M_1 is available for not more than 400 minutes and machine M_2 is available for not more than 600 minutes during any working day. Formulate the above problem as a maximization linear programming problem and solve it using simplex method.

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

27. Find the optimal solution of the following transportation problem by using VAM,

	$\boldsymbol{M_1}$	$\boldsymbol{M_2}$	$\boldsymbol{M_3}$	Supply
$\boldsymbol{W_1}$	7	3	4	2
$\boldsymbol{W_2}$	2	1	3	3
$\boldsymbol{W_3}$	3	4	6	5
Demand	2	1	5	

(2x 10 = 20 Marks)