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Reg. No. :

Name :

Fifth Semester B.A./B.Sc./B.Com. Degree Examination, March 2023

First Degree Programme Under CBCSS

Double Main Programme

Mathematics

Open Course

MM 1551.1 : OPERATIONS RESEARCH

(2020 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – I

Answer **all** the questions. They carry **1** mark each.

1. Define feasible solution of LPP?
2. What is objective function?
3. Write the first step in formulation of LPP
4. What is transportation problem?
5. When a basic feasible solution is called non-degenerate?
6. What you mean by balanced transportation problem?
7. What is CPM?

P.T.O.



8. What are corner points of feasible region?
9. Define dummy activity?
10. Who developed assignment algorithm?

(10 × 1 = 10 Marks)

SECTION – II

Answer **any eight** questions. These question carry **2** marks each.

11. In which case alternate solutions of LPP exist?
12. What are the applications of linear programming techniques?
13. Distinguish between assignment problem and transportation problem.
14. What are degenerate and non-degenerate basic feasible solutions?
15. Define event?
16. Explain simplex method.
17. Use graphical method to solve

$$\text{Maximize : } Z = 6x_1 + 11x_2$$

$$\text{Subject to : } 2x_1 + x_2 \leq 104$$

$$x_1 + 2x_2 \leq 76$$

$$x_1, x_2 \geq 0$$

18. Write a short note on unbalanced transportation problem
19. What is the minimum number of lines covering all zeros in a reduced cost matrix of order n?
20. What is modi method?



21. What vertex is common to the graph of inequalities $2x + y \geq 2$ and $x - y \leq 3$.
22. Write the mathematical form of a LPP.
23. When does a transportation problem have a unique solution?
24. Write down the basic steps involved in solving a transportation problem
25. Why assignment problem will always provide degeneracy?
26. Why a transportation technique or simplex method cannot used to solve an assignment problem?

(8 × 2 = 16 Marks)

SECTION – III

Answer **any six** questions. These question carry 4 marks each.

27. Use simplex method to solve; *Maximize* $Z = 2x_1 + 4x_2$

$$\text{Subject to } 2x_1 + 3x_2 \leq 48$$

$$x_1 + 3x_2 \leq 42$$

$$x_1 + x_2 \leq 21$$

$$x_1, x_2 \geq 0$$

28. Solve the following transportation problem

		To			Supply
		1	2	3	
From	1	2	7	4	5
	2	3	3	1	8
	3	5	4	7	7
	4	1	6	2	14
Demand		7	9	18	34

29. What are the differences of PERT and CPM?



30. A company has 4 persons to do 4 jobs. Each job can be assigned to one and only one person. The cost of each machine is given in the following table:

		Machines			
		1	2	3	4
Jobs	I	12	30	21	15
	II	18	23	9	31
	III	44	25	24	21
	IV	23	30	28	14

What are the job assignments which will minimize the cost?

31. What are the procedures for the construction of a network diagram?
 32. Use graphical method to solve the following LPP

Maximize; $Z = 2x + 2y$

Subject to: $x + y \leq 400$

$2x + y \leq 600$

$x, y \geq 0$

33. Write the algorithm for simplex method.
 34. Construct the network diagram for the following activity data

Activity : A B C D E F G H I J K L

Preceded by : – – A B,C D E B,C F F,G H,I B F,G,K

35. Explain the difference between a transportation problem and an assignment problem.
 36. Solve the following LPP

Minimize: $Z = 40x + 24y$

Subject to: $20x + 50y \geq 4800$

$80x + 50y \geq 7200$

$x, y \geq 0$



37. What is degeneracy? Discuss a method to resolve degeneracy in LPP.
38. Explain optimality test in transportation problem.

(6 × 4 = 24 Marks)

SECTION – IV

Answer **any two** questions. These questions carry **15** marks each.

39. An animal feed manufactures has to produce 200kg of a feed mixture consisting of two ingredients x_1 and x_2 , x_1 costs Rs.6 per kg while x_2 Rs.16 per kg. Not more than 80kg of x_1 and not less than 60kg of x_2 can be used. Solve graphically so as to minimize the total cost.

40. Use simplex method to solve the following linear programming

$$\text{Minimize: } Z = x_1 - 3x_2 + 2x_3$$

$$\text{Subject to: } 3x_1 - x_2 + 2x_3 \leq 7$$

$$-2x_1 + 4x_2 \leq 12$$

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

$$x_1, x_2, x_3 \geq 0$$

41. A company is faced with the problem of assigning six different machines to five different jobs The cost are estimated as follows (hundreds of rupees)

		Job				
		1	2	3	4	5
Machine	1	2.5	5	1	6	1
	2	2	5	1.5	7	3
	3	3	6.5	2	8	3
	4	3.5	7	2	9	4.5
	5	4	7	3	9	6
	6	6	9	5	10	6

Solve the problem assuring that the objective is to minimise total cost



42. A company has four plants P_1, P_2, P_3, P_4 from which it supplies to three markets M_1, M_2, M_3 . Determine the optimal transportation plan from the following data giving the plant to market shifting costs, quantities available at plant and quantities required at each market

Market	P_1	P_2	P_3	P_4	Required at Market
M_1	19	14	23	11	11
M_2	15	16	12	21	13
M_3	30	25	16	39	19
Available at plant	6	10	12	15	43

43. Find an optimal solution the following LPP without using simplex algorithm

$$\text{Minimize: } Z = 2x_1 + 3x_2 + 4x_3 + 7x_4$$

$$\text{Subject to: } 2x_1 + 3x_2 - x_3 + 4x_4 = 8$$

$$x_1 - 2x_2 + 6x_3 - 7x_4 = -3$$

$$x_i \geq 0, i = 1, 2, 3, 4$$

44. A project schedule has the following characteristics.

Activity	Expected duration(Weeks)		
	Optimistic	Most likely	Pessimistic
1-2	3	3	3
2-3	3	6	9
2-4	2	4	6
3-5	4	6	8
4-6	4	6	8
5-6	0	0	0
5-7	3	4	5
6-7	2	5	8

- (a) Draw the project network and trace all the possible paths from it

- (b) Determine the critical path and the expected project time.

(2 × 15 = 30 Marks)

