SOMANI'S Approximation Method (SAM): An Innovative Method for finding optimal Transportation Cost

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Abstract: Transportation problem is one of the sub classes of Linear Programming Problem (LPP) in which the objective is to transport various quantities of a single product that are stored at various origins to several destinations in such a way that the total transportation cost is minimum. The costs of shipping from sources to destinations are indicated by the entries in the matrix. To achieve this objective we must know the amount and location of available supplies and the quantities demanded. The different solution procedure of such type of problem illustrate in given paper.

Keywords: Transportation problem, Source, Destination, SAM Method

I. INTRODUCTION

All The Transportation problem is one if the original application of Linear Programming Problem. The main objective of transportation problem is to minimize the cost of transportation from the source to destination while satisfying supply as well as demand [1, 2]. Two contributions are mainly responsible for such type of problem which involves a number of sources and the number of destinations. Transportation problems may involve movement of a product from plants to warehouses, warehouses to wholesalers, wholesalers to retailers and retailers to customers. This problem can be used for a variety of situations such as scheduling, inventory control, personnel assignment, plant location etc. [1-8]

Basic Hypothesis in Transportation Problem

1) Total quantities of the items are available at a different source, equally the total demand at different destination.

2) Product can be transported easily from all sources to destinations.

3) The unit transportation cost of the item from all sources to destinations is known.

4) The transportation cost on a given route is directly proportion to the number of units shipped on that route.

5) The Main objective is to minimize the total transportation cost for the organization [2,11]

Mathematical Representation of Transportation Problem

The transportation problem can be formulated into a LP problem. Let x_{ij}, $i = 1 \ldots m$, $j = 1 \ldots n$ be the number of units transported from origin i to destination j. The LP problem is as follows:

$$\text{Minimize: } \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij}\, x_{ij}$$

Subject to: $\sum_{j=1}^{n} x_{ij} \leq s_i$ (i = 1, 2, - - -, m)

$\sum_{i=1}^{m} x_{ij} \geq d_j$ (j = 1, 2, - - -, n)

$x_{ij} \geq 0$ (i = 1, 2, - - -, m, j = 1, 2, - - - n)

A transportation problem is said to be balanced, if
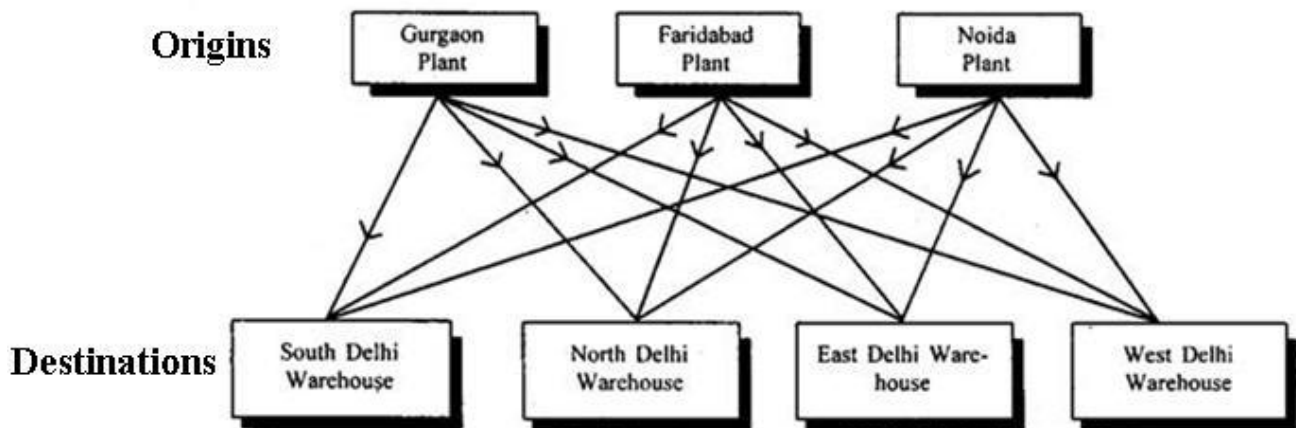
$$\sum_{i=1}^{m} s_i = \sum_{j=1}^{n} d_j$$

Figure 1: A sample transportation model showing origins and destinations [8, 9]

II.   PROPOSED METHOD (SOMANI'S APPROXIMATION METHOD)

The SOMANI'S method (SAM) for Minimum Transportation Cost proceeds as follows:

Step 1: Make transportation table for given problem and convert into balance one if it is not.

Step 2: Find minimum element of each row.

Step 3: Compare the minimum element of each row and put the demand according the supply on which element that the mathematical value is minimum.

Step 4: If, the row demand and supply is equal then next step we will find the remaining rows minimum element and follow step -3 whenever the demand and supply are not satisfy.

Step 5: In case, demand and supply are not equal then we again find the minimum element of each rows and follow step -3.

Step 6: If, the minimum element are same then, we can firstly allocate those minimum element which demand is minimum.

Step 7: Now, same process follows whenever all given supply and demand are not satisfy.

Step 8: After satisfying demands and supply of each column and row, multiply the allocated row or column element with allocation values.

Step 9: Now, add all the multiplied value that is the required transportation cost is given problem.

III. A CASE STUDY

Solve the given transportation problem. Table 1 show the demand and supply for origins and destinations for a sample transportation problem.

Table 1: A transportation problem

	W1	W2	W3	W4	W5	Supply
A	3	4	6	8	9	20
B	2	10	1	5	8	30
C	7	11	20	40	3	15
D	2	1	9	14	16	13
Demand	40	6	8	18	6	78

Step- 1: Supply and demand of Product is equal so the problem is balanced.

Step -2: Find the minimum element of each row, as shown below:

A	3
B	1
C	3
D	1

Step -3: Compare the minimum element of each row and put the demand according the supply on which element that the mathematical value is minimum. So the minimum value is B=1 and D=1. Allocation s made on D because the demand of D is minimum to B.

	W1	W2	W3	W4	W5	Supply
A	3	4	6	8	9	20
B	2	10	1	5	8	30
C	7	11	20	40	3	15
D	2	^{6}1	9	14	16	13
Demand	40	6	8	18	6	78

Step- 4: The demand of W2 is over. Now, again find the minimum value of each row excluding W2.

A	3
B	1
C	3
D	2

Minimum Value is B=1. Now allocation is made on B=1.

	W1	W2	W3	W4	W5	Supply
A	3	4	6	8	9	20
B	2	10	^{8}1	5	8	30
C	7	11	20	40	3	15
D	2	^{6}1	9	14	16	13
Demand	40	6	8	18	6	78

Step -5: Follow the same process, whenever all demand and supply are not satisfy. In case the minimum element is same then we can firstly allocate those minimum elements which demand is minimum.

The demand of W3 is over. Now again find the minimum value of each row excluding W2 & W3.

A	3
B	2
C	3
D	2

Minimum Value is B=2 and D=2. So first we will allocate D=2

	W1	W2	W3	W4	W5	Supply
A	3	4	6	8	9	20
B	2	10	^{8}1	5	8	30
C	7	11	20	40	3	15
D	^{7}2	^{6}1	9	14	16	13
Demand	40	6	8	18	6	78

The demand of W1 is not over. But supply of D is over. Now again find the minimum value of each row excluding W2, W3 & D.

A	3
B	2
C	3

Minimum Value is B=2. Now allocation is made on B=2.

	W1	W2	W3	W4	W5	Supply
A	3	4	6	8	9	20
B	^{22}2	10	^{8}1	5	8	30
C	7	11	20	40	3	15
D	^{7}2	^{6}1	9	14	16	13
Demand	40	6	8	18	6	78

The demand of W1 is not over. But supply of B is over. Now again find the minimum value of each row excluding W2, W3, D & B.

A	3
C	3

Minimum Value is A=C=3. Now allocation is made on A=3 because its demand is minimum to C.

	W1	W2	W3	W4	W5	Supply
A	11_3	4	6	8	9	20
B	22_2	10	8_1	5	8	30
C	7	11	20	40	3	15
D	7_2	6_1	9	14	16	13
Demand	40	6	8	18	6	78

The demand of W1 is over. Now, again find the minimum value of each row excluding W1, W2, W3, D & B.

A	8
C	3

Minimum Value is C=3. Now allocation is made on C=3.

	W1	W2	W3	W4	W5	Supply
A	11_3	4	6	8	9	20
B	22_2	10	8_1	5	8	30
C	7	11	20	40	6_3	15
D	7_2	6_1	9	14	16	13
Demand	40	6	8	18	6	78

The demand of W5 is over. The last column W4 is remaining. Put the demand according to supply of each row.

	W1	W2	W3	W4	W5	Supply
A	11_3	4	6	9_8	9	20
B	22_2	10	8_1	5	8	30
C	7	11	20	9_{40}	6_3	15
D	7_2	6_1	9	14	16	13
Demand	40	6	8	18	6	78

Step -6: After completion of all allocation the allocated element multiplied by same row element.

Minimum Transportation Cost = 11*3 + 9*8 + 22*2 + 8*1 + 9 *40 + 6*3 + 7*2 + 6*1 = 555 Units

Therefore the solution of problem is A_{11} = 11, A_{14} = 9, B_{11} = 22, B_{13} = 8, C_{14} = 9 C_{15} = 6, D_{11} = 7, D_{12} = 6 and the transportation cost is = 555 Units

IV. CONCLUSION

This method gives a basic feasible solution for a given transportation problem. The solution of given problem obtained from NWC, ROW Minima, Diagonal Minima, Column Minima is 878, 656, 383, 405. So the solution getting from this new method is nearby all this method. Hence, the SAM method gives an optimal solution of any type of transportation problems.

V. REFERENCES

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