QP CODE: 24019214

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Reg No : ....

Name : ....

B.Sc DEGREE (CBCS) REGULAR / IMPROVEMENT / REAPPEARANCE EXAMINATIONS, MAY 2024

Second Semester

B.Sc Mathematics Model II Computer Science

Complementary Course - MM2CMT02 - MATHEMATICS - OPERATIONS RESEARCH - DUALITY, TRANSPORTATION AND ASSIGNMENT PROBLEM

2017 ADMISSION ONWARDS

C2CC7200

Time: 3 Hours

Max. Marks : 80

Part A

*Answer any **ten** questions.*

*Each question carries **2** marks.*

1. If in the primal LPP , there are n variables and m constraints , how many variables and constraints are there in the dual of the LPP?
2. If in the dual problem, the k^{th} variable y_k is unrestricted, then what we can say about the k^{th} constraint in the primal?
3. Find the dual of the LPP, Min $Z = 5x_1 + x_2 - 2x_3$ subject to $x_1 + 3x_2 + 2x_3 \leq 4$, $2x_1 + 7x_2 - 2x_3 \geq -9$, $x_1 + 4x_2 - 4x_3 \leq 9$, $x_1, x_2, x_3 \geq 0$.
4. Write some applications of linear programming.
5. What are the constraints of transportation problem?
6. If m = 3 , n = 5 in a transportation problem , what is the order of the transportation matrix?
7. If in a transportation problem total demand is less than total supply, what is the procedure to convert it into a balanced transportation problem?
8. Give an example of an unbalaced transportation problem.
9. Define loop in a transportation array.
10. What is a triangular basis?

11. Are the following statements true?
(i) Assignment problem is a particular form of a transportation problem.
(ii) Transportation problem is a particular form of an assignment problem.

12. Write the objective function in an assignment problem.

(10×2=20)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. Find the dual of the LPP, Min $Z = x_1+9x_2 + 3x_3$ subject to $9x_1 + x_2 - 4x_3 \geq 2$, $7x_1 + x_2 + 6x_3 \leq 3$, $x_1 - x_2 +3x_3 = 3$, $x_1, x_2 , x_3 \geq 0$.

14. Use dual simplex method to solve Min $z = 2x_1 + 3x_2$ subject to $2x_1 + 3x_2 \leq 30$, $x_1 + 2x_2 \geq 10$, $x_1 , x_2 \geq 0$.

15. Describe degeneracy in a transportation problem.

16. With the help of an example explain the process " changing the basis " in a transportation problem.

17. A farmer has 3 farms A,B and C which need respectively 100,300,50 units of water annually. The canal can supply 150 units and the tube well 200 units while the balance is left at the mercy of rain god. The following table shows the cost per unit of water in a dry year, when rain totally fails. The third row giving the cost of failure of rain. Find how the canal and tube well water should utilize to minimize the total cost.

	A	B	C	
Canal	3	5	7	150
Tube well	6	4	10	200
Failure of rain	8	10	3	100
	100	300	50	

18. Test whether the following six variables shown in the following table form a triangular set of equations,where m = 3 , n = 4.

x_{11}	x_{12}		x_{14}
x_{21}	x_{22}		
		x_{33}	

19. State the assignment problem.

20. Give an algorithm to solve an assignment problem.

21. Using the following cost matrix determine (a) optimal job assignment (b) cost of assignment.

		Jobs				
		J_1	J_2	J_3	J_4	J_5
Machines	A	10	3	3	2	8
	B	9	7	8	2	7
	C	7	5	6	2	4
	D	3	5	8	2	4
	E	9	10	9	6	10

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **15** marks.*

22. For the problem Min $z = x_1 + x_2$ subject to $2x_1 + x_2 \geq 8$, $3x_1 + 7x_2 \geq 21$, $x_1 , x_2 \geq 0$ (i) Find the dual (ii) Solve the primal and dual graphically and verify that the optimum value of the primal if exists is equal to the optimal value of the dual.

23. Solve the following transportation problem for minimum cost starting with the degenerate solution $x_{12} = 30$, $x_{21} = 40$, $x_{32} = 20$, $x_{43} = 60$.

	D_1	D_2	D_3	a_i
O_1	4	5	2	30
O_2	4	1	3	40
O_3	3	6	2	20
O_4	2	3	7	60
b_j	40	50	60	150

24. Solve the following T.P. for minimum cost with the cost coefficients , demands and supplies as given in following table. Also begin the solution procedure with the solution $x_{11} = 40$, $x_{12} = 28$, $x_{13} = 2$, $x_{24} = 38$, $x_{33} = 28$, $x_{34} = 4$.

	D_1	D_2	D_3	D_4	a_i
O_1	1	2	-2	3	70
O_2	2	4	0	1	38
O_3	1	2	-2	5	32
b_j	40	28	30	42	140

25. A salesman has to visit 5 cities C_i , i = 1,2,3,4,5. He should start from C_1 , his headquarters , visit each city once and only once and return to C_1 . The cost of going from

C_i to C_j is given in the following table. Blank indicates that the journey is not possible . Find how he should travel to minimize cost.

	C_1	C_2	C_3	C_4	C_5
C_1	-	20	4	15	-
C_2	6	-	5	-	10
C_3	7	4	-	6	8
C_4	11	5	8	-	12
C_5	-	13	9	6	-

(2×15=30)