A New Procedure to get Minimal Cost in Transportation Problems

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Abstract

Transportation Problem (TP) is the exceptional case to obtain the minimum cost. A new hypothesis is discussed for getting minimal cost in transportation problem in this paper and also Vogel's Approximation Method (VAM) and MODI method are analyzed with the proposed method. This approach is examined with various numerical illustrations.
Keywords: Transportation Problem, Initial Basic Feasible Solution (IBFS), Minimal Cost.
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1 Introduction

In operations research, the appealing application of quantitative study to solve production problems has been in the physical allocation of goods, usually named as "Transportation Problem" (TP).

TP is used to reduce the transportation cost for industries with the number of sources and number of destinations while satisfying the supply limit and demand requirement. Purpose of TP is to reduce the cost. Transportation model provides a great support to find out the best way to distribute supplies to client. The two major objectives of such problems are

1. Reduce the cost.
2. Increase the profit.

In 1941, the transportation was presented by F.L.Hitchcock [6] and in 1947 "Optimum Utilization of the transportation" was studied by T.C. Koopmans. Further so many researchers analyzed transportation [3, 4, 5, 7].

TP deals IBFS and optimal solution which has minimum cost. For IBFS so many researchers developed new methods [2, 1, 8, 9, 12]. Optimal solution deals with two techniques for solving TP.

An innovative approach to get a minimal cost in TP is presented here which was very simple and understandable. The proposed algorithm is presented in section 2 and section 3 deals with numerical illustrations. In section 4, comparative study for VAM, MODI and projected method was presented and to end with conclusion for the new approach which was given in section 5.

2 Algorithm

Step 1: Formulate a transportation table from the given problem.

Step 2: Make sure that the transportation problem is balanced or not, if not, formulate it balanced.

Step 3: Obtain an IBFS using VAM Method.

Step 4: Consider the unoccupied cells and select the minimum cost. If tie appears choose arbitrarily. Construct a loop or closed path from the cell with occupied cells in any possible way.

Step 5: In that loop assign unoccupied starting cell as $+\theta$ and others in the path as alternate $-\theta$ and $+\theta$.

Step 6: Now find $\theta = \min(-\theta)$.

Step 7: Then Add θ to $+\theta$ and Subtract θ to $-\theta$.

Step 8: Now calculate the cost in usual manner.

3 Numerical illustration

3.1 Solve the Transportation problem

	D1	D2	D3	D4	Supply
S1	10	0	20	11	20
S2	12	7	9	20	25
S3	0	14	16	18	15
Demand	10	15	15	20	60

After applying VAM method we get the following table

10	[15] 0	20	[5] 11
12	7	[15] 9	[10] 20
[10] 0	14	16	[5] 18

Here minimum cost from unoccupied cell is (2, 2) = 7. Starting from that cell draw a loop and the table becomes

10	[15] 0 $-\theta$	20	[5] 11 $+\theta$
12	7 $+\theta$	[15] 9	[10] 20 $-\theta$
[10] 0	14	16	[5] 18

Then $\min(-\theta) = \min(15, 10) = 10$. So add 10 to $+\theta$ add subtract 10 to $-\theta$. Then the table is

10	[5] 0	20	[15] 11
12	[10] 7	[15] 9	20
[10] 0	14	16	[5] 18

Now the TP cost $= 5 \times 0 + 15 \times 11 + 10 \times 7 + 15 \times 9 + 10 \times 0 + 5 \times 18 = 460$.

4 Comparative study

Table 1:

S.NO	Problem dimension		VAM	MODI	Proposed method
1.	3	5	9360	9240	9240
2.	4	3	80	76	76
3.	3	4	480	460	460
4.	3	5	2810	2700	2700
5.	4	5	248	240	240
6.	3	3	1745	1665	1665
7.	3	4	476	412	412
8.	3	4	960	920	920
9.	3	4	630	610	610
10.	3	4	779	743	743

5 Conclusion

Our main aim is to minimize the transportation cost. Using this new approach the cost is reduced with less time and work. And also various sizes of problems were compared with other two methods. Finally we conclude that the minimal cost is obtained which is very less compared with VAM and also the cost is equal with MODI method.

References

[1] Abul Kalam, Azad, Md. Bellel Hossain and Md. MizanurRahman, An Algorithmic Approach to solve Transportation Problems with the average total opportunity cost method, *International Journal of Scientific and Research Publications* 7(2) (2017).

[2] M.M. Ahmed, M.A. Islam, M. Katun, S. Yesmin and M.S. Uddin, New Procedure of finding an initial basic feasible solution of time minimizing Transportation Problems, *Open Journal of Applied Sciences* (2015).

[3] A. Charnes, W.W. Cooper and A. Henderson, *An Introduction to linear programming* (John Wiley & sons, New York, 1953).

[4] G.B. Dantzig, *Application of the simplex method to a transportation problem, Activity Analysis of production and allocation* In: Koopmans, T.C., Ed., (John Wiley and sons, New York, 1951), 359-373.

[5] A.T. Hamdy, *Operations Research, An Introduction* (8th Edition, Pearson Prentice Hall, Upper Saddle River, 2007).

[6] F.L. Hitchcock, The distribution of a product from several sources to numerous localities, *Journal of mathematics and physics* (1941).

[7] Kanti Swarup, Gupta and Man Mohan, *Introduction to Management Science*, (Sultan chand and sons, New Delhi, 2017).

[8] M. Kavitha and V. Vinoba, A Study on Transportation problem using stepping stone method and its Applications, *International Journal of Mathematics Trends and Technology* 22(1) (2015), 52.

[9] Md. Mizanur Rahman, Md. Bellel Hossain and Md. Mosharraf Hossain, A New Approach for minimization of Transportation Time: An Algorithmic Approach, *Imperial journal of interdisciplinary Research (IJIR)* 2(7) (2016).

[10] P. Sumathi, A New approach to solve linear programming problems with intercept values, *Journal of Information and Optimization Sciences* 7(4) (2016), 95-510.

[11] P. Sumathi and S. Paulraj, Identification of redundant constraints in large scale linear programming problems with minimal computational effort, *Applied Mathematical Sciences* 7(80) (2013), 3963-3974.

[12] P. Sumathi and C.V. Sathiyabama, A Tactical Strategy in Transportation Problems Using Statistical Process, *International journal of engineering and technology*, 7(4.10) (2018), 473-475.