Reg. No .... Name **24U674**

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2024

SEMESTER 6 - MATHEMATICS

COURSE : **19U6CRMAT13 - OPERATIONS RESEARCH (EL)**

(For Regular - 2021 Admission and Supplementary - 2020/2019 Admissions)

Time : Three Hours Max. Marks: 75

PART A

Answer any 10 (2 marks each)

1. What is the optimality condition for a transportation problem? Give the general formula.
2. Find value of the game and saddlepoint for the following payoff matrix;

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

3. Find the dual of the primal

$$\begin{aligned} \text{Minimize} \quad & 2x_1 + 3x_2 \\ \text{subject to} \quad & 3x_1 + 45x_2 \leq 1 \\ & 2x_1 + x_2 = 17 \\ & 8x_1 + 2x_2 \geq 10 \\ & x_1, x_2 \geq 0 \end{aligned}$$

4. Find the saddle point of

	B1	B2	B3	B4
A1	1	7	3	4
A2	5	6	4	5
A3	-1	2	0	3

5. Define balanced transportation problem.
6. Find the initial solution using Least Cost Method

	A	B	C	
1	2	1	3	10
2	4	5	7	25
3	6	0	9	25
4	1	3	5	30
	20	20	15	

7. Define Basic feasible solution.
8. Differentiate between unbounded solution and infeasible solution.
9. What is the standard form of LPP.
10. Define unbalanced transportation problem with example.

11. Identify whether the feasible region formed by the constraints x+y≤4, 3x+3y≥18, x≥0, y≥0 is bounded or unbounded.

12. Consider an LPP with m constraints and n variables, then what is the number of non - basic variable.

(2 x 10 = 20)

PART B

Answer any 5 (5 marks each)

13. Prove that if either the primal or dual has an unbounded objective function , then the other problem has no feasible solution.

14. What can be concluded regarding the solution of the problem Max $f(x) = 3x_1 + 4x_2$ subject to $4x_1 + 3x_2 \geq 12, x_1 + 2x_2 \leq 2$, $x_1, x_2 \geq 0$.

15. If the i^{th} constraint of the primal is equality then show that i^{th} variable of the dual is unrestricted in sign.

16. Find the value of 2 person game using formula with the following payoff.

	B1	B2
A1	-5	10
A2	5	-10

17. Obtain an initial basic feasible solution using NWCR, LCM and VAM for the following transportation problem.

	A	B	C	D	Supply
U	19	30	50	10	7
V	70	30	40	60	9
W	40	8	70	20	18
Demand	5	8	7	14	

18. Use graphical method to solve

$$\begin{aligned} \text{Maximize} \quad & z = 2x_1 + 3x_2 \\ \text{Subject to} \quad & 5x_1 + 7x_2 \leq 35 \\ & 4x_1 + 9x_2 \leq 36. \end{aligned}$$

x_1, x_2 are non negative .

19. Construct the initial simplex table and calculate the first pivoting.

$$\begin{aligned} \text{Max} \quad & 40x_1 + 30x_2 \\ \text{subject to} \quad & x_1 + x_2 \leq 12 \\ & 2x_1 + 1x_2 \leq 16 \\ & x_1, x_2 \geq 0 \end{aligned}$$

20. Briefly explain the mathematical model of assignment problem.

(5 x 5 = 25)

PART C
Answer any 3 (10 marks each)

21. Solve the following payoff matrix using Linear Programming Problem;

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

22. Solve the assignment problem:

	P	Q	R	S	T
A	85	75	65	125	75
B	90	78	66	132	78
C	75	66	57	114	69
D	80	72	60	120	72
E	76	64	56	112	68

23. Solve

$$\begin{aligned} \text{Minimize} \quad & 5x_1 + 3x_2 \\ \text{subject to} \quad & 2x_1 + 4x_2 \leq 12 \\ & 2x_1 + 2x_2 = 10 \\ & 5x_1 + 2x_2 \geq 10 \\ & x_1, x_2 \geq 0 \end{aligned}$$

24. A company has factories at A,B and C which supply to warehouses P,Q and R. Weekly factory capacities are 200,160 and 90 units. Weekly warehouse requirements are 180, 120 and 150 units. shipping cost per unit is given as follows.Determine the optimal distribution for this company to minimize total shipping cost.

	P	Q	R
A	16	20	12
B	14	8	18
C	26	24	16

(10 x 3 = 30)