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Finding an Optimal Solution for Transportation Problem– Zero Neighbouring Method

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Abstract

In this paper a different approach namely zero neighbouring method is applied for finding a feasible solution for transportation problems directly. The proposed method is a unique, it gives always feasible (may be optimal for some extent) solution without disturbance of degeneracy condition. This method takes least iterations to reach optimality, compared to the existing methods available in the V. J. Sudhakar et al. Here a numerical example is solved to check the validity of the proposed method and degeneracy problem is also discussed.

Key words: Assignment problem, Transportation problem, Degeneracy, Zero neighbouring method.

Mathematics Subject Classifications Codes: 90C08, 90C90

Introduction

The transportation problem constitutes an important part of logistics management.

In addition, logistics problems without shipment of commodities may be formulated as transportation problems. For instance, the decision problem of minimizing dead kilometres[11] can be formulated as a transportation problem[18,20]. The problem is important in urban transport undertakings, as dead kilometres mean additional losses. It is also possible to approximate certain additional linear programming problems by using a transportation formulation[4].

Various methods are available to solve the transportation problem to obtain an optimal solution. Typical/well-known transportation methods include the stepping stone method[2], the modified distribution method[3], the modified stepping-stone method[16], the simplex-type algorithm[1] and the dual-matrix approach[9]. Glover *et al.*[6] presented a detailed computational comparison of basic solution algorithms for solving the transportation problems. Shafaat and Goyal[14] proposed a systematic approach for handling the situation of degeneracy encountered in the stepping stone method[19].

A detailed literature review on the basic solution methods is not presented. All the optimal solution algorithms for solving transportation problems need an initial basic feasible solution to obtain the optimal solution. There are various heuristic methods available to get an initial basic feasible solution, such as "North West Corner" rule, "Best Cell Method," "VAM — Vogel's Approximation Method"[13], Shimshak version of VAM [17], Coyal's version of VAM [7], Ramakrishnan's version of VAM [12] *etc*. Further, Kirca and Satir[10] developed a heuristic, called TOM (Total Opportunity-cost Method), for obtaining an initial basic feasible solution for the transportation problem. Gass[5] detailed the practical issues for solving transportation problems and offered comments on various aspects of transportation problem methodologies along with discussions on the computational results, by the respective researchers[8].

Recently, Sharma and Sharma[15] (2000) proposed a new heuristic approach for getting good starting solutions for dual based approaches used for solving transportation problems. Even in the above method needs more iteration to arrive optimal solution. Hence the proposed method helps to get directly optimal solution with less iteration. The proposed method is given below.

Zero Neighbouring Method :

We, now introduce a new method called the Zero Neighbouring Method (ZNM) for finding an feasible solution to a transportation problem .The zero neighbouring method proceeds as follows.

Step 1. Construct the transportation table.

Step 2. Select minimum from each row and subtract with each element in the corresponding row.

Step 3. Select column minimum form each column and subtract with each element in the corresponding column.

Step 4. In the reduced cost matrix there will be at least one zero in each row and column, then find an average of non-zero neighbour in zero position.

Step 5. Find a maximum among zero neighbours. If it has one maximum value then first supply to that demand corresponding to the cell. If it has more equal values then select $\{a_i, b_j\}$ and supply to that demand maximum possible.

Step 6. After the above step, the exhausted demands (column) or supplies (row) to be trimmed. The resultant matrix must possess at least one zero is each row and column,else repeat 5.

Step 7. Repeat step 2 to step 6 until the feasible solution is obtained.

Numerical Example

Consider the following cost minimizing transportation problems.

	D_1	D_2	D_3	D_4	Supply
S_1	2	3	9	8	9
S_2	2	10	6	5	21
S_3	9	11	5	7	18
Demand	12	4	15	17	48

Now, using the zero neighbouring method, the feasible solution is $X_{11}=9, X_{21}=3, X_{23}=1, X_{24}=17$, $X_{32}=4$, $X_{33}=14$ and the optimal solution is 229.

Conclusion and Future work

Thus the zero neighbouring method provides a feasible value of the objective function for the transportation problem. The proposed algorithm carries systematic procedure, and very easy to understand. It can be extended to assignment problem and travelling salesman problems to get optimal solution. The proposed method is important tool for the decision makers when they are handling various types of logistic problems, to make the decision optimally.

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