



22103107

QP CODE: 22103107

Reg No :

Name :

**B.Sc DEGREE (CBCS) REGULAR / IMPROVEMENT / REAPPEARANCE
EXAMINATIONS, OCTOBER 2022**

Second Semester

B.Sc Mathematics Model II Computer Science

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

2017 ADMISSION ONWARDS

B47AEE14

Time: 3 Hours

Max. Marks : 80

Part A

*Answer any **ten** questions.*

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

1. Define dual of an LPP
2. Consider the L.P.P. : $\sum_{j=1}^n c_j x_j$ with respect to the constraints $\sum_{j=1}^n a_{ij} x_j \geq b_i$ and $x_j \geq 0$ for $j = 1, 2, \dots, n$. Write the constraints of the dual L.P.P.
3. Find the dual of the LPP, Max $Z = 5x_1 + 5x_2 + 9x_3$ subject to $2x_1 + x_2 - x_3 \leq 4$, $-2x_1 + x_2 - 5x_3 \geq -8$, $4x_1 + x_2 + x_3 \leq 8$, $x_1, x_2, x_3 \geq 0$.
4. (a) What is the dual of the dual in an LPP?
(b) If in the optimal solution of the primal and dual assume that a primal slack variable x_{n+i} is positive. What is the value of the corresponding dual variable y_i ?
5. What is the objective function of transportation problem?
6. Assume that there are 5 sources and 7 sinks in a transportation problem. What is the order of the transportation matrix?
7. In a basic solution of a transportation problem what is the maximum number of variables having non zero values?
8. Give an example of an unbalanced transportation problem.

9. Define loop in a transportation array.
10. When we say that a transportation problem is balanced?
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 constraints in an assignment problem.

(10×2=20)

Part B

Answer any **six** questions.

Each question carries **5** marks.

13. Give the dual of the LPP $\text{Max } z = x + 2y$ subject to $2x + 3y \geq 4$, $3x + 4y = 5$, $x \geq 0$ and y is unrestricted in sign
14. Use dual simplex method to solve $\text{Min } z = 2x_1 + 3x_2$ subject to $2x_1 + 3x_2 \leq 30$, $x_1 + 2x_2 \geq 10$, $x_1, x_2 \geq 0$.
15. Explain the term "transportation array".
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_{12}	x_{13}	
	x_{22}		
x_{31}		x_{33}	x_{34}



19. State the assignment problem.
20. State generalised transportation problem.
21. 4 operators A,B,C and D are to be assigned to 4 machines M_1, M_2, M_3 and M_4 with the restriction that A and C can not work on M_3 and M_2 respectively. The assignment cost are given below. Find the minimum assignment cost.

	M_1	M_2	M_3	M_4
A	5	2	-	5
B	7	3	2	4
C	9	-	5	3
D	7	7	6	2

(6×5=30)

Part C

Answer any **two** questions.

Each question carries **15** marks.

22. A small manufacturing company produces one-band pocket radios and two-band table radios. Each two-band model requires twice as much time as one-band model. If the company wish to produce only two-band models it would manufacture 150 units per week. The company is licensed to produce in all not more than 250 units per week. The market survey has shown that no more than 100 pieces of two-band models per week to be sold. The company is also committed to supply atleast 50 pieces of one-band model per week. If the net profit on the sale of one-band model is Rs. 10 per piece and on the two band model is Rs. 15 per piece how should the company planned its production to maximize profit?

23. Solve the following transportation problem with the following cost matrix.

	D_1	D_2	D_3	D_4	a_i
O_1	3	2	5	4	25
O_2	4	1	7	6	35
O_3	7	8	3	5	30
b_j	10	18	20	42	90



24. Power stations P_j , $j = 1, 2, 3, 4$ run on coal found in mines Q_i is a_i and maximum possible production of power at P_j is b_j . The cost of production of unit quantity of coal at Q_i is c_i and its cost of transportation to P_j is c_{ij} . The unit quantity of coal produces h_j units of power at P_j . How should coal be distributed so that the total cost of coal at power station is minimum and what is the power produced at each stations. Solve the problem for the following data.

i	C_{ij}				C_i	a_i
1	4	3	2	1	10	750
2	3	5	6	2	15	350
3	6	4	3	3	20	400
h_j	1/2	1/2	1/3	1/4		
b_j	100	150	300	200		
j	1	2	3	4		

25. A group of friends six boys and six girls liked each other and decided to marry each other among themselves with the objective of maximize the total happiness of the group through monogamy. Each girl 'i' rates her preference for a boy 'j' as a_{ij} and each boy rates his preference for a girl as b_{ji} . The coefficient $c_{ij} = a_{ij} + b_{ji}$ is taken as a measure of the couple's happiness if married. With the following table for c_{ij} how should the partners be chosen?

		Girls					
		1	2	3	4	5	6
Boys	1	5	0	-6	8	7	-4
	2	-5	2	-3	0	6	-7
	3	3	-4	4	3	-5	2
	4	3	4	9	7	-2	3
	5	0	-1	-3	2	-1	2
	6	4	3	2	-1	0	4

(2×15=30)