Reg. No .... Name **23U672**

B. Sc. DEGREE END SEMESTER EXAMINATION : MARCH 2023

SEMESTER 6 : MATHEMATICS

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

(For Regular - 2020 Admission and Supplementary - 2019 Admission)

Time : Three Hours Max. Marks: 75

PART A

Answer any 10 (2 marks each)

1. The corners points of the feasible region determined by the system of linear constraints are (0, 10), (5, 5) (15, 15), (0, 20). Let z= px + qy, where p, q > 0.Condition on p and q so that the maximum of z occurs at both the points (15, 15) and (0, 20) is
2. The linear or non-linear function of variable which is to be maximised is called............
3. Define Artificial variable.
4. If the number of rows and columns are not equal in an assignment problem, how do we solve it.
5. Define Minimax - Minimax principle.
6. Define saddle point.
7. For the LP problem Minimize z = 2x + 3y the coordinates of the corner points of the bounded feasible region are A(3, 3), B(20,3), C(20, 10), D(18, 12) and E(12, 12). What is the minimum and maximum value of z ?
8. What are the constraints of the following LPP

$$\begin{aligned} \text{Maximize} \quad & z = -160y_1 + 30y_2 + 10y_3 \\ \text{Subject to} \quad & -2y_1 + y_2 + y_3 \leq 1 \\ & -4y_1 - y_2 \leq 2. \end{aligned}$$

   y_1, y_3 are non negative and y_2 unrestricted in sign.
9. What is the optimality condition for a transportation problem? Give the general formula.
10. Define balanced transportation problem.
11. If a Linear programming problem has n variables and m constraints, what is the number of basic variables?
12. Find an initial solution of the 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	

(2 x 10 = 20)

PART B

Answer any 5 (5 marks each)

13. If the i^{th} constraint of the primal is equality then prove that i^{th} variable of the dual is unrestricted in sign.
14. Briefly explain Simplex Method.

15. Briefly explain the mathematical model of asignment problem.

16. Prove that the dual of the dual is primal.

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. Solve the following using graphical method

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

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

	B1	B2
A1	-5	10
A2	5	-10

20. Use two phase method to solve
Max $z = x_1 + x_2$ subject to
$7x_1 - 6x_2 \leq 5,$
$6x_1 + 3x_2 \geq 7$
$-3x_1 + 8x_2 \leq 6$
x_1, x_2 are non negative .

(5 x 5 = 25)

PART C
Answer any 3 (10 marks each)

21. Use graphical method to solve
Max $z = x_1 + x_2$ subject to
$7x_1 - 6x_2 \leq 5,$
$6x_1 + 3x_2 \geq 7$
$-3x_1 + 8x_2 \leq 6$
x_1, x_2 are non negative .

22. Find the value of game with the given payoff $\begin{bmatrix} 3 & -2 & 4 \\ -1 & 4 & 2 \\ 2 & 2 & 6 \end{bmatrix}$

23. Obtain an optimal solution using MODI method 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	

24. Find the minimum cost for the following 5 x 5 problem whose cost coefficient are given :

	A	B	C	D	E
1	-2	-4	-8	-6	-1
2	0	-9	-5	-5	-4
3	-3	-8	-9	-2	-6
4	-4	-3	-1	0	-3
5	-9	-5	-8	-9	-5

(10 x 3 = 30)