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FINDING THE OPTIMALITY OF A TRANSPORTATION PROBLEM USING PGM-METHOD

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Abstract

In this paper, we introduced the new PGM to find out the optimum solution of a Transportation method. The most impressive feature of this method is that it requires very simple statistical calculation, which compared to the MODI Method. In L.P.Ps the Transportation Problem is one of the subclass. The objective is to satisfy the minimum transportation cost for the given constraints. The developed algorithms with some numerical illustrations are discussed in this article.

1. Introduction

Transportation plays a vital role in our economy as well as in legislative decision making. The fundamental transportation problem was mainly urbanized by F. L. Hitchcock (1941) [1] in his study on the topic "the distribution of a product from several sources to numerous location". In 1947, T.C. Koopmans independently established a study on "optimum utilization of the transportation system". The LP formulation and the associated systematic procedure for solution were given by George B. Dantzig (1951) [2]. Many implements of its model and methods have subsequently been extended.

In the past few year Sudhaker et al. [3] and Abdual Quddoos et al. [4] implemented two different methods in 2012 respectively, for finding an optimal solution. In 1954 Charnes and Copper [5] was developed Stepping

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Stone method on “The Simplex method is not suitable for the Transportation problem especially for large scale transportation problem due to its special structure of model”.

Now days the researchers recently focus on many different methods that provide a betterment for transportation problem. Urvashikumari D.Patel et al. [6] established “Transportation Problem using Stepping Stone Method and its Application. And also Neetu M. Sharma et al. [7] cope with “An alternative method to north west corner method for solving transportation problem which is totally new concept. A. Amaravathy et al. [8], Reena G. Patel et al. [9, 10] and Sushma Duraphe et al. [11] implemented the method is very helpful by solving less iterations and also required minimum time period for getting optimal solution.

2. Material and Methods

In this article we proposed a new concept for solving TP in easiest manner. The geometric mean of a series of n positive observations is defined as the nth root of their Product.

$$GM = (x_1 \cdot x_2, \ldots, x_n)^{1/n} = \left(\prod_{i=1}^{n} X_i\right)^{1/n}.$$

2.1. Algorithm for PGM

Step 1: Determine whether the transportation problem is balanced or not. If it is balanced then proceed further step.

Step 2: Obtain the Geometric Mean for each row and column by using the corresponding principle.

Step3: Choose the highest value from step 2 and allot the min (supply or demand) at the place of minimum value of corresponding row or column.

Step4: Reiterate step 2 and step 3 till the demands or supplies become zero.

Step 5: Total minimum cost is estimated as sum of the product of cost and its subsequent allocated values of supply/demand.

3. Calculation

Example 3.1. Illustrate the following cost minimizing transportation problem with three origins and four destinations

	D_1	D_2	D_3	D_4	Supply
S_1	2	3	11	7	6
S_2	1	0	6	1	1
S_3	5	8	15	9	10
Demand	7	5	3	2	17

Solution:

The above mentioned transportation table is balanced, therefore it exist a IBFS to PGM method.

	D_1	D_2	D_3	D_4	Supply				
S_1	2	3 / 2	11 / 2	7 / 2	6 , 4, 2	(4.64)	(4.64)	(3.48)	(2.45)
S_2	1	0	6 / 1	1	1	0	**	**	**
S_3	5 / 7	8 / 3	15	9	10,3	(4.64)	(4.64)	(4.64)	(4.64)
Demand	7	5, 2	3, 2	2	17				
	(3.98)	(2.88)	(9.97)	(3.98)					
	(3.16)	(4.90)	(12.85)	(7.94)					
	(3.16)	(4.90)	**	(7.94)					
	(3.16)	(4.90)	**	**					

$\therefore$ The number of non-negative independent allocated cell is $m + n - 1 = 3 + 4 - 1 = 6$.

The Transportation cost is

$$Z = 3 * 2 + 11 * 2 + 7 * 2 + 6 * 1 + 5 * 7 + 8 * 3 = 107 /$$

Table 3.1. Comparison of the numerical result.

Method	Example 3.1
Proposed Geometric Mean	107
North West Corner Method	116
Least Cost Method	112
VAM	102
MODI-Method	107

Example 3.2. Illustrate

	D_1	D_2	D_3	D_4	Supply
S_1	13	11	14	40	2
S_2	17	14	12	13	6
S_3	18	18	15	12	7
Demand	3	3	4	5	15

Solution:

The above mentioned transportation table is balanced, therefore it exist a IBFS to PGM method problem.

	D_1	D_2	D_3	D_4	Supply						
S_1	13 / 2	11	14	40	2	(17.1)	(12.9)	**	**	**	**
S_2	17 / 1	14 / 3	12 / 2	13	6, 5	(13.9)	(14.2)	(14.2)	(14.2)	(12.9)	(12)
S_3	18	18	15 / 2	12 / 5	7, 2	(15.5)	(16.9)	**	**	**	**
Demand	3, 1	3	4, 2	5	15						
	(15.8)	(14.1)	(13.9)	(18.4)							
	(15.8)	(14.1)	(13.9)	**							
	(14.9)	(12.4)	(13.4)	**							
	(17)	(14)	(12)	**							
	**	(14)	(12)	**							
	**	**	(12)	**							

$\therefore$ The number of non-negative independent allocated cell is $m + n - 1 = 3 + 4 - 1 = 6.$

The Transportation cost is

$$Z = 13 * 2 + 17 * 1 + 14 * 3 + 12 * 2 + 15 * 2 + 12 * 5 = 199 /-$$

Table 3.2. Comparison of the Numerical Results.

Method	Example 3.2
Proposed Geometric Mean	199
North West Corner Method	199
Least Cost Method	197
VAM	197
MODI-Method	199

4. Results and Discussion

The Numerical results of the problem have been obtained in the previous section. In order to highlight the result of IBFS the following methods have been showcased Northwest corner Rule, Least cost method, Vogel's Approximation method and the optimal solution is found through MODI Method. The result of Transportation cost, PGM and MODI method is same. Without Finding IBFS for obtaining the optimal solution, we can directly use Proposed Geometric Mean Method.

5. Conclusion

In this article, we implemented the algorithm for less iterations and getting minimum optimal solution. And also we have described the comparison results for various methods of TPM and PGM is same as MODI's method in Table 3.1 and Table 3.2. Finally, we conclude that the PGM is important Geometrical tool for the decision makers when they are handling the variety of logistic problems.

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