

Mixed Constraints Cost Minimization Transportation Problem: An Effective Algorithmic Approach

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Abstract In the literature, there are several methods for finding an initial basic feasible solution to the cost-minimizing transportation problem with equality constraints. In this paper, we proposed an efficient algorithm for solving transportation problems in which the origin and destination constraints consist not only of equality but also inequality. The proposed method is easy to understand and to apply for finding an initial basic feasible solution to transportation problems happening in real-life situations.

Keywords Transportation problem (TP), Cost Minimization Transportation Problem with Mixed Constraints (CMTP-MC), Initial Basic Feasible Solution (IBFS)

1. Introduction

The transportation problem (TP) is a special class of linear programming problems, which deals with shipping commodities from sources to destinations. The transportation problem is to find the amount of commodity which should be transported from each source to each destination satisfying all the supply and demand limits of sources and destinations respectively so that the overall transporting cost is minimum which the objective of the TP. If the total supply and demand limits are equal, then the problem is said to be a balanced transportation problem with equality constraints.

The transportation problem was formalized by the French Mathematician Monge, [1]. Major advances were made in the field during World War II by the Russian Mathematician and Economist Leonid Vitaliyevich Kantorovich [2]. The standard form of the transportation problem was first presented by Frank Lauren Hitchcock [3]. Efficient methods of solution were derived by T. C. Koopman [4], Danzig, G.B., [5], and then by Charnes A. et al. [6-8].

Many researchers developed a lot of methods to solve the Transportation problem. Some recent research work I mentioned here, Babu et al. [9] demonstrate that Vogel's Approximation Method (VAM) has some limitations and computational blunders. To overcome these limitations, they developed an Improved Vogel's Approximation Method (IVAM) by correcting these blunders.

Baidya [10] develop the stochastic solid transportation models to minimize the total transport time and ensuring safety with the safety and time objective functions. Dash and Mohanty et al. [11] inspect the TP where unit transportation cost, supplies, and demands are measured as uncertain normal variables. They develop the conceptual uncertain programming model for TP which is converted to a deterministic linear programming model. Sometimes per unit transport cost is uncertain due to the unstable condition of the fuel market. Gupta and Arora [12] provide an algorithm for determining the minimum unit transportation cost in a capacitated transportation problem with bounds on rim conditions. Ahmad and Adhami [13] develop a couple of mathematical optimization models to obtain the lower and upper bounds of the TP, where the supplies and demands quantities vary in an interval. Some transport systems impose a certain charge to use their routes along with the transport cost. Khurana and Adlakha [14] propose an algorithm for solving a multi-index fixed charge bi-criterion TP which minimizes the variable and fixed costs simultaneously to yield an optimal basic feasible solution. They also offer an algorithm to obtain an initial basic feasible solution of the multi-index TP.

If the capability of a supply is appreciably expanded/reduced and the requirement of a destination is also appreciably expanded/decreased, then the usual transportation system transformed to unequal transportation problem with mixed constraints. The special type of transportation problem with mixed constraints was meticulously studied firstly by Brügden [15]. He solved this problem by considering a related standard transportation problem having two additional sources and two additional

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