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Optimal Value and Post Optimal Solution in a Transportation Problem

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Abstract In this work, we analyse the transportation problem of a real-life situation by obtaining the optimal feasible solutions, thus carrying out the sensitivity analysis of the problem. The work utilises the data obtained from the Asejire and Ikeja plants of Coca-Cola company, aiming to aid decision-making regarding the best possible options to satisfy customers at the barest minimum cost of transportation. Rerunning the optimization of a problem is an expensive scheme for gathering and obtaining enough data required for a problem. Thus, to minimize the transportation cost, the sensitivity analysis of parameters is a good tool to determine the behaviour of some input parameters where the values of these parameters are varied arbitrarily such that optimal results are verified. Maple 18 Software is used to solve the problem and the result obtained is compared with the values evaluated from northwest corner method, least cost method and Vogel's approximation method. The study critically shows how a little change in a unit or more of any model parameter affects the expected results.

Keywords Optimal solution, Sensitivity analysis, Transportation.

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1. Introduction

Transportation problem can generally be defined as the problem of how to structuring production and mobilize goods produced from the factories. This can either be regarded as source or origin or park as the case may be, at different destinations and larger to their customers all across wherever they might be. This is the reason why it is regarded as transportation problem. The real-life problem that can yet make light of but very stressful is the problem called transportation problem for companies and organization especially for the procurement department of the manufacturing and transport companies.

There is no permanent solution ideal enough to be a remedy to life problems. However, mathematics fully assured us that problems also have solutions. Thus, more methods will be developed, and applications built and different tools will be created to control most life problems.

The transportation problem began to form a shape as a problem in 1871 by a French economist and mathematician called Gaspard Monge, and the transportation problem was first studied in 1920 as a problem according to Sarbjit (2012) [20].

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One of the key problems that companies or organizations are facing is transportation problems. Ralf et al. [16] (1998) concluded that one way of optimization is better planning. They used methods that have been developed in the theory of optimization to maximize the result of resources and existing technology. The work of Ralf et al. [16] shows that discrete mathematics applies to the theory of optimization, inputting powerful algorithm and putting modern computations into planning practice. The transportation problem applies to industries, companies, communication network, genetics, transportation schedule and allotment. The transportation models or problems are primarily concerned with how a product can be best transported from different factories or plants (origins) to some warehouses (destinations). The goal of every transportation problem is to reach the requirements of the destination, with which the capacity constraints at the minimum possible cost of production operates. It is necessary to understand that movement of goods from any source to any destination will require that cost is being minimized, if income (profit) must be maximized. Let us take the below as an example. Nine distinct factories such as X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8 and X_9 have to meet the request of also nine warehouses, say Y_1, Y_2, Y_3, Y_4, Y_5, Y_6, Y_7, Y_8 and Y_9. The goods available at each factory is specified x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8 and x_9, and the goods requested at each warehouse y_1, y_2, y_3, y_4, y_5, y_6, y_7, y_8 and y_9. The cost of moving goods from the factories to warehouses can be represented on tables of saying m_{ij} where the subscripts (1-9) indicate the cell, given the cost of moving from the factories (origin) i to the warehouse destination) j. Therefore, the cost of moving goods from the factory x_4 to warehouse y_7 is m_{47}. The transportation problem is the problem of how to plan production and transport goods produced from the plants (source/origin/park) at different locations and larger to their customers all across wherever they might be. This is the reason for the name-transportation problem because many of its applications are involved in the objective of transporting goods with the best possible outcome. The problem that can yet be unnoticed but very frustrating is the logistical problem called transportation problem for organizations, especially for manufacturing and transport companies. The linear programming method is a useful tool for dealing with such a problem as a transportation problem. Each source can supply a fixed number of units of products, which is usually called capacity or availability. Each destination has a fixed demand, which is usually known as a requirement. The nature of the and its application in solving problems involving several products from sources to several destinations, and this type of problem is frequently and generally called “The Transportation Problem”.

2. Literature review

In the research work “Optimization Techniques for Transportation Problem of Three Variables”, Rekha [18] applied four methods named northwest corner method, least cost method, Vogel and MODI method. In the process of considering the optimization techniques of transportation for three variables, the steps to each method and the steps to determine the optimal solution were explained, and the comparison between the MODI method and every other method was made. The work aims at getting the shortest, best and cheapest route to satisfy the demand from any destination. In the paper “A Comparative study of transportation problem under probabilistic and fuzzy uncertainties”, Chaudhuri and Kajal [3] worked on the comparative study of transportation problem by using probabilistic and fuzzy