THE LNM INSTITUTE OF INFORMATION TECHNOLOGY
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Optimization 2019 (Odd)
Computation by Computer/Programming
Simplex, Big-M, Two-Phase Methods, Duality, Transportation Problem, Game Theory, Sequencing Problem (Job assignment in Machine)

Write the computer program for the following problems and submit programs, flow chart of your program and the results/output. **You can take help from your friends but do not copy directly**.

1. Solve the following L.P.P by Simplex Method:
   Max. $z = 4x_1 + 5x_2 + 9x_3 + 11x_4$
   subject to $x_1 + x_2 + x_3 + x_4 \leq 15$,
   $7x_1 + 5x_2 + 3x_3 + 2x_4 \leq 120$,
   $3x_1 + 5x_2 + 10x_3 + 15x_4 \leq 100$,
   $x_1, x_2, x_3, x_3 \geq 0$.

   [Ans. Optimal solution is $x_1 = 50/7$, $x_2 = 0$, $x_3 = 55/7$, $x_4 = 0$ and $z_{max} = 695/78$]

2. Solve the following L.P.P by Charnes Big M-Method:
   Min. $z = 2x_1 + 4x_2 + x_3$
   subject to $x_1 + 2x_2 - x_3 \leq 5$,
   $2x_1 - x_2 + 2x_3 = 2$,
   $-x_1 + 2x_2 + 2x_3 \geq 1$,
   $x_1, x_2, x_3 \geq 0$.

   [Ans. $z_{min} = 1$]

3. Solve the following L.P.P by Two Phase Method:
   Max. $z = 2x_1 + x_2 + x_3$
   subject to $4x_1 + 6x_2 + 3x_3 \leq 8$,
   $3x_1 - 6x_2 - 4x_3 \leq 1$,
   $2x_1 + 3x_2 - 5x_3 \geq 4$,
   $x_1, x_2, x_3 \geq 0$.

   [Ans. Optimal solution is $x_1 = 9/7$, $x_2 = 10/21$, $x_3 = 0$, and $z_{max} = 64/21$]

4. By solving the dual of the the following L.P.P, find the minimum value of z.:
   Min. $z = 3x_1 - 2x_2 + 4x_3$
   subject to $3x_1 + 5x_2 + 4x_3 \geq 7$,
   $6x_1 + x_2 + x_3 \geq 4$,
   $7x_1 - 2x_2 - x_3 \leq 10$,
   $4x_1 + 7x_2 - 2x_3 \geq 2$,
   $x_1 - 2x_2 + 5x_3 \geq 3$,
   $x_1, x_2, x_3 \geq 0$.

   [Ans. It has no Feasible Solution]

5. Find the initial B.F.S of the following T.P. by Matrix Minimum Method.

	D_1	D_2	D_3	a_i
O_1	10	9	8	8
O_2	10	7	10	7
O_3	11	9	7	9
O_4	12	14	10	4
b_j	10	10	8	

   [Ans. Initial B.F.S is a $x_{11} = 5$, $x_{12} = 3$, $x_{22} = 7$, $x_{31} = 1$, $x_{33} = 8$, $x_{41} = 4$]

6. For the following T.P., obtain the different starting solutions by adopting VAM and northwest-corner method and find out which solution is better.

	D_1	D_2	D_3	a_i
O_1	5	1	8	12
O_2	2	4	0	14
O_3	3	6	7	4
b_j	9	10	11	

[Ans. Initial B.F.S by northwest-corner method is $x_{11} = 9$, $x_{12} = 3$, $x_{22} = 7$, $x_{23} = 7$, $x_{33} = 4$ and the corresponding cost is 104. Initial B.F.S by VAM is $x_{11} = 2$, $x_{12} = 10$, $x_{21} = 3$, $x_{23} = 11$, $x_{31} = 4$ and the corresponding cost is 38.]

7. Obtain an initial B.F.S. by row minimum and column minimum method to the following T.P.

	D_1	D_2	D_3	D_4	a_i
O_1	19	30	50	10	7
O_2	70	30	40	60	9
O_3	40	8	70	20	18
b_j	5	8	7	14	

[Ans. Initial B.F.S. by row minimum method is $x_{14} = 7$, $x_{22} = 8$, $x_{23} = 1$, $x_{31} = 5$, $x_{33} = 7$, $x_{34} = 6$ and by column minimum methodt is $x_{11} = 5$, $x_{14} = 2$, $x_{23} = 7$, $x_{24} = 2$, $x_{32} = 8$, $x_{34} = 10$]

8. Consider four bases of operations B_i and three targets T_j. The tops of bombs per air craft from any base that can be delivered are given in the following tableau:

	T_1	T_2	T_3
B_1	8	6	5
B_2	6	6	6
B_3	10	8	4
B_4	8	6	4

The daily sortie capability of each of the four bases is 150 sorties per day. The daily requirement in sorties over each individual target is 200 and it is decided for the maximize the total tonnage over all three targets. Find the intial allocation of sorties from each base to each target by (i) the northwest-corner method (ii) Matrix Minimum Method (iii) VAM method.

9. Given the following data for cost:

	D_1	D_2	D_3	a_i
O_1	2	2	3	10
O_2	4	1	2	15
O_3	1	3	X	40
b_j	20	15	30	

The cost of shipment from third source to the third destination is not known and it is dicided that the transportation cost of all the units to their destinations is a minimum. Find the intial B.F.S for the transportation problem.

10. Two players (called Odd and Even) simultaneously choose the number of fingers (1 or 2) to put out. If the sum of the fingers put out by both players is odd, then Odd wins Rs. 1 from Even. If the sum of the fingers is even, then Even wins Rs. 1 from Odd. We consider the row player to be Odd and the column player to be Even. Formulate the game and determine whether this game has a saddle point. Find the solution of the game.

11. During the 8 to 9 P.M. time slot, two networks are vying for an audience of 100 million viewers. The networks must simultaneously announce the type of show they will air in that time slot. The possible choices for each network and the number of network 1 view- ers (in millions) for each choice are shown in the Table below. For example, if both networks choose a western, the matrix indicates that 35 million people will watch network 1 and $100 - 35 = 65$ million people will watch network 2. Thus, we have a two-person constant-sum game with $c = 100$ (million). Does this game have a saddle point? What is the value of the game to network 1?

Network 2			
Network 1	Western	Soap Opera	Comedy
Western	35	15	60
Soap Opera	45	58	50
Comedy	38	14	70

12. Find the value and the optimal strategies for the following two- person zero-sum game:

4	5	5	8
6	7	6	9
5	7	5	4
6	6	5	5

13. Show that the following pay-off matrix involves more than one saddle point. Find the solution of the game and the value of the game.

-2	15	-2
-6	-6	-4
-5	18	-8

14. Suppose we have six 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. Determine an order in which these jobs should be processed so as to minimize the total processing time.

Job	1	2	3	4	5	6
Machine A	11	18	9	8	12	12
Machine B	21	20	13	18	11	14