



20100571

QP CODE: 20100571

Reg No : .....

Name : .....

**BSc DEGREE (CBCS) EXAMINATION, MARCH 2020**

**Sixth Semester**

**Choice Based Core Course - MM6CBT01 - OPERATIONS RESEARCH**

B.Sc Mathematics Model I, B.Sc Mathematics Model II Computer Science

2017 Admission Onwards

E6EBE66E

Time: 3 Hours

Weightage: 80

**Part A**

*Answer any ten questions.*

*Each question carries 2 marks.*

1. Define basic feasible solution of an LP problem.
2. Use the Graphical method to solve the given LP problem.  
Maximize  $Z = -x_1 + 2x_2$  subject to the constraints  
 $x_1 - x_2 \leq -1$ ,  $-0.5x_1 + x_2 \leq 2$ ,  $x_1, x_2 \geq 0$ .
3. Define Iso- profit ( cost) function line.
4. How can you identify a key row in simplex table and Define key element .
5. Define un restricted variables.
6. State complete slackness theorem.
7. What is the indicator of an alternate optimal solution in a transportation problem?
8. Why is the enumeration method not always suitable for solving an assignment problem?
9. Find an Initial Basic Feasible Solution by North West Corner Method:

	D1	D2	D3	D4	Supply
O1	21	16	15	3	11
O2	17	18	14	23	13
O3	32	27	18	41	19
Demand	6	10	12	15	



10. Find an optimal assignment to minimize cost.

		Programmes			
		A	B	C	D
Programmers	1	2	3	4	5
	2	4	5	6	7
	3	7	8	9	8
	4	3	5	8	4

11. Explain two person zero sum game with a suitable example.
12. Define pure strategy and mixed strategy.

(10×2=20)

**Part B**

Answer any six questions.

Each question carries 5 marks.

13. A manufacturer produces two different models, X and Y of the same product. Model X makes a contribution of Rs.50 per unit and model Y, Rs.30 per unit, towards total profit. Raw materials  $r_1$  and  $r_2$  are required for production. At least 18 kg of  $r_1$  and 12 kg of  $r_2$  must be used daily. Also at most 34 hours of labour are to be utilized. A quantity of 2 kg of  $r_1$  is needed for model X and 1 kg of  $r_1$  for model Y. For each of X and Y, 1 kg of  $r_2$  is required. It takes 3 hours to manufacture model X and 2 hours to manufacture model Y. Formulate this problem as an LP model.
14. a) Define slack variables, surplus variables and artificial variables in an LP problem.  
b) Introduce the above variables using an example.
15. Use Big -M method and find first two tables, to solve the following LP problem.  
Maximize  $Z = x_1 + 2x_2 + 3x_3 - x_4$  subject to the constraints  
 $x_1 + 2x_2 + 3x_3 = 15,$   
 $2x_1 + x_2 + 5x_3 = 20,$
16. Solve the following LP problem  
Maximize  $Z = 6x_1 + 4x_2$  subject to the constraints  
 $x_1 + x_2 \leq 5, x_2 \geq 8,$  and  $x_1, x_2 \geq 0.$
17. Explain primal dual relationship in LP problem.
18. Write the dual of the following LP problem.  
Minimize  $Z = 2x_1 + 5x_2 + 6x_3$  subject to the constraints  
 $5x_1 - 6x_2 - x_3 \leq 3,$   
 $-2x_1 + x_2 + 4x_3 \leq 4,$   
 $x_1 - 5x_2 + 3x_3 \leq 1,$   
 $-3x_1 - 3x_2 + 7x_3 \leq 6$  and  $x_1, x_2, x_3 \geq 0$



19. Find an Initial Basic Feasible Solution by VAM and solve the following Transportation Problem to minimize cost:

	D1	D2	D3	D4	Supply
O1	1	2	-2	3	70
O2	2	4	0	1	38
O3	1	2	-2	5	32
Demand	40	28	30	42	

20. Find an optimal assignment to minimize cost:

		Job			
		I	II	III	IV
Contractor	1	10	24	30	15
	2	16	22	28	12
	3	12	20	32	10
	4	9	26	34	16

21. Solve the game using matrix method after reducing to a 2 x 2 game,

		Player B		
Player A		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
A <sub>1</sub>		1	7	2
A <sub>2</sub>		6	2	7
A <sub>3</sub>		5	1	6

(6×5=30)

**Part C**

Answer any two questions.

Each question carries 15 marks.

22. Solve using Simplex method ,  
 Maximize  $Z = 2x_1 + 5x_2$  Subject to the constraints  
 $x_1 + 4x_2 \leq 24$ ,  
 $3x_1 + x_2 \leq 21$ ,  
 $x_1 + x_2 \leq 9$ ,  $x_1, x_2 \geq 0$

23. Find an Initial Basic Feasible Solution by the North West Corner Method and proceed to solve:

	D1	D2	D3	Supply
O1	7	3	4	2
O2	2	1	3	3
O3	3	4	6	5
Demand	4	1	5	



24. Find an optimal assignment schedule to minimize loss. Also find an alternate solution if it exists:

		Territory			
		I	II	III	IV
Salesman	1	0	7	14	21
	2	12	17	22	27
	3	12	17	22	27
	4	18	22	26	30

25. Solve the zero sum game using Linear Programming method .

Player A	Player B		
	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
A <sub>1</sub>	1	-1	-1
A <sub>2</sub>	-1	-1	3
A <sub>3</sub>	-1	2	-1

(2×15=30)