

## A TWO-STAGE GENETIC ALGORITHM FOR SOLVING THE TRANSPORTATION PROBLEM WITH FUZZY DEMANDS AND FUZZY SUPPLIES

FENG-TSE LIN<sup>1</sup> AND TZONG-RU TSAI<sup>2</sup>

<sup>1</sup>Department of Applied Mathematics  
Chinese Culture University  
Yangminshan, Taipei 111, Taiwan  
ftlin@faculty.pccu.edu.tw

<sup>2</sup>Department of Statistics  
Tamkang University  
Tamsui, Taipei 251, Taiwan  
trtsai@stat.tku.edu.tw

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**ABSTRACT.** *This paper investigates solving the transportation problem with fuzzy demands and fuzzy supplies using a two-stage genetic algorithm (GA). At the first stage, we simulate a fuzzy number by distributing a fuzzy value into certain partition points. We then use GA to evolve the values in each partition point and the final values represent the membership grade of that fuzzy number. As a result, we obtain the estimated values of all fuzzy demands and fuzzy supplies and the original fuzzy problem becomes a defuzzified instance. The best solution to the defuzzified instance is then solved by the following stage via evolution process. The experimental results show that the proposed two-stage GA approach outperforms the other fuzzy approach to solving the transportation problem with fuzzy demands and fuzzy supplies.*

**Keywords:** Genetic algorithms, Fuzzy transportation problem, Fuzzy demand, Fuzzy supply

**1. Introduction.** The transportation problem was originally proposed by Hitchcock in 1941 and is an important role in logistics and supply chain management for reducing cost and improving service [4, 12]. It deals with the situation in which a commodity is shipped from sources to destinations. The objective is to determine the amounts shipped from each source to each destination that minimizes the total cost while satisfying both the supply limits and the demand requirements. The transportation model can be further extended to areas other than transportation of a commodity, such as inventory control, employment scheduling, and personnel assignment [15].

Several efficient algorithms have been developed over the past decades for solving the transportation problem when the cost coefficients and the supply and demand values are known exactly. In practice, however, this condition may not be fulfilled. This is because the unit of transportation cost may vary in a time frame and the supplies and demands may be uncertain due to some unpredictable factors, such as weather, social, or economic problems. Usually, fuzzy sets provide a useful tool to model and solve this kind of imprecision problem [11]. Kaufmann and Gupta [6] first examined the fuzzy transportation problem. One straightforward approach is to apply the existing fuzzy linear programming techniques directly to the fuzzy transportation problem. Several investigators have also discussed using different approaches to solving the problem. Chanas et al. [1] investigate the transportation problem with fuzzy supplies and fuzzy demands and solve them via