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# PROPOSAL OF A SOLUTION TO FUZZY TRANSPORTATION PROBLEM USING FUZZY SET APPROACH

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**Özet**

Gerçek problemlerde, miktarlarının kesin olarak bilinmediği taşıma problemleri ile sık sık karşılaşılır. Mevcut stok ve talep miktarları bazı kontrol edilemeyen etmenlerden dolayı belirsiz olabilir.

Bu çalışmada, birim taşıma maliyetleri ile stok ve talep miktarları bulanık sayılar olduğunda, bulanık sayıların üyelik fonksiyonlarını kullanarak bulanık taşıma problemini çözen bir algoritma sunduk. Önerilen bu çözüm algoritmasında, taşıma probleminin optimal uygun çözümleri elde edildi. Önerilen çözümün etkinliğini göstermek için, sayısal örnek verildi. Verilen örnek WINQSB[16] optimizasyon programı ile çözüldü.

**Abstract**

In the real world applications, frequently may be faced up with transportation problems that these quantities may not be known in precise manner. The supplies and demands may be uncertain due to some uncontrollable factors.

In this study, we have presented an algorithm solving fuzzy transportation problem using membership functions of these fuzzy numbers when the unit shipping costs, the supply quantities and the demand quantities are fuzzy numbers. The proposed solution algorithm to fuzzy transportation problem yields optimal compromise solutions. To show the ability the proposed solution, the numerical example has been presented. The given example is solved using optimization software WINQSB [16].

## 1. INTRODUCTION

The conventional transportation problem is a special form of linear programming problem. In a transportation problem a product is to be transported from m sources to n destinations and their capacities are $s_1, s_2, \ldots s_m$ and $d_1, d_2, \ldots, d_n$, respectively. In addition, there is a penalty $c_{ij}$ associated with transporting a unit of product from source $i$ th to destination $j$ th. This penalty may be cost or time or safety of delivery, etc. A variable $x_{ij}$ represents the unknown quantity to be transported from source $i$ th to destination $j$ th.

Efficient algorithms have been developed for solving the transportation problem when the cost coefficients and supply and demand quantities are known exactly. However, there are transportation problems that these quantities may not be known in precise manner. For example; the unit transport cost may vary in a time. The supplies and demands may be uncertain due to some uncontrollable factors. After Bellmann and Zadeh [1] introduced the concept of fuzziness [2], a lot of techniques have been developed that apply the existing fuzzy linear programming to the fuzzy transportation problem [2-13] in the literature. Shiang-Tai Liu and Chiang Kao [3] develop a solution procedure that is able to calculate the fuzzy objective value of fuzzy transportation problem, where at least one of the parameters are fuzzy numbers: using Zadeh's extension principle. Waid F.Abd El-Wahed [4] presented a fuzzy programming approach to find an optimal compromise solution of a classical transportation problem with multi objectives. J.L.Ringuest and D.B Rinks [6] presented two interactive algorithms which take advantage of the special form of the multiple objective transportation problems.