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A note on MDMA Method-An optimal solution for transportation problems

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Abstract

This note presents a simplification of MDMA (Maximum Divide Minimum Allotment) Method for obtaining the initial basic feasible solution (IBFS) of Transportation Problem (TP). The simplification gives same solution as by MDMA.

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Keywords: Transportation Problem, MDMA, IBFS, optimal solution.

1. Introduction

It is very important to find best initial solution of TP in easy and effective way, so that optimal solution can be obtained from IBFS in minimum possible iterations. For such purpose, several researchers have developed methods to find IBFS, which are, Reinfeld et al. [13], Dantzig [4], Russell [14], Shimshak et al. [16], Goyal [5], Ramakrishnam [12], Balakrishan [2], Kirca and satir [8], Goyal [6], Sharma et al. [15], Kasana et al. [7], Kulkarni [10], Mathirajan and Minakshi [11], Korukoglu et al. [9] and Amaravathy et al. [1] etc. Among them Amaravathy et al. [1] presented MDMA Method, which is based on making allocatrions to minimum cost cell of reduced transportation table. In this note, first we have presented that there is no need of reduction of tranportation table to reach same solution as by MDMA. Second MDMA gives same solution as LCM in absence of ties in selecting minimum cost cells.

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2. Statement and Solution

The Classical Transportation Problem is concerned with making supply of m sources to n destination in such a way that total transportation cost should be minimized. The Linear Programming Representation of Cost Minimization Transportation Problem is as follows:

Objective

$$\text{Minimize} \sum_{i=1}^{m}\sum_{j=1}^{n}(c_{ij}x_{ij})$$

Supply Constraints

$$\sum_{j=1}^{n} x_{ij} \le a_i \quad (1 \le i \le m)$$

Demand Constraints

$$\sum_{i=1}^{m} x_{ij} \ge b_j \quad (1 \le j \le n)$$

Non-Negative Restrictions

$$x_{ij} \ge 0$$

where

m	number of sources (S_i)
n	number of destinations (D_j)
a_i	supply amount of the product at S_i,
b_j	demand of the product at D_j
x_{ij}	amount of homogeneous product to be transported from S_i to D_j
c_{ij}	unit transportation cost of the product from S_i to D_j

a_i and b_j are given non-negative numbers.

Remark 2.1. The Transportation Problem is said to be balanced if the total supply of the goods is same as its demand, i.e., $\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$, otherwise the problem is said to be unbalanced.

In MDMA Method, Amaravathy, et al. [1] reduced the original transportation table of given TP on dividing all cost cells by maximum cost cell and after this made allocation in the minimum cost cell of reduced transportation table. They repeated this procedure of reduction of table at each stage before making allocation, which seems to be useless. Because, When we divide all cost cells by maximum cost cell, the ratio will remains same between all cost cells (e.g. if there are number 2, 5, 7, 9 and we divide all numbers by 9, result will be $\frac{2}{9}, \frac{5}{9}, \frac{7}{9}, 1$. So before and after division first number remains the minimum of all and second number remains second minimum etc.). So there is no need of reduction of table and direction allocations can be by choosing minimum cost cell, which gives same solution as by MDMA.

Secondly, MDMA Method gives same solution as 'Least Cost Method' (LCM), except for the cases, where tie occurs in selecting minimum cost. Because, when tie occurs in MDMA, that minimum cost is selected, in which minimum allocation is possible. But in 'Least Cost Method', that minimum cost is selected, to which maximum allocation is possible.

3. Application

For application of our point same Transportation Problem is considered as by Amarathy et al. [1]. Input data of the problem is given in Table 1.

Table 1: Input data of TP

Destination → source ↓	D_1	D_2	D_3	D_4	D_5	Supply
S_1	12	4	9	5	9	55
S_2	8	1	6	6	7	45
S_3	1	12	4	7	7	30
S_4	10	15	6	9	1	50
Demand	40	20	50	30	40	180

Table 2: Results of TP

Destination → source ↓	D_1	D_2	D_3	D_4	D_5	Supply
S_1	cost 12; 10	cost 4	cost 9; 15	cost 5; 30	cost 9	55
S_2	cost 8	cost 1; 20	cost 6; 25	cost 6	cost 7	45
S_3	cost 1; 30	cost 12	cost 4	cost 7	cost 7	30
S_4	cost 10	cost 15	cost 6; 10	cost 9	cost 1; 40	50
Demand	40	20	50	30	40	180

On obtaining initial solution by making allocations in minimum cost cell of original transportation table and breaking ties according to MDMA by selecting that minimum cost cell, to which minimum allocation is possible. Results are given in Table 2.

So obtained solution is same as by Amaravathy et al. [1] and with simple way.

4. Conclusions

From above theory and application, it is concluded that MDMA Method can be made easy by making direct allocations and there is no difference between MDMA and LCM in absence of tie in selecting minimum cost.

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