PalArch's Journal of Archaeology of Egypt / Egyptology

A New Perspective for Solving Generalized Trapezoidal Intuitionistic Fuzzy Transportation Problems using Centroid of Centroids

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Indira Singuluri, N. Ravi Shankar: A New Perspective for Solving Generalized Trapezoidal Intuitionistic Fuzzy Transportation Problems using Centroid of Centroids -- Palarch's Journal Of Archaeology Of Egypt/Egyptology 17(9). ISSN 1567-214x

Keywords: IFN, TrIFN, Intuitionistic optimum solution, Trapezoidal intuitionistic fuzzy transportation problem

ABSTRACT

In today's daily life situations TP we frequently face the situation of unreliability in addition to unwillingness due to various unmanageable components. To handle with unreliability and unwillingness multiple researchers have recommended the intuitionistic fuzzy (IF) delineation for material. This paper proposes the approach used by generalized triangular intuitionistic fuzzy number to solve these transport problem, i.e. capacity and demand are considered as real numbers and charge of transport from origin to destination is considered as generalized triangular intuitionistic fuzzy numbers as charge of product per unit. The generalized triangular intuitionistic fuzzy numbers ranking function is used on the basis of IFN'S centroid of centroids. Through the traditional optimization process, we generate primary basic feasible solution and foremost solution. The numerical illustration shows efficacy of technique being suggested. A fresh technique is implemented to seek foremost solution using ranking function of a fuzzy TP of generalized triangular intuitionistic fuzzy number. Without finding a IBFS, this approach explicitly provides optimal solution for GTrIFTP. Finally, for ranking function we apply a proposed GTrIFTP method illustrated Numerical example.

1. Introduction

Fuzzy set (FS) theory was first invented by [11] has been involved effective in different fields. The concept fuzzy mathematical programming was invented by Tanaka et al in 1947 the framework of fuzzy decision of [2]. The concept of Intuitionistic fuzzy sets (IFS's) suggested by [1] is found to be hugely useful to deal with ambiguity. The IFS's separate proportion integration (fulfillment level) and proportion non-participation (non-fulfillment level) of an element in

the set. IFS's assist constrained to agree proportion fulfillment, proportion of non-fulfillment and proportion of uncertainty for consignment and assist to mould decision about intensity of approval and non-approval for TC in any TP. Owing upon execution of IFS theory enhance fit attractive in regulating obstacles. Consequently keen exceed to avail IFS in contrast with FS to review unfaithfulness. In [4], look over a relative swot on TP in fuzzy domain. Reference [6] investigated a method to solve fuzzy transportation problem (FTP) by taking trapezoidal fuzzy numbers. So, many authors used IFS's in different regenerate obstacles. Reference [3] introduced computational operations of IFS's. Multiple researchers further devised with IFS's. Intuitionistic trapezoidal fuzzy numbers are introduced in [10], which are extending of intuitionistic triangular fuzzy numbers. Intuitionistic triangular fuzzy numbers and intuitionistic trapezoidal fuzzy numbers are extending of intuitionistic fuzzy sets in another way, which extends discrete set to continuous set, and they are extending of fuzzy numbers. Intuitionistic trapezoidal fuzzy weighted arithmetic averaging operators and weighted geometric averaging operators are introduced by [8][9]. Reference [5] defined ordering of IFN's using centroid of centroids of IFN. We extended above paper [5] by assuming transportation problem. However assumed TP is solved by using proposed method and zero centered method.
Rest of article is organized as follows: Section 2 Preliminaries deals with some basic definitions, section 3 provides Ranking function of GTrIFN, section 4 deals with mathematical formulation and proposed method, section 5consists Numerical example, finally conclusion is given in section 6.

2. Preliminaries

In this segment a few preliminaries and computations are discussed.

Intuitionistic Fuzzy Set (IFS):

An IFS $\tilde{A}^{IFS}$ in X is detailed as object of following form

$$\tilde{A}^{IFS} = \{\langle x, \mu_{\tilde{A}^{IFS}}(x), \nu_{\tilde{A}^{IFS}}(x)\rangle : x \in X\}$$

Where, the functions$\mu_{\tilde{A}^{IFS}} : X \to [0, 1]$ and $\nu_{\tilde{A}^{IFS}}: X \to [0, 1]$ define intensity of integration function and the non-membership of element$x \in X$, respectively and $0 \le \mu_{\tilde{A}^{IFS}}(x), \nu_{\tilde{A}^{IFS}}(x) \le 1$, for every$x \in X$.

Intuitionistic Fuzzy Numbers (IFN's):

A subset of IFS, $\tilde{A}^{IFS} = \{\langle x, \mu_{\tilde{A}^{IFS}}(x), \nu_{\tilde{A}^{IFS}}(x)\rangle : x \in X\}$, of real line $\Re$ is called an IFN if following holds:

(i) $\exists m \in \Re, \mu_{\tilde{A}^{IFS}}(m) = 1 \, and \, \nu_{\tilde{A}^{IFS}}(m) = 0$

(ii) $\mu_{\tilde{A}^{IFS}} : \Re \to [0, 1]$is continuous and for every $x \in \Re, 0 \le \mu_{\tilde{A}^{IFS}}(x), \nu_{\tilde{A}^{IFS}}(x) \le 1$ holds.

The membership function and non-membership function of $\tilde{A}^{IFS}$is demonstrated,

$$\mu_{\tilde{A}^{IFS}}(x) = \begin{cases} f_1(x), & x \in [m-\alpha_1, m) \\ 1, & x = m \\ h_1(x), & x \in (m, m+\beta_1] \\ 0, & otherwise \end{cases} \text{ and } \nu_{\tilde{A}^{IFS}}(x) = \begin{cases} 1, & x \in (-\infty, m-\alpha_2) \\ f_2(x), & x \in [m-\alpha_2, m) \\ 0, & x = m, x \in [m+\beta_2, \infty) \\ h_2(x), & x \in (m, m+\beta_2] \end{cases}$$

Where $f_i(x)$ and $h_i(x)$; $i = 1,2$ are strictly increasing and decreasing functions in $[m-\alpha_i, m)$ and $(m, m-\beta_i]$ respectively. α_i and β_i are the left and right spreads of $\mu_{\tilde{A}^{IFS}}(x)$ and $\nu_{\tilde{A}^{IFS}}(x)$ respectively.

Trapezoidal Intuitionistic Fuzzy Number (TrIFN):

An IFN $\tilde{A}^{TrIFS} = \langle (a_1, a_2, a_3, a_4)(a_1', a_2, a_3, a_4') \rangle$ is an TrIFN in $\Re$ with the following membership function $\mu_{\tilde{A}^{IFS}}$ and non-membership function $\nu_{\tilde{A}^{IFS}}$ defined by

$$\mu_{\tilde{A}^{IFS}}(x) = \begin{cases} 0 & x < a_1 \\ \frac{x-a_1}{a_2-a_1} & a_1 < x < a_2 \\ 1 & a_2 < x < a_3 \\ \frac{x-a_4}{a_3-a_4} & a_3 < x < a_4 \\ 0 & a_4 < x \end{cases} \text{ and } \upsilon_{\tilde{A}^{IFS}}(x) = \begin{cases} 0 & x < a_1' \\ \frac{x-a_2}{a_1'-a_2} & a_1' < x < a_2 \\ 0 & a_2 < x < a_3 \\ \frac{x-a_3}{a_3-a_4'} & a_3 < x < a_4' \\ 1 & a_4' < x \end{cases}$$

Generalized TrIFN (GTrIFN):

An IFN $\tilde{A}^{IFS} = \langle (a_1, a_2, a_3, a_4; \omega_a)(a_1', a_2, a_3, a_4'; \sigma_a) \rangle$ claimed to be a GTrIFN if its integration and non-membership consequence are respectively liable

$$\mu_{\tilde{A}^{IFS}}(x) = \begin{cases} 0 & if\ x < a_1 \\ \frac{(x-a_1)\omega_a}{a_2-a_1} & if\ a_1 < x < a_2 \\ \omega_a & if\ a_2 < x < a_3 \\ \frac{(x-a_4)\omega_a}{a_3-a_4} & if\ a_3 < x < a_4 \\ 0 & if\ a_4 < x \end{cases} \text{ and } \upsilon_{\tilde{A}^{IFS}}(x) = \begin{cases} 0 & if\ x < a_1' \\ \frac{x-a_2-\sigma_a(a_1'-x)}{a_1'-a_2} & if\ a_1' < x < a_2 \\ \sigma_a & if\ a_2 < x < a_3 \\ \frac{a_3-x-\sigma_a(x-a_4')}{a_3-a_4'} & if\ a_3 < x < a_4' \\ 1 & if\ a_4' < x \end{cases}$$

Where ω_a and σ_a constitute extreme intensity of integration and minimal intensity of non-membership sequentially, gratifying $0 \le \omega_a \le 1, 0 \le \sigma_a \le 1, 0 \le \omega_a + \sigma_a \le 1$. Graphical representation of GTrIFN is illustrated in Fig.1.

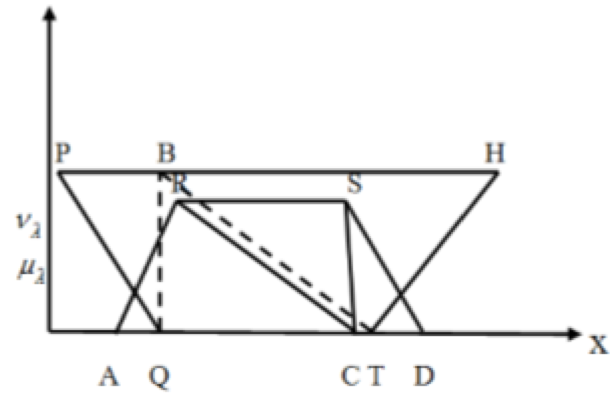

Fig 1: GTrIFN graph

Arithmetic operations of GTrIFN:
For any two TrIFN's
$\tilde{A}^{TrIFN} = \langle (a_1, a_2, a_3, a_4; \omega_a)(a'_1, a_2, a_3, a'_4; \sigma_a) \rangle$ and
$\tilde{B}^{TrIFN} = \langle (b_1, b_2, b_3, b_4; \omega_b)(b'_1, b_2, b_3, b'_4; \sigma_b) \rangle$ the arithmetic operations are as follows,

(i) GTrIFN's Addition:

$$\tilde{A}^{GTrIFN} \oplus \tilde{B}^{GTrIFN} = \left\langle \begin{matrix} (a_1+b_1, a_2+b_2, a_3+b_3, a_4+b_4; \min(\omega_a, \omega_b)) \\ (a'_1+b'_1, a_2+b_2, a_3+b_3, a'_4+b'_4; \max(\sigma_a, \sigma_b)) \end{matrix} \right\rangle$$

(ii) GTrIFN's Subtraction:

$$\tilde{A}^{GTrIFN} - \tilde{B}^{GTrIFN} = \left\langle \begin{matrix} (a_1-b_4, a_2-b_2, a_3-b_3, a_4-b_1; \min(\omega_a, \omega_b)) \\ (a'_1-b'_4, a_2-b_2, a_3-b_3, a'_4-b'_1; \max(\sigma_a, \sigma_b)) \end{matrix} \right\rangle$$

(ii) Scalar Multiplication:

$$k \times \tilde{A}^{GTrIFN} = \left\langle \begin{matrix} (ka_1, ka_2, ka_3, ka_4; \omega_a)(ka'_1, ka_2, ka_3, ka'_4; \sigma_a) \text{ if } k > 0 \\ (ka_4, ka_3, ka_2, ka_1; \omega_a)(ka'_4, ka_3, ka_2, ka'_1; \sigma_a) \text{ if } k > 0 \end{matrix} \right\rangle$$

3. Ranking Function Of Gtrifn

Definition: Let the GTrIFN be $\tilde{A}^{TrIFN} = \langle (a_1, a_2, a_3, a_4; \omega_a)(b_1, b_2, b_3, b_4; \omega_a) \rangle$ ranking function of a GTrIFN can be taken from Pardha Saradhi et al. [5] is

$$R(\tilde{A}^{TrIFN}) = \left(\frac{a_1 + b_1 + 2(a_2 + b_3) + 5(a_3 + b_2) + a_4 + b_4}{18} \right) \left(\frac{4\omega_a + 5\omega_b}{18} \right)$$

$Ex:\ Let\ \tilde{A}^{GTrIFN} = \langle (2, 7, 11, 15; 0.5)(1, 7, 11, 18; 0.3) \rangle\ then$

$$R(\tilde{A}^{GTrIFN}) = \left(\frac{2 + 1 + 2(7 + 11) + 5(11 + 7) + 15 + 18}{18} \right) \left(\frac{4(0.5) + 5(0.3)}{18} \right)$$

$$= 1.75$$

Comparison of GTrIFN's:

In order to compare GTrIFN's with every one, obliged to graded. An assignment comparable $R: F(\mathfrak{R}) \rightarrow \mathfrak{R}$, which depict each TIFN's amongst existent rule, is called ranking function. At this moment, $F(\mathfrak{R})$ signify inclined GTrIFN's.

By using the ranking function "R", GTrIFN's can be compared.

Let $\tilde{A}^{TrIFN} = \langle (a_1, a_2, a_3, a_4; \omega_a)(a'_1, a_2, a_3, a'_4; \sigma_a) \rangle$ and $\tilde{B}^{TrIFN} = \langle (\mathrm{b}_1, \mathrm{b}_2, \mathrm{b}_3, \mathrm{b}_4; \omega_b)(\mathrm{b}'_1, \mathrm{b}_2, \mathrm{b}_3, \mathrm{b}'_4; \sigma_b) \rangle$ are two GTrIFN's then

$$R(\tilde{A}^{TrIFN}) = \left(\frac{a_1 + a'_1 + 2(a_2 + a'_3) + 5(a_3 + a'_2) + a_4 + a_4}{18} \right) \left(\frac{4\omega_a + 5\sigma_a}{18} \right) \ and$$

$$R(\tilde{B}^{TrIFN}) = \left(\frac{b_1 + b'_1 + 2(b_2 + b'_3) + 5(b_3 + b'_2) + b_4 + b'_4}{18} \right) \left(\frac{4\omega_b + 5\sigma_b}{18} \right)$$

Subsequently series circumscribed as

(i) $\tilde{A}^{TrIFN} > \tilde{B}^{TrIFN}$ if $\mathrm{R}\left(\tilde{A}^{TrIFN}\right) > R\left(\tilde{B}^{TrIFN}\right)$,

(ii) $\tilde{A}^{TrIFN} < \tilde{B}^{TrIFN}$ if $\mathrm{R}\left(\tilde{A}^{TrIFN}\right) < R\left(\tilde{B}^{TrIFN}\right)$, and (iii) $\tilde{A}^{TrIFN} = \tilde{B}^{TrIFN}$ if $\mathrm{R}\left(\tilde{A}^{TrIFN}\right) = \mathrm{R}\left(\tilde{B}^{TrIFN}\right)$

Ranking function *R* confine the following possessions:

(i) $\mathrm{R}\left(\tilde{A}^{TrIFN}\right) + \mathrm{R}\left(\tilde{B}^{TrIFN}\right) = \mathrm{R}\left(\tilde{A}^{TrIFN} + \tilde{B}^{TrIFN}\right)$, (ii) $\mathrm{R}\left(\mathrm{k}\tilde{A}^{TrIFN}\right) = \mathrm{k}\,\mathrm{R}\left(\tilde{A}^{TrIFN}\right) \forall \mathrm{k} \in \boldsymbol{R}$

4. Mathematical Formulation Of Trapezoidal Intuitionistic Fuzzy Transportation Problem:

In TP decision maker or magnificent temporize abounding aspect over spanning in order through dealer and requirement. Occasionally decision maker is indecisive substantially more aggregate of peculiar commodity accessible at repository at peculiar time unlike intention. To this extent, he has not transmit to his associate or he is uncertain that how often aggregate of peculiar commodity credibly fabricate according to accessible primal matter by peculiar time. Uniformly, he may temporize from requirement. Intendedly new commodity eventually instigates in a market then he cannot decide exact aggregate of this commodity should transit to a peculiar terminus. Perhaps owing to unfamiliarity of the customers about this commodity or difference in cost and efficacy of commodity to similar one. We employ IFNs to deal with hesitation and uncertainty.

Appraise a TP with 'm' inceptions and 'n' terminus. Let c_{ij} be cost of transiting one unit of commodity from i^{th} inception to the j^{th} terminus.

Let $\tilde{a}_i^{GTrIFN} = (a_1^i, a_2^i, a_3^i, a_4^i, \omega_a; a_1^{i'}, a_2^i, a_3^i, a_4^{i'}, \sigma_a)$ be the Intuitionistic fuzzy quantity available at the i^{th} origin.

$\tilde{b}_j^{GTrIFN} = (b_1^j, b_2^j, b_3^j, b_4^j, \omega_b; b_1^{j'}, b_2^j, b_3^j, b_4^{j'}, \sigma_b)$ be the Intuitionistic fuzzy quantity needed at the j^{th} destination. $\tilde{x}_{ij}^{GTrIFN} = (x_1^{ij}, x_2^{ij}, x_3^{ij}, x_4^{ij}; x_1^{ij'}, x_2^{ij}, x_3^{ij}, x_4^{ij'})$ be the Intuitionistic fuzzy quantity transformed from the i^{th} origin to the j^{th} destination. Then the balanced generalized trapezoidal intuitionistic fuzzy transportation problem is given by

$$Min\, \tilde{Z}^{GTrIFN} = \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} \times x_{ij}$$

$$s.t. \quad \sum_{j=1}^{n} \tilde{x}_{ij}^{GTrIFN} \le \tilde{a}_i^I, i = 1, 2, ..., m$$

$$\sum_{i=1}^{m} \tilde{x}_{ij}^{GTrIFN} \ge \tilde{b}_i^I, j = 1, 2, ..., n$$

$$\tilde{x}_{ij}^{GTrIFN} \ge \tilde{0};\ i = 1, 2, ..., m;\ j = 1, 2, ..., n$$

5. Proposed Method

Preferred method is elementary and prompt strategy to seek prime solution $\{x_{ij}\}$ including intuitionistic fuzzy optimal value $\tilde{Z}^{GTrIFN}$ of TP having repository including demand limitations as real number and TC, $\tilde{c}_{ij}^{GTrIFN}; (i = 1, 2, ..., m; j = 1, 2, ..., n)$ from i^{th} source to j^{th} requirement, extract intuitionistic fuzzy number represented in Table 1.

	D_1	D_2	…	D_n	**Sup** (s_i)
S_1	$\tilde{c}_{11}^{GTrIFN}$	$\tilde{c}_{12}^{GTrIFN}$	…	$\tilde{c}_{1n}^{GTrIFN}$	s_1
S_2	$\tilde{c}_{21}^{GTrIFN}$	$\tilde{c}_{22}^{GTrIFN}$		$\tilde{c}_{2n}^{GTrIFN}$	s_2
.	.	.	…	.	.
.	.	.	…	.	.
.	.	.	…	.	.
S_m	$\tilde{c}_{m1}^{GTrIFN}$	$\tilde{c}_{m2}^{GTrIFN}$		$\tilde{c}_{mn}^{GTrIFN}$	s_m
Dem (d_j)	d_1	d_2	…	d_n	

Table 1: GTrIFTP.

Step 1: Origin depletion form

Utilizing contingent formula, discussed in “Comparison of GTrIFN’s” segment, determine least GTrIFN from all origin of generalized trapezoidal intuitionistic fuzzy price matrix of generalized trapezoidal intuitionistic fuzzy TP (GTrIFTP) and deduct from GTrIFN’s of equivalent origin.

Step 2: Requirement depletion form

Utilizing contingent formula, discussed in “Comparison of GTrIFN’s” section determine least GTrIFN from demand of derived generalized trapezoidal intuitionistic fuzzy price matrix, acquired in Step 1, and deduct from each GTrIFN’s of equivalent column.

Step 3: Generalized Trapezoidal Intuitionistic fuzzy zero centered value
Review all origin and column has minimum one GTrIFN whose rank is zero. If it is inconsistent, then replicate Step1 and Step2. Evaluategeneralized trapezoidal intuitionistic fuzzy zero centered value i.e., $\tilde{c}_{ij}^{GTrIFN}$, for every unit possess zero rank value. Where $\tilde{c}_{ij}^{GTrIFN}$ is $\tilde{c}_{ij}^{GTrIFN} = \frac{sum\, of\ generalized\ trapezoidal\ IF\ \cos t\ around\ the\ cell\ having\ zero\ rank\ value}{Number\ of\ generalized\ trapezoidal\ IF\ \cos t\ added\ having\ non-zero\ rank\ value}$
Step 4: Allocation
Prefer a unit $\{(i,j):\min\{R(\tilde{c}_{ij}^{GTrIFN})\}\}$, and assign maximal attainable extent to unit. Eradicate either the i^{th} row or j^{th} column, whose extent is fully assigned.
Step 5: Iteration
Replicate Step 3 and Step 4 until all assignments have been made.
Step 6: Optimum solution and generalized trapezoidal Intuitionistic fuzzy optimum value
Solution, acquired in Step 5, is prime solution $\{x_{ij}\}$ and intuitionistic fuzzy optimal value is $\sum_{i=1}^{m}\sum_{j=1}^{n}\tilde{c}_{ij}^{GTrIFN}\otimes x_{ij}$.

6. Numerical Examples:

In this unit, an prevailed numerical example is resolved to instance proposed generalized trapezoidal intuitionistic fuzzy zero centred method.
Example 1: An existing Generalized trapezoidal Intuitionistic fuzzy transportation problem (GTrIFTP), with three repositories i.e.S1, S2, S3 including three demands i.e., D1, D2, D3 respectively by Table 2 taken from [7], is resolved using proposed intuitionistic fuzzy zero centered method.

	D1	D2	D3	Supply
S1	(2,4,8,15;0.6)(1,4,8,18: 0.3)	(3,5,7,12;0.5)(1,5,7,15; 0.3)	(2,5,9,16;0.7)(1,5,9,18; 0.3)	25
S2	(2,5,8,10;0.6)(1,5,8,12; 0.2)	(4,8,10,13;0.4)(3,8,10,15; 0.3)	(3,6,10,15;0.8)(2,6,10,18;0.2)	30
S3	(2,7,11,15;0.5)(1,7,11,18; 0.3)	(5,9,12,16;0.7)(3,9,12,19; 0.2)	(4,6,8,10;0.6)(3,6,8,12; 0.3)	40
Demand	35	45	15	

Table 2 GTrITP

Solution:
Problem is resolved in the following steps
Step 1: Origin depletion form
Utilizing Step 1 of proposed method, GTrIFTP, given in Table 2 remodelinto rowdiminish form as given in Table 3.

Table 3Origin depletion form

	D1	D2	D3	Supply
S1	(-10,-3,3,12;0.5)(-14,-3,3,17: 0.3)	**(-9,-2,2,9;0.5)(-14,-2,2,14;0.3)**	(-10,-2,4,13;0.5)(-14,-2,4,17; 0.3)	25
S2	**(-8,-3,3,8;0.6)(-11,-3,3,11; 0.2)**	(-6,0,5,11;0.4)(-9,0,5,14; 0.3)	(-7,-2,5,13;0.6)(-10,-2,5,17;0.2)	30
S3	(-8,-1,5,11;0.5)(-11,-1,5,15; 0.3)	(-5,1,6,12;0.6)(-9,1,6,16;0.3)	**(-6,-2,2,6;0.6)(-9,-2,2,9;0.3)**	40
Demand	35	45	15	

Step 2: Intuitionistic fuzzy zero centered value

In Table 3, we can definitely observe that cell (1, 2), (2, 1), (3, 3) has zero rank value, therefore the intuitionistic fuzzy zero centered value corresponding to these cells are,

$$\tilde{C}_{12} = \frac{(-10,-3,3,12;0.5)(-14,-3,3,17:\ 0.3)\oplus(-6,0,5,11;0.4)(-9,0,5,14;\ 0.3)\oplus(-10,-2,4,13;0.5)(-14,-2,4,17;\ 0.3)}{3}$$

$$= (-8.6667,-1.6667,4,12;0.4)(-12.3333,-1.6667,4,14;0.3)$$

such that $R(\tilde{C}_{12}) = 0.2041$.

$$\tilde{C}_{21} = \frac{(-10,-3,3,12;0.5)(-14,-3,3,17:\ 0.3)\oplus(-6,0,5,11;0.4)(-9,0,5,14;\ 0.3)\oplus(-8,-1,5,11;0.5)(-11,-1,5,15;\ 0.3)}{3}$$

$$= (-8,-1.3333,4.3333,11.3333;0.4)(-11.3333,-1.3333,4.3333,15.3333;0.3)$$

such that $R(\tilde{C}_{21}) = 0.2711$.

$$\tilde{C}_{33} = \frac{(-7,-2,5,13;0.6)(-10,-2,5,17;0.2)\oplus(-5,1,6,12;0.6)(-9,1,6,16;\ 0.3)}{2}$$

$$= (-6,-0.5,5.5,12.5;0.6)(-9.5,-0.5,5.5,16.5;0.3)$$

such that $R(\tilde{C}_{33}) = 0.5838$

Step 4: Allocation

Since, $R(\tilde{C}_{12}) = 0.2041$ is smallest value, attained in Step 2, therefore, assign maximum potential amount i.e. 25 to cell (1, 2) and eradicate repository S1.Final outcome given in Table 4.

Table4 After first allocation

	D1	D2	D3	Supply
e	**(-8,-3,3,8;0.6)(-11,-3,3,11; 0.2)**	(-6,0,5,11;0.4)(-9,0,5,14; 0.3)	(-7,-2,5,13;0.6)(-10,-2,5,17;0.2)	30
S3	(-8,-1,5,11;0.5)(-11,-1,5,15; 0.3)	(-5,1,6,12;0.6)(-9,1,6,16;0.3)	**(-6,-2,2,6;0.6)(-9,-2,2,9;0.3)**	40
Demand	35	20	15	

Second column doesn't have any zero rankgeneralized trapezoidal Intuitionistic fuzzy number. So, we subtract(-6,0,5,11;0.4)(-9,0,5,14; 0.3)having least ranking value from second column, attained new table is shown in Table 5.

Table5 New reduced table

	D1	D2	D3	Supply
S2	**(-8,-3,3,8;0.6)(-11,-3,3,11; 0.2)**	**(-17,-5,5,17;0.4)(-23,-5,5,23; 0.3)**	(-7,-2,5,13;0.6)(-10,-2,5,17;0.2)	30
S3	(-8,-1,5,11;0.5)(-11,-1,5,15; 0.3)	(-16,-4,6,18;0.4)(-23,-4,6,25;0.5)	**(-6,-2,2,6;0.6)(-9,-2,2,9;0.3)**	40
Demand	35	20	15	

Since, $R(\tilde{C}_{21}) = 0.3013$ is smallest value attained in table 5, therefore, assign maximum potential amount i.e. 30 to cell (2, 1) and eradicate repository S2.Final outcome given in Table 6.

Table 6 New reduced table

	D1	D2	D3	Supply
S3	(-8,-1,5,11;0.5)(-11,-1,5,15; 0.3)	(-16,-4,6,18;0.4)(-23,-4,6,25;0.5)	**(-6,-2,2,6;0.6)(-9,-2,2,9;0.3)**	40
Demand	5	20	15	

Again applying the Step 3 and Step 4 of the proposed method, all the allocations are made as shown in Table7.

Step 5: Optimum solution and intuitionistic fuzzy optimum value

Optimal solution, attained in Step 4, is $x_{12} = 25, x_{21} = 30, x_{31} = 5, x_{32} = 20$ and $x_{33} = 15$. Generalized trapezoidal Intuitionistic fuzzy optimum value of trapezoidal Intuitionistic fuzzy transportation problem, given in Table 2, is

$$25 \otimes (3,5,7,12;0.5)(1,5,7,15;\ 0.3) + 30 \otimes (2,5,8,10;0.6)(1,5,8,12;\ 0.2) + 5 \otimes (2,7,11,15;0.5)(1,7,11,18;\ 0.3)$$
$$+ 20 \otimes (5,9,12,16;0.7)(3,9,12,19;\ 0.2) + 15 \otimes (4,6,8,10;0.6)(3,6,8,12;\ 0.3)$$
$$= (305,580,830,1145;0.5)(165,580,830,1385;0.3) \approx 139.0278.$$

Table 7 Optimum solution of GTrIFTP

	D1	D2	D3	Supply
S1	(2,4,8,15;0.6)(1,4,8,18: 0.3)	(3,5,7,12;0.5)(1,5,7,15; 0.3) **(25)**	(2,5,9,16;0.7)(1,5,9,18; 0.3)	25
S2	(2,5,8,10;0.6)(1,5,8,12; 0.2) **(30)**	(4,8,10,13;0.4)(3,8,10,15; 0.3)	(3,6,10,15;0.8)(2,6,10,18;0.2)	30
S3	(2,7,11,15;0.5)(1,7,11,18; 0.3) **(5)**	(5,9,12,16;0.7)(3,9,12,19; 0.2) **(20)**	(4,6,8,10;0.6)(3,6,8,12; 0.3) **(15)**	40
Demand	35	45	15	

7. Conclusion

Finally we initiate an optimum solution for generalized trapezoidal intuitionistic fuzzy transportation problem whose costs are taken as GTrIFN's. In initiated method we solved by using ranking function found by [5]. Using this method we can attain directly optimum solution without finding IBFS, which is simplest method and we can solve real life transportation problems. Optimum solution compares with proposed method, zero centered method and [6], we attained similar results.

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