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AN INNOVATIVE APPROACH FOR FINDING THE OPTIMAL SOLUTION FOR TRANSPORTATION PROBLEMS

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ABSTRACT

In this paper a new method is proposed for finding an optimal solution for all transportation problems. It is a direct method where we do not require basic feasible solutions. An example is given and the optimality of the result obtained by SI method is also checked with the other methods. This method is easy to understand and is very efficient for those decision makers. This method can easily adopt among the existing method.

***Keywords**: Transportation problem, cost matrix, optimal solution, SI method.*

1. INTRODUCTION

A study of optimal transportation and allocation of resources is transportation theory. In the most general form of transportation problem will have a number of origins and destinations. Nowadays transportation problem has become a standard application for industrial organizations having several manufacturing units, warehouses and distribution centers. In 1941 Hitchcock developed the basic transportation problem along with the constructive method of solution. Dantzig [1] formulated the transportation problem as linear programming problem and also provided the solution method in 1951.

To get an optimal solution for transportation problems it was required to solve the problem into two stages. In first stage the initial basic feasible solution was obtained by using any one of the methods such as North West Corner Rule, Least Cost Method, and Vogel's Approximation Method etc. Goyal [2] improved VAM for unbalanced transportation problem. Then in the next and last stage Modified Distribution method was applied to get an optimal solution. Stepping Stone Method was developed by Charnes and Cooper [3] for finding an optimal solution from the initial basic feasible solution.

Pandian and Natarajan [4] proposed a new method for finding an optimal solution directly in 2010. Later, Sudhakar *et al.* [5] also proposed a different method in 2012 for finding an optimal solution. Here a much easier approach is proposed for finding an optimal solution directly with lesser number of iterations and very easy computations. The stepwise procedure of proposed method is carried out as follows.

2. PROPOSED METHOD

Step 1: Set the given problem in the tabular form known as the transportation table.

Step 2: Identify the smallest element in each row of the given cost matrix table and then subtract the same from each element of the respective rows.

Step 3: In the reduced matrix obtained from Step 2, identify the smallest element of each column and then subtract the same from each element of the respective columns.

Step 4: Check the formed matrix. Each row and column will contain at least one zero.

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Step 5: Each zero is to be discussed as follows:
Considering zero of (i, j). (ith row, jth column) count the number of zeros in ith row, jth column leaving (i, j)th zero. Give the maximum possible allocation to the transportation table for the least number of zeros.

Step 6: Delete the row or column from the table which is exhausted after giving allocation.

Step 7: The process is repeated till all the allocations are completed.

Note: While finding the number of zeros (row + column) sometimes there may have tie. To break the tie, add all the values in that particular row and particular column of those zeros separately. The maximum values for which the allocation is given as per availability of the requirements. Further while finding the tie breakup, sometimes again a tie in the maximum values thus obtained, in that case we consider the least cost in the transportation table of these tie up positions for allocations. Allocation is then completed.

Step 8: Then calculate the least total cost.

3. NUMERICAL METHOD

Consider a transportation problem

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Requirement	200	225	275	250	950

Applying the steps 2 and 3 we get the cost matrix

	D	E	F	G	Available
A	0	0	3	3	250
B	6	6	1	0	300
C	11	12	0	0	400
Requirement	200	225	275	250	950

Now there will be at least one zero in each row and column in the obtained cost matrix. The number of zeroes in the positions using step 5, (A, D), (A, E), (B, G), (C, F), (C, G) are 1, 1, 1, 1, 2 respectively. Select the position (C, F). Since least number of zeros are in four places to break the tie we find the total value for each positions of (A, D), (A, E), (B, G), (C, F) are respectively 23, 24, 16, 27 where (C, F) position is maximum.

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13 (275)	10	125
Requirement	200	225	0	250	950

Allocate the cell (C, F) then delete the column F.

	D	E	G	Available
A	11	13	14	250
B	16	18	10	300
C	21	24	10	125
Requirement	200	225	250	675

Repeat the same steps until all the requirements and the available are exhausted.

	D	E	F	G	Available
A	11 (200)	13 (50)	17	14	0
B	16	18 (175)	14	10 (125)	0
C	21	24	13 (275)	10 (125)	0
Requirement	0	0	0	0	0

The total cost associated with the above allocations is

$$(200 \text{ x } 11 + 50 \text{ x } 13 + 175 \text{ x } 18 + 125 \text{ x } 10 + 275 \text{ X } 13 + 125 \text{ X } 10) = 12075.$$

SI method is simple, because the optimal solution is obtained directly without using initial basic feasible solution. The comparison table is given below.

North-West Corner Rule	VAM	MODI	SI
12200	12075	12075	12075

4. CONCLUSION

Thus it can be concluded that SI – method provides an optimal solution directly without using basic feasible solutions in few steps for transportation problems. This method consumes less time and is easy to understand to apply all transportation problems for decision makers.

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