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A COMPARISON OF TRAPEZOIDAL, OCTAGONAL AND DODECAGONAL FUZZY NUMBERS IN SOLVING FTP

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ABSTRACT

In this paper the optimal solution for a fuzzy transportation problem obtained when solved using octagonal fuzzy numbers and dodecagonal fuzzy numbers have been compared and discussed. Also the importance of octagonal fuzzy numbers over dodecagonal fuzzy numbers though the latter may be considered as a more general class of the former has been explained.

1. INTRODUCTION

In [2] the authors have solved fuzzy transportation problem using octagonal fuzzy numbers. In [1] Jatinder pal *et. al.* have solved fuzzy transportation problem using dodecagonal fuzzy numbers and have compared their results with the results obtained in [2].

In this paper, the shortcomings of the results obtained in [1] has been discussed.

2. OCTAGONAL FUZZY NUMBERS: BASIC DEFINITIONS

For the sake of completeness we recall from **[2]**, the required definitions and results.

Definition 2.1 A generalized octagonal fuzzy number denoted by $\tilde{A}_\omega$ is defined to be the ordered quadruple $\tilde{A}_\omega \approx (l_1(r), s_1(t), s_2(t), l_2(r))$, for $r \in [0, k]$, and $t \in [k, \omega]$ where

(i) $l_1(r)$ is a bounded right continuous non decreasing function over $[0, \omega_1]$, $[0 \leq \omega_1 \leq k]$
(ii) $s_1(t)$is a bounded right continuous non decreasing function over $[k, \omega_2]$, $[k \leq \omega_2 \leq \omega]$
(iii) $s_2(t)$is a bounded right continuous non increasing function over $[k, \omega_2]$, $[k \leq \omega_2 \leq \omega]$
(iv) $l_2(r)$ is a bounded right continuous non increasing function over $[0, \omega_2]$, $[0 \leq \omega_1 \leq k]$

Remark 2.1 If ω=1, then the above-defined number is called a normal octagonal fuzzy number.

Definition 2.2 If $\tilde{A}$ be an octagonal fuzzy number, then the α-cut of $\tilde{A}$ is

$$[\tilde{A}]_\alpha = \{x | \tilde{A}(x) \geq \alpha\}$$
$$= \begin{cases} [l_1(\alpha), l_2(\alpha)] \text{ for } \alpha \in (0, k] \\ [s_1(\alpha), s_2(\alpha)] \text{ for } \alpha \in (k, 1] \end{cases}$$

The octagonal fuzzy number is convex as their α-cuts are convex sets in the classical sense.

The octagonal fuzzy numbers we consider for our study is a subclass of the generalized octagonal fuzzy numbers (Definition 2.1) defined as follows:

Definition 2.3 A fuzzy number $\tilde{A}$ is an octagonal fuzzy number (OFN) denoted by $(a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8; k, 1)$ where $a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8$ are real numbers and its membership function $\mu_{\tilde{A}}(x)$ is given below

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$$\mu_{\tilde{A}}(x) = \begin{cases} k\left(\frac{x-a_1}{a_2-a_1}\right), & a_1 \leq x \leq a_2 \\ k, & a_2 \leq x \leq a_3 \\ k+(1-k)\left(\frac{x-a_3}{a_4-a_3}\right), & a_3 \leq x \leq a_4 \\ 1, & a_4 \leq x \leq a_5 \\ k+(1-k)\left(\frac{a_6-x}{a_6-a_5}\right), & a_5 \leq x \leq a_6 \\ k, & a_6 \leq x \leq a_7 \\ k\left(\frac{a_8-x}{a_8-a_7}\right), & a_7 \leq x \leq a_8 \\ 0, & otherwise \end{cases}$$

where $0 < k < 1$.

Remark 2.2 If $k = 0$, the octagonal fuzzy number reduces to the trapezoidal number (a_3, a_4, a_5, a_6) and if k=1, it reduces to the trapezoidal number (a_1, a_2, a_7, a_8).

Remark 2.3 Membership functions $\mu_{\tilde{A}}(x)$ are continuous functions.

Remark 2.4 The collection of all normal octagonal fuzzy real numbers $\tilde{A}$ corresponding to $\mu_{\tilde{A}}: \mathbb{R} \longrightarrow I(=[0,1])$ is denoted by $\mathbb{R}(I)$.

Definition 2.4 For any octagonal fuzzy number $\tilde{A}$ given in Definition 2.3,

$$\tilde{A} - \tilde{A} \not\approx (0,0,0,0,0,0,0,0;k,1)$$

But

$$\tilde{A} - \tilde{A} \approx (-(a_8-a_1), -(a_7-a_2), -(a_6-a_3), -(a_5-a_4), (a_5-a_4), (a_6-a_3), (a_7-a_2), (a_8-a_1); k, 1)$$

and octagonal fuzzy number of the form
$(-(a_8-a_1), -(a_7-a_2), -(a_6-a_3), -(a_5-a_4), (a_5-a_4), (a_6-a_3), (a_7-a_2), (a_8-a_1); k, 1)$ are called octagonal fuzzy number equivalent to 0, denoted by $\tilde{0}$.

Definition 2.5 A trapezoidal fuzzy number (TrFN) denoted by $\tilde{A}$ is defined as (a_1, a_2, a_3, a_4) where the membership function is given by

$$\mu_{\tilde{A}}(x) = \begin{cases} \dfrac{x-a_1}{a_2-a_1}, & a_1 \leq x \leq a_2 \\ 1, & a_2 \leq x \leq a_3 \\ \dfrac{a_4-x}{a_4-a_3}, & a_3 \leq x \leq a_4 \\ 0 & otherwise \end{cases}$$

Definition 2.6[1]: The membership function $\mu_{\tilde{D}}$ for the Dodecagonal fuzzy number (DodeFN) $\tilde{D} \approx (a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8, a_9, a_{10}, a_{11}, a_{12})$ is given by

$$\mu_{\tilde{D}}(x) = \begin{cases} 0 & x \leq a_1 \\ k_1\left(\frac{x-a_1}{a_2-a_1}\right) & a_1 \leq x \leq a_2 \\ k_1 & a_2 \leq x \leq a_3 \\ k_1+(1-k_1)\left(\frac{x-a_3}{a_4-a_3}\right) & a_3 \leq x \leq a_4 \\ k_2 & a_4 \leq x \leq a_5 \\ k_2+(1-k_2)\left(\frac{x-a_5}{a_6-a_5}\right) & a_5 \leq x \leq a_6 \\ 1 & a_6 \leq x \leq a_7 \\ k_2+(1-k_2)\left(\frac{a_8-x}{a_8-a_7}\right) & a_7 \leq x \leq a_8 \\ k_2 & a_8 \leq x \leq a_9 \\ k_1+(1-k_1)\left(\frac{a_{10}-x}{a_{10}-a_9}\right) & a_9 \leq x \leq a_{10} \\ k_1 & a_{10} \leq x \leq a_{11} \\ k_1\left(\frac{a_2-x}{a_2-a_1}\right) & a_{11} \leq x \leq a_{12} \\ 0 & a_{12} \leq x \end{cases}$$

Arithmetic of Octagonal Fuzzy Numbers

For the sake of completeness we recall the definition of addition, subtraction and multiplication of octagonal fuzzy numbers as in [2] in terms of their $\alpha - cuts$.

a) α-cut of an octagonal fuzzy number: To find the α-cut of a normal octagonal fuzzy number $\tilde{A} \approx (a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8; k, 1)$ given in Definition 2.2 (i.e.$\omega = 1$), for $\alpha \in (0, 1]$,

$$[\tilde{A}]_\alpha = \begin{cases} \left[a_1 + \left(\frac{\alpha}{k}\right)(a_2 - a_1),\ a_8 - \left(\frac{\alpha}{k}\right)(a_8 - a_7)\right] & \text{for } \alpha \in (0, k] \\ \left[a_3 + \left(\frac{\alpha - k}{1-k}\right)(a_4 - a_3),\ a_6 - \left(\frac{\alpha - k}{1-k}\right)(a_6 - a_5)\right] & \text{for } \alpha \in (k, 1] \end{cases}$$

b) Addition on octagonal fuzzy numbers:
Let $\tilde{A} \approx (a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8; k, 1)$ and $\tilde{B} \approx (b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8; k, 1)$ be two octagonal fuzzy numbers. To calculate addition of fuzzy numbers $\tilde{A}$ and $\tilde{B}$ we first add the α–cuts of $\tilde{A}$ and $\tilde{B}$ using interval arithmetic.

$$[\tilde{A}]_\alpha + [\tilde{B}]_\alpha = \begin{cases} \left[a_1 + b_1 + \frac{\alpha}{k}(a_2 - a_1 + b_2 - b_1), a_8 + b_8 - \frac{\alpha}{k}(a_8 - a_7 + b_8 - b_7)\right], fo \quad \alpha \in (0, k] \\ \left[a_3 + b_3 + \left(\frac{\alpha - k}{1-k}\right)(a_4 - a_3 + b_4 - b_3), a_6 + b_6 - \left(\frac{\alpha - k}{1-k}\right)(a_6 - a_5 + b_6 - b_5)\right], fo \quad \alpha \in (k, 1] \end{cases}$$

c) Subtraction on octagonal fuzzy numbers:
Let $\tilde{A} \approx (a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8; k, 1)$ and $\tilde{B} \approx (b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8; k, 1)$ be two octagonal fuzzy numbers. To calculate subtraction of fuzzy numbers $\tilde{A}$ and $\tilde{B}$ we first subtract the *α–cuts* of $\tilde{A}$ and $\tilde{B}$ using interval arithmetic.

$$[\tilde{A}]_\alpha - [\tilde{B}]_\alpha = \begin{cases} \left[a_1 - b_8 + \frac{\alpha}{k}(a_2 - a_1 + b_8 - b_7), a_8 - b_1 - \frac{\alpha}{k}(a_8 - a_7 + b_2 - b_1)\right], \text{for } \alpha \in (0, k] \\ \left[a_3 - b_6 + \left(\frac{\alpha - k}{1-k}\right)(a_4 - a_3 + b_6 - b_5), a_6 - b_3 - \left(\frac{\alpha - k}{1-k}\right)(a_6 - a_5 + b_4 - b_3)\right], \text{for } \alpha \in (k, 1] \end{cases}$$

d) Multiplication on octagonal fuzzy numbers:
Let $\tilde{A} \approx (a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8; k, 1)$ and $\tilde{B} \approx (b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8; k, 1)$ be two octagonal fuzzy numbers. To calculate multiplication of fuzzy numbers $\tilde{A}$ and $\tilde{B}$ we multiply the *α–cuts* of $\tilde{A}$ and $\tilde{B}$ using interval arithmetic.

$[\tilde{A}]_\alpha \otimes [\tilde{B}]_\alpha = [q_\alpha^L, q_\alpha^R]$ where

$$q_\alpha^L = \min\left\{\left(a_1 + \frac{\alpha}{k}(a_2 - a_1)\right)\left(b_1 + \frac{\alpha}{k}(b_2 - b_1)\right), \left(a_1 + \frac{\alpha}{k}(a_2 - a_1)\right)\left(b_8 - \frac{\alpha}{k}(b_8 - b_7)\right), \left(a_8 - \frac{\alpha}{k}(a_8 - a_7)\right)\left(b_1 + \frac{\alpha}{k}(b_2 - b_1)\right), \left(a_8 - \frac{\alpha}{k}(a_8 - a_7)\right)\left(b_8 - \frac{\alpha}{k}(b_8 - b_7)\right)\right\}$$

$$q_\alpha^R = \max\left\{\left(a_1 + \frac{\alpha}{k}(a_2 - a_1)\right)\left(b_1 + \frac{\alpha}{k}(b_2 - b_1)\right), \left(a_1 + \frac{\alpha}{k}(a_2 - a_1)\right)\left(b_8 - \frac{\alpha}{k}(b_8 - b_7)\right), \left(a_8 - \frac{\alpha}{k}(a_8 - a_7)\right)\left(b_1 + \frac{\alpha}{k}(b_2 - b_1)\right), \left(a_8 - \frac{\alpha}{k}(a_8 - a_7)\right)\left(b_8 - \frac{\alpha}{k}(b_8 - b_7)\right)\right\} \quad \text{for } \alpha \in (0, k]$$

and

$$q_\alpha^L = \min\left\{\left(a_3 + \left(\frac{\alpha - k}{1-k}\right)(a_4 - a_3)\right)\left(b_3 + \left(\frac{\alpha - k}{1-k}\right)(b_4 - b_3)\right), \left(a_3 + \left(\frac{\alpha - k}{1-k}\right)(a_4 - a_3)\right)\left(b_6 + \left(\frac{\alpha - k}{1-k}\right)(b_6 - b_5)\right), \left(a_6 - \left(\frac{\alpha - k}{1-k}\right)(a_6 - a_5)\right)\left(b_3 + \left(\frac{\alpha - k}{1-k}\right)(b_4 - b_3)\right), \left(a_6 - \left(\frac{\alpha - k}{1-k}\right)(a_6 - a_5)\right)\left(b_6 + \left(\frac{\alpha - k}{1-k}\right)(b_6 - b_5)\right)\right\}$$

$$q_\alpha^R = \max\left\{\left(a_3 + \left(\frac{\alpha - k}{1-k}\right)(a_4 - a_3)\right)\left(b_3 + \left(\frac{\alpha - k}{1-k}\right)(b_4 - b_3)\right), \left(a_3 + \left(\frac{\alpha - k}{1-k}\right)(a_4 - a_3)\right)\left(b_6 + \left(\frac{\alpha - k}{1-k}\right)(b_6 - b_5)\right), \left(a_6 - \left(\frac{\alpha - k}{1-k}\right)(a_6 - a_5)\right)\left(b_3 + \left(\frac{\alpha - k}{1-k}\right)(b_4 - b_3)\right), \left(a_6 - \left(\frac{\alpha - k}{1-k}\right)(a_6 - a_5)\right)\left(b_6 + \left(\frac{\alpha - k}{1-k}\right)(b_6 - b_5)\right)\right\} \quad \text{for } \alpha \in (k, 1]$$

3. RANKING OF OCTAGONAL FUZZY NUMBERS [2]

In this paper, ranking of octagonal fuzzy numbers introduced by the authors in **[2]** is used to solve fuzzy transportation problem, wherein the cost, supply and demand are octagonal fuzzy numbers.

Definition 3.1 Let $\tilde{A}$ be an octagonal fuzzy number. The value $M_0^{Oct}(\tilde{A})$, called the measure of $\tilde{A}$ is calculated as follows:

$$M_0{}^{Oct}(\tilde{A}) = \frac{1}{2}\int_0^k (l_1(r) + l_2(r))dr + \frac{1}{2}\int_k^1 (s_1(t) + s_2(t))dt \text{ where } 0<k<1$$

$$= \frac{1}{2}[(a_1 + a_2 + a_7 + a_8)k + (a_3 + a_4 + a_5 + a_6)(1-k)] \quad (3.1)$$

Remark 3.1 If

$$a_1 + a_2 + a_7 + a_8 = a_3 + a_4 + a_5 + a_6 \quad (3.2)$$

We would get the measure of an octagonal fuzzy number same for any value of k $(0 < k < 1)$.

Remark 3.2 If $\tilde{A}$ and $\tilde{B}$ are two octagonal fuzzy numbers, then we have:

1. $\tilde{A} \preccurlyeq \tilde{B} \Leftrightarrow M_0^{Oct}(\tilde{A}) \le M_0^{Oct}(\tilde{B})$
2. $\tilde{A} \approx \tilde{B} \Leftrightarrow M_0^{Oct}(\tilde{A}) = M_0^{Oct}(\tilde{B})$
3. $\tilde{A} \succcurlyeq \tilde{B} \Leftrightarrow M_0^{Oct}(\tilde{A}) \ge M_0^{Oct}(\tilde{B})$

Remark 3.3 $\max_{i\in\mathbb{N}_n} \tilde{A}_i$ and $\min_{i\in\mathbb{N}_n} \tilde{A}_i$ are determined using the ranking defined by (3.1)

4. FUZZY TRANSPORTATION PROBLEM

Consider the fuzzy transportation problem involving octagonal fuzzy numbers given in [1]

Source	Destination				Supply
	(-3,-2,1,2,3,4,7,8;0.8,1)	(-2,-1,2,3,4,5,8,9;0.8,1)	(6,7,10,11,12,13,16,17;0.8,1)	(2,3,6,7,8,9,12,13;0.8,1)	(-1,0,5,6,7,8,13,14;0.8,1)
	(-4,-3,0,1,2,3,6,7;0.8,1)	(-5,-4,-1,0,1,2,5,6;0.8,1)	(0,1,5,6,7,8,12,13;0.8,1)	(-5,-4,0,1,2,4,7,9;0.8,1)	(-4,-3,0,1,2,3,6,7;0.8,1)
	(0,1,4,5,6,7,10,11;0.8,1	(1,2,7,8,9,10,15,16;0.8,1	(8,9,14,15,16,17,22,23;0.8,1)	(2,4,8,10,12,13,18,19;0.8,1)	(5,6,8,10,12,13,15,17;0.8,1)
Demand	(2,3,6,7,8,9,12,13;0.8,1)	(-2,0,3,5,6,7,11,12;0.8,1)	(-2,-1,2,3,4,5,8,9;0.8,1)	(-3,-2,1,2,3,4,7,8;0.8,1)	

Th optimal solution to this problem when solved as in [2] is $x_{12} \approx (-2,0,3,5,6,7,11,12;0.8,1)$, $\tilde{x}_{13} \approx (-14,-12,-2,0,2,5,14,17;0.8,1)$, $\tilde{x}_{23} \approx (-4,-3,0,1,2,3,6,7;0.8,1)$, $\tilde{x}_{31} \approx (2,3,6,7,8,9,12,13;0.8,1)$, $\tilde{x}_{33} \approx (-18,-16,-5,-1,3,6,17,20;0.8,1)$, $\tilde{x}_{34} \approx (-3,-2,1,2,3,4,7,8;0.8,1)$. The fuzzy optimal value is

$$\tilde{Z} \approx (-773,-609,-73,58,188,333,990,1227;0.8,1)$$

And the crisp optimal value of the fuzzy transportation problem is 192.3.

Note - 1: When the above fuzzy transportation problem is solved by taking $k = 0.4$ i.e.,

Source	Destination				Supply
	(-3,-2,1,2,3,4,7,8;0.4,1)	(-2,-1,2,3,4,5,8,9;0.4,1)	(6,7,10,11,12,13,16,17;0.4,1)	(2,3,6,7,8,9,12,13;0.4,1)	(-1,0,5,6,7,8,13,14;0.4,1)
	(-4,-3,0,1,2,3,6,7;0.4,1)	(-5,-4,-1,0,1,2,5,6;0.4,1)	(0,1,5,6,7,8,12,13;0.4,1)	(-5,-4,0,1,2,4,7,9;0.4,1)	(-4,-3,0,1,2,3,6,7;0.4,1)
	(0,1,4,5,6,7,10,11;0.4,1	(1,2,7,8,9,10,15,16;0.4,1	(8,9,14,15,16,17,22,23;0.4,1)	(2,4,8,10,12,13,18,19;0.4,1)	(5,6,8,10,12,13,15,17;0.4,1)
Demand	(2,3,6,7,8,9,12,13;0.4,1)	(-2,0,3,5,6,7,11,12;0.4,1)	(-2,-1,2,3,4,5,8,9;0.4,1)	(-3,-2,1,2,3,4,7,8;0.4,1)	

The optimal solution obtained is $x_{12} \approx (-2,0,3,5,6,7,11,12;0.4,1)$, $x_{13} \approx (-14,-12,-2,0,2,5,14,17;0.4,1)$, $x_{23} \approx (-4,-3,0,1,2,3,6,7;0.4,1)$, $x_{31} \approx (2,3,6,7,8,9,12,13;0.4,1)$, $x_{33} \approx (-18,-16,-5,-1,3,6,17,20;0.4,1)$, $x_{34} \approx (-3,-2,1,2,3,4,7,8;0.4,1)$ and the fuzzy optimal value is $\tilde{Z} \approx (-773,-609,-73,58,188,333,990,1227;0.4,1)$

The crisp value of the optimum fuzzy transportation cost for the problem is 159.4

Note - 2: In [1] the Jatinder *et. al.* have solved the fuzzy transportation problem

Source	Destination				Supply
	(-3,-2,-1,0,1,2,3,4,5,6,7,8)	(-2,-1,0,1,2,3,4,5,6,7,8,9)	(6,7,8,9,10,11,12,13,14 15,16,17)	(2,3,4,5,6,7,8,9,10,11,12,13)	(-1,0,1,3,5,6,7,8,10,12,13,14)
	(-4,-3,-2,-1,0,1,2,3,4,5,6,7)	(-5,-4,-3,-2,-1,0,1,2,3,4,5,6)	(0,1,2,4,5,6,7,8,9,11,12,13)	(-5,-4,-3,-1,0,1,2,4,5,6,7,9)	(-4,-3,-2,-1,0,1,2,3,4,5,6,7)
	(0,1,2,3,4,5,6,7,8,9,10,11)	(1,2,3,6,7,8,9,10,12,13,15,16)	(8,9,11,12,14,15,16,17,18,21,22,23)	(2,3,5,8,9,10,11,12,15,16,17)	(2,4,5,6,8,10,12,13,15,17,18,19)
Demand	(2,3,4,5,6,7,8,9,10,11,12,13)	(-2,0,1,2,3,5,6,7,8,10,11,12)	(-2,-1,0,1,2,3,4,5,6,7,8,9)	(-3,-2,-1,0,1,2,3,4,5,6,7,8)	

wherein the cost supply and demand entries were dodecagonal fuzzy numbers. Also in [1] they have compared their optimal solution with the optimal solution obtained when done using octagonal fuzzy numbers. But when they converted the entries in the fuzzy problem to octagonal fuzzy numbers, they have used the value of k as 0.8. If the same problem is done using octagonal fuzzy numbers by taking the value of k as 0.4, then the solution obtained will be a better one (i.e., more optimal), only when it is done using octagonal fuzzy numbers. Hence it cannot be concluded that solving fuzzy transportation problem using dodecagonal fuzzy numbers always gives better results than when the problem is done using octagonal fuzzy numbers. Depending on the nature of the problem the appropriate fuzzy number is to be used.

In [1] Jatinder *et al.* has solved the FTP using Trapezoidal Fuzzy cost by taking $k_1 = k_2 = 1$, in the problem solved using dodecagonal fuzzy numbers and the fuzzy transportation problem reduced to the trapezoidal fuzzy transportation problem given by

Source	Destination				Supply
	$(-3,-2,7,8)$	$(-2,-1,8,9)$	$(6,7,16,17)$	$(2,3,12,13)$	$(-1,0,13,14)$
	$(-4,-3,6,7)$	$(-5,-4,5,6)$	$(0,1,12,13)$	$(-5,-4,7,9)$	$(-4,-3,6,7)$
	$(0,1,10,11)$	$(1,2,15,16)$	$(8,9,22,23)$	$(2,3,16,17)$	$(2,4,18,19)$
Demand	$(2,3,12,13)$	$(-2,0,11,12)$	$(-2,-1,8,9)$	$(-3,-2,7,8)$	

On solving this problem [1] the crisp value of the FTP is obtained as 202.667.

	TrFN	OFN	DodeFN
$\tilde{z}$	(-773,-609, 990,1227)	$\begin{pmatrix} -773,-609,-73,58, \\ 188,333,990,1227;0.4,1 \end{pmatrix}$	(-773,-609,-416,-224,-73,58, 188,333, 516,773,990,1227)
Crisp Optimal Cost	202.667	159.4	173.7

Note 3: The arithmetic operation – subtraction given in [1] is over-done, in sense, it is not necessary to write minimum and maximum because using the concept of interval arithmetic

$[a_1, b_1] - [a_2, b_2] = [a_1 - b_2, b_1 - a_2]$ and

$$\neq [\min(a_1 - a_2, a_1 - b_2, b_1 - a_2, b_1 - b_2), \max(a_1 - a_2, a_1 - b_2, b_1 - a_2, b_1 - b_2)]$$

CONCLUSION

In [1] Jatinder pal et. al. have solved a fuzzy transportation problem using dodecagonal fuzzy numbers and in [2] the authors have solved a fuzzy transportation problem using octagonal fuzzy numbers. In this connection the authors would like to mention that the conclusion given in [1] is not true generally.

In section 7.1 of [1] the authors have compared their result with the result obtained by solving the fuzzy transportation problem as in [2]. The authors have mentioned in their conclusion that the fuzzy optimal cost for a fuzzy transportation problem obtained when solved using dodecagonal fuzzy number is more optimal than when the problem is solved using octagonal fuzzy number. To justify their work they have solved the problem using octagonal fuzzy number by taking the value of k as 0.8. If the same problem is done by taking k value as any value less than 0.5, then the cost obtained would be optimal only when it is solved using octagonal fuzzy numbers. Hence the conclusion given by Jatinder pal et. al in [1] is not true generally, depending on the nature of the problem the fuzzy number which gives more optimal solution should be considered for solving a fuzzy transportation problem.

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