Subject Title: Operations Research   Prepared by: E.Sukanya
Year: III   Semester: VI   Updated on: 25-03-

Unit - I:

1. Definitions of (i) Operations Research (ii) Deterministic model (iii) Probability model
2. Definitions of (i) Decission Variable (ii) Convex sets (iii) Extreme points of Convex Sets.
3. Definitions of (i) Solution (ii) Feasible solution (iii) Basic Solution (iv) Basic Feasible Solution (v) Degenerate Solution (vi) Non-degenerate Solution (vii) Optimum Solution (viii) unbounded solution.
4. Explain about the Fundamental theorem of LPP.
5. Describe about the Graphical Method Algorithm.
6. Describe about the Simplex Method Algorithm.
7. Explain the Characteristics of Standard Form of LPP.
8. Solve the following LP problem by Graphical Method:

   Max z=$5x_1 + 7x_2$; STC:$x_1 + x_2 \leq 4, 3x_1 + 8x_2 \leq 24,\ 10x_1 + 7x_2 \leq 35, x_{1,}x_2 \geq 0$
9. Solve the LP problem by Simplex Method:

   Maxz=$3x_1 + 5x_2 + 4x_3; STC: 2x_1 + 3x_2 \leq 8, 2x_2 + 5x_3 \leq 10,\ 3x_1 + 2x_2 + 4x_3 \leq 15\ \ and\ x_1, x_2, x_3 \geq 0$
10. Solve the LP problem by Simplex Method:

    Maxz=$x_1 - 3x_2 + 2x_3\ \ STC: 3x_1 - x_2 + 3x_3 \leq 7, -2x_1 + 4x_2 \leq 12, -4x_1 + 3x_2 + 8x_3 \leq 10\ \ and\ x_1, x_2, x_3 \geq 0$

Unit - II:

11. Describe the algorithm of Big M or Penalty method.
12. Describe the algorithm of Two Phase Method
13. Describe the algorithm of Duality.
14. Explain the dual of the Dual is Primal.
15. Definition of (i) Artificial variable (ii) Degeneracy in LPP (iii) Duality of LPP (iv) Primal and Dual pairs.

16. Solve the following LP problem by Big M method.

    Max z= $x_1 + 2x_2 + 3x_3 - x_4$; STC: $x_1 + 2x_2 + 3x_3 = 15;\ 2x_1 + x_2 + 5x_3 = 20; x_1 + 2x_2 + x_3 + x_4$=10 and $x_1, x_2, x_3, x_4 \geq 0$

17. Solve the following problem by Two-Phase Simplex Method:

    Min z=$x_1 + x_2;\ STC: 2x_1 + x_2 \geq 4, x_1 + 7x_2 \geq 7\ and\ x_1, x_2 \geq 0$

18. Write the Dual of the following LP problem:

    Min z=$3x_1 - 2x_2 + 4x_3; STC: 3x_1 + 5x_2 + 4x_3 \geq 7, 6x_1 + x_2 + 3x_3 \geq 4; 7x_1 - 2x_2 - x_3 \leq 10;$

    $$x_1 - 2x_2 + 5x_3 \geq 4; 4x_1 + 7x_2 - 2x_3 \geq 2\ and\ x_1, x_2, x_3 \geq 0.$$

19. Obtain the dual of the LP problem:

    Min z=$x_1 + x_2 + x_3; STC: x_1 - 3x_2 + 4x_3 = 5; x_1 - 2x_2 \leq 3, 2x_2 - x_3 \geq 4, x_1, x_2 \geq 0\ and\ x_3$ is unrestricted.

20. Solve the following problem by Dual Simplex Method:

    Min z= $2x_1 + x_2; STC: 3x_1 + x_2 \geq 3,\ 4x_1 + 3x_2 \geq 6, x_1 + 2x_2 \geq 3\ and\ x_1, x_2 \geq 0$

Unit - III:

21. Definitions of (i) Feasible Solution (ii) Basic Feasible Solution (iii) Degenerate basic feasible solution (iv) Optimum basic feasible solution (v) Transhipment problem
22. Describe the algorithm of North West Corner Rule (NWCR)
23. Describe the algorithm of Matrix Minima method or Least Cost Method.
24. Describe the algorithm of VAM.
25. State the algorithm of Stepping stone method
26. State The Algorithm Of UV Method or MODI Method
27. Obtain an Initial Feasible Solution by NWCR

	D1	D2	D3	D4	
O1	4	6	8	13	500
O2	13	11	10	8	700
O3	14	4	10	13	300
O4	9	11	13	3	500
	400	350	1050	200	

28. Obtain an Initial Basic Feasible Solution by Least cost Entry method to the following transportation problem.

	Destinations				
origins	1	2	3	4	Availability
I	20	22	17	4	120
II	24	37	9	7	70
III	32	37	20	15	50
	60	40	30	110	

29. Obtain an Initial Basic Feasible Solution by using VAM to the following Transportation problem

	Destinations				
origins	D1	D2	D3	D4	Capacities
I	6	6	4	4	5
II	7	9	1	2	7
III	6	5	16	7	8
IV	11	9	10	2	10
	10	5	10	5	

30. Obtain an Optimum Basic Feasible Solution by using Stepping Stone Method

	Destinations				
origins	I	II	III	IV	Availability
A	4	6	8	6	700
B	3	5	2	5	400
C	3	9	6	5	600
	400	450	350	500	

31. Solve the following Transportation problem using UV –method/ MODI method

	B1	B2	B3	B4	B5	Availability
A1	3	4	6	8	9	20
A2	2	10	1	5	8	30
A3	7	11	20	40	3	15
A4	2	1	9	14	16	13
	40	6	8	18	6	

32. Resolve Degeneracy if occurs and solve the following Transportation problem

	D1	D2	D3	Availability
O1	8	5	6	120
O2	15	10	12	80
O3	3	9	10	80
Req	150	80	50	

33. Consider a Transhipment problem with two sources, three destinations, the cost for shipment in rupees are given below. Determine the Optimum Schedule

	S1	S2	D1	D2	D3	Availability
S1	0	65	1	3	15	150
S2	1	0	3	5	25	300
D1	3	15	0	23	1	-
D2	25	3	1	0	3	-
D3	45	55	65	3	0	-

Unit - IV

34. Describe the Hungarian method for an assignment problem.
35. Describe the algorithm of Johnson's algorithm to obtain optimum sequence for n jobs and two machines
36. Describe the algorithm of n jobs through three machines
37. Describe the algorithm of n jobs through K machines
38. A department has four sub ordinates and four tasks have to be performed. Subordinates

differ in efficiency and tasks differ in their intrinsic difficulty. Time each man would take to perform each task is given in the effectiveness matrix. How the tasks should be allocated to each person so as to minimize the total man-hours?

		I	II	III	IV
Task	A	8	26	17	11
	B	13	28	4	26
	C	38	19	18	15
	D	19	26	24	10

39. The owner of a small machine shop has four machinists available to do jobs for the day.Five jobs are offered with expected profit for each machinist on each job as follows.

	1	2	3	4
A	32	41	57	18
B	48	54	62	34
C	20	31	81	57
D	71	43	41	47
E	52	29	51	50

Find by using an assignment method, the assignment of machinists to jobs that will result a maximum profit. Which job should be declined.

40. A company has 4 machines on which to do 3 jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following table.

		Machine			
		W	X	Y	Z
Job	A	18	24	28	32
	B	8	13	17	19
	C	10	15	19	22

What are the job assignment which will minimize the cost?

41. We have 5 jobs, each of which has to be processed on two machines A and B in the order AB. Processing times are given in the following table (in hours)

Jobs	1	2	3	4	5
Mach A	6	2	10	4	11
Mach B	3	7	8	9	5

Determine an order in which these jobs should be processed so as to minimize the total elapsed time.

42. Determine the optimal sequence of jobs that minimizes the total elapsed time base on the given processing times

Jobs	1	2	3	4	5	6	7
Mach A	3	8	7	4	9	8	7
Mach B	4	3	2	5	1	4	3
Mach C	6	7	5	11	5	6	12