QP CODE: 20101107 20101107 **Reg No** : ....

Name : ....

B.Sc. DEGREE (CBCS) EXAMINATION, NOVEMBER 2020

Second Semester

B.Sc Mathematics Model II Computer Science

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

2017 ADMISSION ONWARDS

15954E41

Time: 3 Hours Max. Marks : 80

Part A

*Answer any **ten** questions.*

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

1. Define dual of an LPP.
2. (a) In the primal problem if the objective is to maximise,then what is the objective in the dual problem?
(b) How many terms are there in the objective function of the dual of an LPP with n variables and m constraints?
3. Find the dual of the LPP, Max $Z = x_1 + 2x_2$ subject to $x_1 + x_2 = 5$, $2x_1 + 3x_2 \leq 6$, $x_1, x_2 \geq 0$
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 of transportation problem?
6. If m = 5, n = 6 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. When we stop the transportation algorithm while solving a 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 $Z = 2x_2 + 5x_3$ subject to $x_1 + x_2 \geq 2$, $2x_1 + x_2 + 6x_3 \leq 6$, $x_1 - x_2 + 3x_3 = 4$, $x_1, x_2, x_3 \geq 0$

14. Write some applications of duality.

15. Describe 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_{21}		x_{23}	
		x_{33}	x_{34}

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. Solve the following problem by simplex method. Also solve it by solving its dual graphically. Max $z = y_1 + y_2 + y_3$ subject to $2y_1 + y_2 + 2y_3 \leq 2$, $4y_1 + 2y_2 + y_3 \leq 2$, $y_j \geq 0$, j = 1,2,3.

23. Food bags have to be lifted by 3 different types of aircrafts A_1 , A_2 , A_3 from an airport and dropped in flood affected villages V_1 , V_2 , V_3 . The quantity of food that can be carried in one trip by aircraft A_i to village V_j is given in the following table. The total number of trips that A_i can make in a day is given in the last column. The number of trips possible in each day to village V_j is given in the last row. Find the number of trips each aircraft should make on each village so that the total quantity of food transported in a day is maximum.

	V_1	V_2	V_3	V_4	V_5	
A_1	10	8	6	9	12	50
A_2	5	3	8	4	10	90
A_3	7	9	6	10	4	60
	100	80	70	40	20	

24. Solve the following T.P. for minimum cost with the cost coefficients , demands and supplies as given in following table.

	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. For seminars are to be organized for a class in a week Monday through Friday such that not more than one seminar is held per day and the number of students who cannot attend is kept at the

minimum. It is estimated that the number of students who are not free to attend a seminar on a particular day is as follows. Also seminar S_3 can not be held on Tuesday. Write the optimum schedule of seminars to maximize attendance.

	S_1	S_2	S_3	S_4
Mon	60	20	50	40
Tue	40	30	10	30
Wed	30	20	60	20
Thu	20	30	30	30
Fri	10	30	10	20

(2×15=30)