# Solving Transportation Problem By Using Supply Demand Minima Method

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**Abstract**

In this paper, we are trying to find the optimum solution of a transportation problem and is to minimize the cost. The most attractive feature of this method is that it requires very simple arithmetical and logical calculation, which compared to the existing method an optimal solution and illustrated with numerical example.
*Key words:* Transportation, Minimization cost, Sources, Destination, SDM- Method, Optimal solution.
**Mathematics Classification :** transportation problem 90C08.

## 1. Introduction

**A** transportation problem is one of the earliest and most important applications of linear programming problem. It was first studied by F.L. Hitchcock in[5], then separately by T.C. Koopmans in 1947, and finally placed in framework of linear programming and solved by simplex method by G.B. Dantzing in[3]. The Simplex method is not suitable for the Transportation problem especially for large scale transportation problem due to its special structure of model in 1954 charnes and cooper[4] was developed Stepping Stone method.

A balanced condition (total demand is equal to total supply) is assumed. Then finding an optimal schedule of shipment of the commodity with the satisfaction of demands at each destination is the main goal of the problems. The first stage the (IBFS) was obtained by opting any of the available methods such as North West Corner, Matrix Minima Method or LCM, and Vogel's Approximation Method, etc. Then in the next and last stage MODI method was adopted to get an optimal solution, it's a much easier approach to propose for finding an optimal solution and very easy computations.

In last few year Abdual Quddoos *et.al.*[2] and sudhaker *et.al.*[12] proposed two different method in 2012 respectively, for finding an optimal solution. Prof. Reena G. Patel *et. al.*[7,8,9] and A. Amaravathy *et.al.*[1] developed the method is very helpful as having less computations and also required the short time of period

for getting the optimal solution.

Besides the covenantal methods many researchers has provide many method a better of a transportation problem. Some of the important related works the current research has deal with are: 'Solving Transportation Problem Using ICMM Method.[6] by Ms. S. Priya *et.al.* 'Transportation Problem using Stepping Stone Method and its Application'[10] by Prof. Urvashikumari D. Patel *et.al.* Hence the another method consider averages of total cost along each row and each column which is totally new concept.[11] In general we try to minimize total transportation cost for the commodities transporting from source to destination.

In this paper we introduce SDM Method full name is 'Supply Demand Minima Method' for solving transportation problem which is very simple, easy to understand and helpful for decision making and it gives minimum solution of transportation problem in a very less time.

**2. Transportation model:** In a transportation problem, we are focusing on the original points. These points may represent factories to produce items, and to supply a required quantity of the products to a certain number of destinations. This process must be done successfully in such a way as to maximize the profit or minimize the cost transportation. Sometimes the origin and destination points are also termed as sources and sinks. However, to illustrate a typical transportation model, suppose that m factories supply certain items to n warehouses. As well as, let factory ($i=1,2,……,m$) produces $a_i$ units, and the warehouses ($j=1,2,….,n$) requires $b_j$ units.

Furthermore, suppose the cost of transportation from factory $i$ to warehouse $j$ is $c_{ij}$. The decision variables $x_{ij}$ is being the transported amount from the factory $i$ to the warehouse $j$, typically our objective is to find the transportation pattern that will minimize the total of the transportation cost.

*2.1. Definition:* A Transportation Problem is said to be balanced transportation problem if total number of supply is same as total number of demand.

*2.2. Definition:* A Transportation Problem is said to be unbalanced transportation problem if total number of supply is not same as total number of demand.

*2.3. Definition:* Any solution $X_{ij} \geq 0$ is said

Table 1. The model of a transportation problem



to be a feasible solution of a transportation problem if it satisfies the constraints. The feasible solution is said to be basic feasible solution if the number of nonnegative allocations is equal to (*m+n-1*). Where m denotes supply and n denotes demand.

*2.4. Definition:* A feasible solution of transportation problem is said to be optimal if it minimizes the total cost of transportation. There always exists an optimal solution to a balanced transportation problem we start with initial basic feasible solution to reach optimal solution which is obtained from above three methods. We then check whether the number of allocated cells is exactly equal to (m+n-1), where m and n are number of rows and columns respectively. It works on the assumption that if the initial basic feasible solution is not basic, then there exists a loop. Found in MODI method.

*3. Algorithm for SDM- Method :*

Step 1 : Examine Whether the transportation problem is balanced or not. If it is balanced then go to next step.

Step : 2 Compare the minimum of supply or demand whichever is minimum then allocate the min (supply or demand) at the place of minimum value of related row or column

Step : 3 After performing step-2, delete the row or column for further allocation where supply from a given source is depleted or the demand for a given destination is satisfied.

Step: 4 Repeat step-2 and step-3 unless and until all the demands are satisfied and all the supplies are exhausted.

Step : 5 Now total minimum cost is calculated as sum of the product of cost and corresponding allocate value of supply/demand

4. Numerical Example:

Example 4.1. Illustrate

Table 2

|  | A | B | C | D | Supply |
|---|---|---|---|---|---|
| X | 19 | 30 | 50 | 10 | 7 |
| Y | 70 | 30 | 40 | 60 | 9 |
| Z | 40 | 8 | 70 | 20 | 18 |
| Demand | 5 | 8 | 7 | 14 |  |

**Solution**: since $\Sigma a_i = \Sigma b_j = 34$

The given transportation problem is balanced; therefore exist a basic feasible solution to SDM Method problem.

Table 3

|  | A | B | C | D | Supply |
|---|---|---|---|---|---|
| X | 19    5 | 30 | 50 | 10    2 | 7 |
| Y | 70 | 30    2 | 40    7 | 60 | 9 |
| Z | 40 | 8    6 | 70 | 20    12 | 18 |
| Demand | 5 | 8 | 7 | 10 |  |

From this table we see that the number of non-negative independent allocated cell is $m + n - 1 = 3+4-1 = 6$. Hence the solution is non- degenerate basic feasible solution and

The transportation cost is:

Z = 19*5 + 10*2 + 30*2 + 8*6 + 40*7 + 20*12 = 743/-

**Example 4.2.** Illustrate

Table 4

|  | A | B | C | D | Supply |
|---|---|---|---|---|---|
| X | 13 | 18 | 30 | 8 | 8 |
| Y | 55 | 20 | 25 | 40 | 10 |
| Z | 30 | 6 | 50 | 10 | 11 |
| Demand | 4 | 7 | 6 | 12 |  |

**Solution**: since $\Sigma a_i = \Sigma b_j = 29$

The given transportation problem is balanced; therefore exist a basic feasible solution to SDM Method problem.

Table 5

|  | A | B | C | D | Supply |
|---|---|---|---|---|---|
| X | 13    4 | 18 | 30 | 8    4 | 8 |
| Y | 55 | 20    4 | 25    6 | 40 | 10 |
| Z | 30 | 6    3 | 50 | 10    8 | 11 |
| Demand | 4 | 7 | 6 | 12 |  |

From this table we see that the number of non-negative independent allocated cell is $m + n -1 = 3+4-1 = 6$. Hence the solution is non- degenerate basic feasible solution and

The transportation cost is:

$Z = 13*4 + 8*4 + 20*4 + 25*6 + 6*3 + 10*8 = 412$

*5. Comparison of the numerical results :*

Comparison of the numerical results which are obtained from the example 4.1& 4.2 is shown in the following table:

Table 6

| Method | Example 4.1 | Example 4.2 |
|---|---|---|
| SDM Method | 743 | 412 |
| North West Corner Rule | 1015 | 484 |
| Matrix Minima Method | 814 | 516 |
| VAM | 779 | 476 |
| MODI- Method | 743 | 412 |

## 6. Conclusion and Future Work

In this paper, we developed the algorithm is very helpful as having less computation and also required the short time of period for getting the optimal solution.

Also in this paper we have described the comparison between the transportation methods (Table 6) and the SDM Method also the solution is same as that MODI'S method.

It can be extended to travelling salesman problems to get optimal solution. The SDM Method is important tool for the decision makers when they are handling various types of logistic problems.

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