FUZZY TRANSPORTATION PROBLEM USING LCM METHOD WITH THE NEW RANKING TECHNIQUE- A STUDY

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Abstract:

The objective of transportation model is to transport the similar quantities which are initially stored at various origins (supply) to different destinations (demand) in such a way that the total transportation cost is minimum. In this paper, we discuss the solution of a fuzzy transportation problem, with trapezoidal fuzzy number. The trapezoidal fuzzy number is reduced to the ordinary fuzzy number in the use of Robust ranking technique. The problem is solved by using Least cost method. The producer is illustrated with numerical example.

Key words: Fuzzy number, Trapezoidal fuzzy number, Robust ranking technique, Fuzzy transportation model.

I.INTRODUCTION

Transportation model was first introduced by F.L.Hitchcock in1941. Later on, it was further improved by T.C.Koopman in 1949 and G.B.Dantzig in1951. Transportation problem is a special class of linear programming problem which is associated with day to day activities in our real life and mainly deals with logistic. Transportation models play an important role in logistics and supply-chain management for reducing cost and improving service.

The cost of transportation of unit commodity from each source to each destinations, it is required to determine the quantity of Commodity to the transportation from each source to different destinations such that the total cost of transportation is minimum. We shall now discuss the concept of fuzzy numbers.

This model has wide practical applications in the transportation systems. This typical transportation technique is applied to determine on optimal solution of the problem of delivering an available amount of apply to satisfy demands in which the total transportation cost is minimized or the total transportation profit is maximized.

Efficient algorithm has been developed for solving the classical transportation problem when the cost coefficients and supply and demand quantities are exactly known. But in real life, there are many diverse situations due to uncertainty in one or more decision parentless and hence they may not be expressed in a precise way. This is due to measurement inaccuracy, lack of evidence, Computational errors, high information cost, whether conditions etc,. Hence we cannot apply the traditional classical methods to solve the transportation problems successfully. In this case FTP (Fuzzy Transportation Problem) is plays a vital role.

II.PRELIMINARIES

In this section, some basic definition and Trapezoidal fuzzy numbers are discussed.

Crisp sets:

Crisp sets are the **sets** that we have used most of our life. In a **crisp set**, an element is either a member of the **set** or not.

Fuzzy set:

Fuzzy sets are somewhat like sets whose elements have degrees of membership function.

Membership:

For an element of , the value is called the **membership** degree of in the **fuzzy set**. The **membership** degree quantifies the grade of **membership** of the element to the **fuzzy set**. The value 0 means that is not a member of the **fuzzy set**; the value 1 means that is fully a member of the **fuzzy set**

Fuzzy Number:

A fuzzy number is a quantity whose value is imprecise, rather than exact as it's the case with "Ordinary" (Single-valued) numbers. It was introduced by Zadch in order to deal with imprecise numerical quantities.

Trapezoidal fuzzy number:

$u=(x_0, y_0, \sigma, B)$ With two de-fusilier x_0, y_0 and left fuzziness $\sigma > 0$ and right fuzziness $\beta > 0$ is a fuzzy set where the membership function is as,

$$\mu(x) = \begin{cases} \frac{1}{\sigma}(x - x_0 + \sigma), & x_0 - \sigma \le x \le x_0 x\varepsilon[x_0, y_0], \\ 1 & \\ \frac{1}{\beta}(y - x + \beta_0), & y_0 \le x \le y_0 + \beta \\ 0 & otherwise \end{cases}$$

Least cost method:

The least cost method is another method used to obtain the initial feasible solution for the transportation problem.

III.RANKING OF TRAPEZOIDAL FUZZY NUMBERS

Here, a new approach for ranking of generalized trapezoidal number is proposed using trapezoid as reference point. Ranking methods map fuzzy number directly in to the real line.
That is, $M : F \rightarrow R$ which associate every fuzzy number with a real umber and then use the ordering $\geq$ on the real line.

Let $A = (a_1, b_1, c_1, d_1; \omega_1)$ be generalized trapezoidal fuzzy numbers then R(A) is calculated as follows:

Step 1: Find $\omega = \min imum(\omega_1, \omega_2)$

Step 2: Find R(A) = $\frac{\omega}{4}[k(a_1 + d_1) + 2(l - k)(b_1 + c_1)]$, where $k \in (0,1)$

IV.MATHEMATICAL FORMULATION

Numerical Example:

Here we were taking the trapezoidal fuzzy numbers for the fuzzy transportation problem involving supply, demand and destination. Consider the following fuzzy transportation problem.

SOURCE	**DESTINATION**				**SUPPLY**
	(1,2,3,4)	(1,3,4,6)	(9,11,12,14)	(5,7,8,11)	(1,6,7,12)
	(0,1,2,4)	(-1,0,1,2)	(5,6,7,8)	(0,1,2,3)	(0,1,2,3)
	(3,5,6,8)	(5,8,9,12)	(12,15,16,19)	(7,9,10,12)	(5,10,12,17)
DEMAND	(5,7,8,10)	(1,5,6,10)	(1,3,4,6)	(1,2,3,4)	

Step 1:

Now by using the ranking technique, we convert the given fuzzy problem in to a crisp valued problem. The problem is done by taking the value of k as 0.5 and $\omega = 1$. The fuzzy transportation problem is

1.875	2.625	8.625	5.75	4.875
1.25	0.375	4.875	1.125	1.125
4.125	6.375	11.625	7.125	8.25
5.625	4.125	2.625	1.875	

Step 2:

The Least Cost Method (LCM) is used to obtain the initial basic feasible solution for the given transportation problem. Here, the allocation begins with the cell which has the minimum cost. The lower cost cells are chosen over the higher cost cell with the aim to have the least cost of transportation.

A)

1.875	2.625	8.625	5.75	4.875
	1.125			
4.125	6.375	11.625	7.125	8.25
5.625	3	2.625	1.875	

B)

4.875				
	1.125			
4.125	6.375	11.625	7.125	8.25
0.75	3	2.625	1.875	

C)

4.875				
	1.125			
0.75	6.375	11.625	7.125	7.5
	3	2.625	1.875	

D)

4.875				
	1.125			
0.75	3	11.625	7.125	4.5
		2.625	1.875	

E)

4.875				
	1.125			
0.75	3	11.625	1.875	2.625
		2.625		

F)

4.875			
	1.125		
0.75	3	2.625	1.875

This is not an optimal solution

Step 3:

Hence by using the MODI method we shall get the optimal solution as

1.875			
	1.125		
3.75	3	2.625	1.875

The crisp value of the optimum fuzzy transportation for given problem is 71

V.Conclusion:

It is very critical task to rank fuzzy numbers. Since each ranking method represents a different point of view on fuzzy numbers. So in this work a new simple ranking method is discussed. Though it is an impossible work to give a final answer to the question, the fuzzy ranking method is considered as one of the best technique. In this regard, the result obtained is considered to be optimum cost for the fuzzy transportation problems.

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