21P205 (Pages: 2) Name: …..…….

Reg. No: ….……..

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2022

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19P MTH2 C10 - OPERATIONS RESEARCH

(Mathematics)

(2019 Admission onwards)

Time: Three Hours Maximum: 30 Weightage

PART A

Answer ***all*** questions. Each question carries 1 wieghtage.

1. Prove that the set of feasible solutions forms a convex set.
2. What are the two applications of OR?
3. What is the difference between a balanced and unbalanced transportation problem?
4. Define loop in transportation array.
5. Prove that the dual of dual is primal.
6. What is meant by sensitivity analysis?
7. Define mathematical expectation of the game.
8. Define the concept of notion of dominance.

(8 × 1 = 8 Weightage)

PART B

Two questions should be answered from each unit. Each question carries 2 weightage.

UNIT I

9. Let $f(X)$ be defined in a convex domain $K \subseteq E_n$ and be differentiable. Then $f(X)$ is convex if and only if $f(X_2) - f(X_1) \geq (X_2 - X_1)'\nabla f(X_1)$ for all X_1, X_2 in K.
10. Show that the vertex of S_F is a basic feasible solution.
11. What is meant by Simplex multipliers?

UNIT II

12. Show that min $f(X) \geq$ max $\phi(Y)$.
13. Solve the transportation problem.

	D_1	D_2	D_3	D_4	
O_1	1	2	-2	3	70
O_2	2	4	0	1	38
O_3	1	2	-2	5	32
	40	28	30	42	

14. What is meant by Carterer problem?

UNIT III

15. Find the minimum spanning tree in the following undirected graph

Arc	(1,2)	(1,3)	(1,4)	(2,3)	(2,8)	(2,10)	(3,4)	(3,8)	(4,5)	(4,6)
Length	7	4	8	3	9	14	4	10	15	12
Arc	(4,8)	(5,6)	(5,7)	(6,7)	(6,8)	(6,9)	(7,9)	(8,9)	(8,10)	(9,10)
Length	10	4	1	2	20	16	18	3	4	6

16. In sensitivity analysis how can we determine the new optimal solution after introduction of new variables?
17. State and prove the Minimax theorem.

(6 × 2 = 12 Weightage)

PART C

Answer any ***two*** questions. Each question carries 5 weightage.

18. Solve the following problem by simplex method. Also solve it by solving its dual graphically

    Maximize $y_1 + y_2 + y_3$

    Subject to $2y_1 + y_2 + 2y_3 \leq 2,$

    $2y_1 + y_2 + 2y_3 \leq 2,$

    $y_j \geq 0$

    for $j = 1, 2, 3$

19. Show that the maximum flow in a graph is equal to the minimum of the capacities of all possible cuts in it.
20. Solve the problem using branch and bound method.

    Minimize $9x_1 + 10x_2$

    Subject to $0 \leq x_1 \leq 10,$

    $0 \leq x_2 \leq 8,$

    $3x_1 + 5x_2 \geq 45; x_2$ is integer

21. Use notion of dominance to simplify the following payoff matrices and then solve the game

$$\begin{matrix} 0 & 5 & -4 \\ 3 & 9 & -6 \\ 3 & -1 & 2 \end{matrix}$$

(2 × 5 = 10 Weightage)

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