A Study on Intuitionistic Fuzzy Multi Objective LPP into LCP with Neutrosophic Triangular Numbers Approach

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Abstract: In this paper Principal pivoting method is proposed to solve the Fuzzy Linear Complementarity Problems (FLCP). Then we solve the Fuzzy Linear Complementarily Problem with Neutrosophic Triangular Fuzzy numbers. The effectiveness of the proposed methods is illustrated by means of a Numerical example. This problem finds many applications in several areas of science, engineering and economics and is also an important tool for the solution of some NP-hard structured and non convex optimization problems, such as bilevel, bilinear and non convex quadratic programs

Keywords: Fuzzy Linear Complementarity Problem, Neutrosophic Triangular Fuzzy Numbers, Principal pivoting method.

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1. INTRODUCTION

Maximum number of practical problems cannot be represented by linear programming model. Therefore, attempts were made to develop more general mathematical programming methods and many significant advances have been made in the area of nonlinear programming. The first major development was the fundamental paper by Moorthy [6] which laid the foundations for a good deal of later work in nonlinear programming. The linear complementarity problem (LCP) is a well known problem in mathematical programming and it has been studied by many researchers. In 1968, Lemke [5] proposed a complementarity pivoting algorithm for solving linear complementarity problems. Since, the KKT conditions for quadratic programming problems can be written as a LCP, Lemke's algorithm can be used to solve quadratic programs.

Since then the study of complementarity problems has been expanded enormously. Also, Principal Pivoting methods developed for solving LCPs hold great promise for handling very large scale linear programs which cannot be tackled with the well known simplex method because of their large size and the consequent numerical difficulties.

Neutrosophy has been considered as a new branch of philosophy that attempted to study the origin, nature, and scope of neutralities, as well as their interactions with different ideational spectra. In recent years neutrosophic algebraic structures have also been investigated by Smarandache[9].Kandasamy et al. [4] further proposed the neutrosophic numbers (NNs), which can be divided into two parts: determinate part and indeterminate part. So the neutrosophic number (NN) was more practical to handle indeterminate information in real situations. Hence, Wang et al. [3] introduced the concept of single valued neutrosophic set (SVNS).Because of the fuzziness and the complexity of decision problems, Zadeh[] proposed the concept of fuzzy sets (FS).

Atanassov [1] introduced the perception of intuitionistic fuzzy sets (IFS) which was produced by adding the non-membership degree function on the basis of the FS.As an extension of fuzzy linear programming problems, an intuitionistic fuzzy linear programming problems have been studied[2] by many authors. Irfan Deli et al.[3] used the single valued neutrosophic numbers as an extension of intuitionistic fuzzy numbers in multi criteria decision making. Rittik Roy el al.[8] considered the multi-Objective production planning problem based on neutrosophic linear programming approach.

This paper provides a new technique for solving fuzzy linear complementarity problems by converting it into a Neutrosophic Triangular fuzzy linear complementarity problem. Also this paper provides a new of Principal pivoting method of carrying out the fuzzy complementary pivot algorithm without introducing artificial variables, under certain conditions. This paper is organized as follows: Section 2 provides some basic idea about the Intuitionistic triangular fuzzy number with arithmetic operation, Fuzzy Linear Complementarity Problem is described in Section 3. Section 4 deals with the effectiveness of the proposed method are illustrated by different example. Finally in section 5, we conclude the paper.

2. PRELIMINARIES

The aim of this section is to present the preliminary notations of the area of fuzzy set theory, intuitionistic fuzzy set theory which are taken as very useful in our further consideration.

2.1 Fuzzy set

A Fuzzy set Ã is defined by $\tilde{A} = \{x,\mu_A(x)\}$; x€A, $\mu_A(x)$€[0,1]. In the pair (x, $\mu_A(x)$), the first element x belong to the classical set A, the second element $\mu_A(x)$, belong to the interval [0,1] called membership function.

2.2 Intuitionistic Fuzzy Set

An Intuitionstic fuzzy set a assign the each element x of the universe X a membership degree $\mu_{a}(x) \in [0,1]$ and non membership degree $\upsilon_{a}(x) \in [0,1]$ such that $\mu_{a}(x)+ \upsilon_{a}(x) \leq 1$. An IFS a is mathematically represented as $\{<x, \mu_{a}(x), \upsilon_{a}(x)> x \in X\}$

2.3 Intuitionistic Triangular Fuzzy Number

A triangular intuitionistic fuzzy number (TIFN) $\tilde{A}^I$ is an intuitionistic fuzzy set in R with the following membership function $\mu_{\tilde{A}^I}(x)$ and non-membership function $\vartheta_{\tilde{A}^I}(x)$

$$\mu_{\tilde{A}^I}(x) = \begin{cases} \frac{x-a_1}{a_2-a_1}, & a_1 \leq x \leq a_2 \\ \frac{x-a_3}{a_2-a_3}, & a_2 \leq x \leq a_3 \\ 0 & ,otherwise \end{cases} \text{ and } \vartheta_{\tilde{A}^I}(x) = \begin{cases} \frac{a_2-x}{a_2-a_1'}, & a_1' \leq x \leq a_2 \\ \frac{x-a_2}{a_3'-a_2}, & a_2 \leq x \leq a_3' \\ 1 & ,otherwise \end{cases}$$

Where $a_1' \leq a_1 \leq a_2 \leq a_3 \leq a_3'$ and $\mu_{\tilde{A}^I}(x) + \vartheta_{\tilde{A}^I}(x) \leq 1$ or $\mu_{\tilde{A}^I}(x) = \vartheta_{\tilde{A}^I}(x)$, for all $x \in$ R . This TIFN is denoted by $\tilde{A}^I = (a_1, a_2, a_3;\ a_1', a_2, a_3') = \{(a_1, a_2, a_3); (a_1', a_2, a_3')\}$

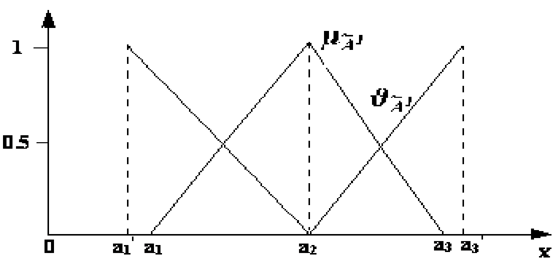

Fig 1: Membership and non-membership functions of TIFN

2.4 Positive triangular intuitionistic fuzzy number:

A positive triangular intuitionistic fuzzy number is denoted as $\{(a_1, a_{2,}, a_3); (a_1', a_2, a_3')\}$where all a_i's anda_i''s >0 for all i=1, 2, 3.

2.5 Negative triangular intuitionistic fuzzy number:

A negative triangular intuitionistic fuzzy number is denoted as $\{(a_1, a_{2,}, a_3); (a_1', a_2, a_3')\}$where all a_i's and a_i''s <0 for all i=1, 2, 3.

2.6 Triangular Neutrosophic Number:

A Single valued triangular neutrosophic number $\tilde{a} = \langle (a_1, b_1, c_1); \omega_{\tilde{a}}, \eta_{\tilde{a}}, \vartheta_{\tilde{a}} \rangle$ is defined as a special neutrosophic set on the real number set R, whose truth membership, indeterminacy – membership are as given as follows:

$$\mu_{\tilde{a}}(x) = \begin{cases} (x - a_1)\omega_{\tilde{a}} / (b_1 - a_1) & (a_1 \le x \le b_1) \\ \omega_{\tilde{a}} & (x = b_1) \\ (c_1 - x)\omega_{\tilde{a}} / (c_1 - d_1) & (b_1 \le x \le c_1) \\ 0 & otherwise \end{cases}$$

Functions Principle:

Let $\tilde{a} = \langle (a_1, b_1, c_1); \omega_{\tilde{a}}, \eta_{\tilde{a}}, \vartheta_{\tilde{a}} \rangle$ and $\tilde{b} = \langle (a_2, b_2, c_2); \omega_{\tilde{b}}, \eta_{\tilde{b}}, \vartheta_{\tilde{b}} \rangle$ be two single valued triangular neutrosophic numbers and $\gamma \neq 0$. Then

1. $\tilde{a} + \tilde{b} = \langle (a_1 + a_2, b_1 + b_2, c_1 + c_2; \omega_{\tilde{a}} \wedge \omega_{\tilde{b}}, \eta_{\tilde{a}} \vee \eta_{\tilde{b},}, \vartheta_{\tilde{a}} \vee \vartheta_{\tilde{b}}) \rangle$

2. $\tilde{a} - \tilde{b} = \langle (a_1 - c_2, b_1 - b_2, c_1 - a_2; \omega_{\tilde{a}} \wedge \omega_{\tilde{b}}, \eta_{\tilde{a}} \vee \eta_{\tilde{b},}, \vartheta_{\tilde{a}} \vee \vartheta_{\tilde{b}}) \rangle$

3. $$\tilde{a}\tilde{b} = \begin{cases} \langle (a_1 a_2, b_1 b_2, c_1 c_2); \omega_{\tilde{a}} \wedge \omega_{\tilde{b}}, \eta_{\tilde{a}} \vee \eta_{\tilde{b},}, \vartheta_{\tilde{a}} \vee \vartheta_{\tilde{b}} \rangle, (c_1 > 0, c_2 > 0) \\ \langle (a_1 c_2, b_1 b_2, c_1 a_2); \omega_{\tilde{a}} \wedge \omega_{\tilde{b}}, \eta_{\tilde{a}} \vee \eta_{\tilde{b},}, \vartheta_{\tilde{a}} \vee \vartheta_{\tilde{b}} \rangle, (c_1 < 0, c_2 > 0) \\ \langle (c_1 c_2, b_1 b_2, a_1 a_2); \omega_{\tilde{a}} \wedge \omega_{\tilde{b}}, \eta_{\tilde{a}} \vee \eta_{\tilde{b},}, \vartheta_{\tilde{a}} \vee \vartheta_{\tilde{b}} \rangle, (c_1 < 0, c_2 < 0) \end{cases}$$

4. $$\tilde{a} / \tilde{b} = \begin{cases} \langle (a_1 / a_2, b_1 / b_2, c_1 / c_2); \omega_{\tilde{a}} \wedge \omega_{\tilde{b}}, \eta_{\tilde{a}} \vee \eta_{\tilde{b},}, \vartheta_{\tilde{a}} \vee \vartheta_{\tilde{b}} \rangle, (c_1 > 0, c_2 > 0) \\ \langle (a_1 / c_2, b_1 / b_2, c_1 / a_2); \omega_{\tilde{a}} \wedge \omega_{\tilde{b}}, \eta_{\tilde{a}} \vee \eta_{\tilde{b},}, \vartheta_{\tilde{a}} \vee \vartheta_{\tilde{b}} \rangle, (c_1 < 0, c_2 > 0) \\ \langle (c_1 / c_2, b_1 / b_2, a_1 / a_2); \omega_{\tilde{a}} \wedge \omega_{\tilde{b}}, \eta_{\tilde{a}} \vee \eta_{\tilde{b},}, \vartheta_{\tilde{a}} \vee \vartheta_{\tilde{b}} \rangle, (c_1 < 0, c_2 < 0) \end{cases}$$

5. $$\gamma\tilde{a} = \begin{cases} \langle (\gamma a_1, \gamma b_1, \gamma c_1); \omega_{\tilde{b}}, \eta_{\tilde{b}}, \vartheta_{\tilde{b}} \rangle (\gamma > 0) \\ \langle (\gamma c_1, \gamma b_1, \gamma a_1); \omega_{\tilde{b}}, \eta_{\tilde{b}}, \vartheta_{\tilde{b}} \rangle (\gamma < 0) \end{cases}$$

6. $\tilde{a}^{-1} = \langle (1/c_1, 1/b_1, 1/a_1); \omega_{\tilde{b}}, \eta_{\tilde{b}}, \vartheta_{\tilde{b}} \rangle, (a \neq 0)$

2.7 Score and Accuracy Function:

Let $\tilde{a} = \langle (a_1, b_1, c_1); \omega_{\tilde{a}}, \eta_{\tilde{a}}, \vartheta_{\tilde{a}} \rangle$ be a single valued triangular neutrosophic number. Then $S(\tilde{a}) = \frac{1}{8}(a_1 + b_1 + c_1) \times (2 + \omega_{\tilde{a}} - \eta_{\tilde{a}} - \vartheta_{\tilde{a}})$ and $A(\tilde{a}) = \frac{1}{8}(a_1 + b_1 + c_1) \times (2 + \omega_{\tilde{a}} - \eta_{\tilde{a}} + \vartheta_{\tilde{a}})$ are called the Score and accuracy degrees of $\tilde{a}$, respectively.

3. FUZZY NUMBER LINEAR COMPLEMENTARITY PROBLEM (FLCP)

3.1. Fuzzy Linear Complementarity Problem (FLCP)

Assume that all parameters in (1) - (3) are fuzzy and are described by fuzzy numbers. Then, the following fuzzy linear complementarity problem can be obtained by replacing crisp parameters with fuzzy numbers.

$$\tilde{W} - \tilde{M}\tilde{Z} = \tilde{q} \quad (1)$$

$$\tilde{W}_j \geq 0, Z_j \geq 0, j = 1,2,3,.........n \quad (2)$$

$$\tilde{W}_j\tilde{Z}_j = 0, j = 1,2,3,..........n \quad (3)$$

The pair $(\tilde{W}_j, \tilde{Z}_j)$ is said to be a pair of fuzzy complementary variables.

3.2 Algorithm for Fuzzy Linear Complementarity Problem by principal pivoting method

Lemke [5] suggested an algorithm for solving linear complementarity problems. Based on this idea, an algorithm for solving fuzzy linear complementarity problem is developed here.

Consider the FLCP$\left(\tilde{q}, \tilde{M}\right)$ of order *n*, suppose the fuzzy matrix $\tilde{M}$ satisfies the conditions: There exists a column vector of $\tilde{M}$ in which all the entries are strictly positive. Then a variant of the complementary pivot algorithm which uses no artificial variable at all can be applied on the FLCP$\left(\tilde{q}, \tilde{M}\right)$.The original tableau for this version of the algorithm is:

$\tilde{w}$	$\tilde{Z}$	
$\tilde{I}$	$-\tilde{M}$	$\tilde{q}$

(4)

We assume that $\tilde{q} \geq 0$ .Let *s* be such that $\tilde{M}_{.s} > 0$ .So, the column vector associated with $\tilde{Z}_s$ is strictly negative in (4).Hence the variable $\tilde{Z}_s$ can be made to play the same role as that of the artificial variable $\tilde{Z}_0$

Step: 1

Determine *t* to satisfy $\left(\dfrac{\tilde{q}_t}{\tilde{m}_{ts}}\right)$ = minimum $\left\{\dfrac{\tilde{q}_i}{\tilde{m}_{is}} / i = 1 \; to \; n\right\}$, and update the table by pivoting at row *t* and the table by pivoting at row *t* and $\tilde{Z}_s$ column. Thus, the right hand side constants vector becomes nonnegative after this pivot step.

Hence,$\left(\tilde{w}_1, \tilde{w}_2, ..., \tilde{w}_{t-1}, \tilde{Z}_s, \tilde{w}_{t+1}, ...\tilde{w}_n\right)$ is a feasible basic vector for (4), and if *s* = *t*, it is fuzzy complementary feasible basic vector and the solution corresponding to it is a FLCP$\left(\tilde{q}, \tilde{M}\right)$, terminate.

If *s*≠ *t*, the feasible basic vector $\left(\tilde{w}_1, \tilde{w}_2, ..., \tilde{w}_{t-1}, \tilde{Z}_s, \tilde{w}_{t+1}, ...\tilde{w}_n\right)$ for (4) satisfies the following properties.

(i). It contains exactly one basic variable from the complementary pair $(\tilde{W}_i, \tilde{Z}_i)$ for *n*-2 values of i (namely *i*≠ *s*, *t* here).

(ii) It contains both the variables from a fixed complementary pair (namely $(\tilde{W}_s, \tilde{Z}_s)$ here), as fuzzy basic variables.

(iii) There exists exactly one fuzzy complementary pair in which both the variables are contained in this basic vector (namely$(\tilde{W}_t, \tilde{Z}_t)$ here).

For carrying out this version of the fuzzy complementary pivot algorithm, any feasible fuzzy basic vector for (4) satisfying (i), (ii), (iii) is known as an almost fuzzy complementary feasible basic vector.

Step: 2

In the canonical tableau of (4) w.r.t the initial almost fuzzy complementary feasible basic vector, the updated column vector of $\tilde{W}_t$ can be verified to be strictly negative. Hence if $\tilde{W}_t$ is selected as the entering variable into the initial basic vector, an almost complementary extreme half-line is generated. Hence the initial almost complementary BFS of (4) is at the end of an almost complementary ray.

Step: 3

Choose $\tilde{Z}_t$ as the entering variable into the initial almost complementary feasible basic vector $\left(\tilde{w}_1, \tilde{w}_2, ..., \tilde{w}_{t-1}, \tilde{Z}_s, \tilde{w}_{t+1}, ...\tilde{w}_n\right)$.In all subsequent steps, the entering variable is uniquely determined by the complementary pivot rule. The algorithm can terminate in two possible ways:

(i) At some stage one of the variables from the complementary pair $(\tilde{W}_s, \tilde{Z}_s)$ drops out of the basic vector or becomes equal to zero in the BFS of (7).The BFS of (4) at that stage is a solution of the FLCP$\left(\tilde{q}, \tilde{M}\right)$.

(ii) At some stage of the algorithm, both the variables in the complementary pair $(\tilde{W}_s, \tilde{Z}_s)$ may be strictly positive in the BFS and the pivot column in that stage may turn out to be no positive, and in this case the algorithm stops with almost complementary ray.

4. NUMERICAL EXAMPLE

4.1 Diet problem

A very simple diet problem in which the nutrients are starch and protein as a group; the two types of foods with data given in the following table.

	Nutrient units/ kg of food type		
	Food 1	Food 2	Maximum Requirements
Starch	1	2	1
Protein	1	3	4
Cost/ Kg	6	3	
Procurement Cost/kg	2	3	

The activities and their levels in the model are given as: activity j: to include 1 kg of food type j in the diet, associated level x_j, for j = 1,2. Constraints are leaded by the various nutrients in the model are the, each of which leads to a constraint. For example, the amount of starch contained in the diet is $1x_1+1x_2$, which must be ≤ 1 for feasibility.Similarly, $2x_1+3x_2 \leq 4$. In this diet problem, the total cost of food and the procurement cost of food should be minimized.

Since the cost coefficients and all other coefficient are indecisive and also contains the indeterminacy part, the problem is modelled as a bi level multi objective neutrosophic linear programming problem (BLMONLPP). Since, thelowest, highest and the most highest values of all coefficients are treated as single valued neutrosophic triangular numbers from a theoretical or practical point of view, the formulation of the above problem is given below.

$$Min\ \tilde{z}_1 = \langle(5,6,7);0.6,0.5,0.5\rangle\tilde{x}_1 + \langle(2,3,4);0.5,0.7,0.5\rangle\tilde{x}_2$$

$$Min\ \tilde{z}_2 = \langle(1,2,3);0.6,0.5,0.5\rangle\tilde{x}_1 + \langle(2,3,4);0.6,0.5,0.5\rangle\tilde{x}_2$$

Subject to the constraints

$$\langle(1,1,1);0.5,0.7,0.5\rangle\tilde{x}_1 + \langle(1,1,1);0.5,0.7,0.5\rangle\tilde{x}_2 \geq \langle(1,1,1);0.5,0.7,0.5\rangle$$

$$\langle(1,2,3);0.5,0.7,0.5\rangle\tilde{x}_1 + \langle(2,3,4);0.6,0.5,0.5\rangle\tilde{x}_2 \geq \langle(3,4,5);0.6,0.5,0.5\rangle$$

$\& \tilde{x}_1, \tilde{x}_2 \geq 0.$

Finally the Intuitionistic Linear Complimentarity fuzzy matrix $\widetilde{M}$ & $\tilde{q}$ is given by

$$\widetilde{M} = \begin{bmatrix} \tilde{0} & -\widetilde{A} \\ \widetilde{A}^T & \widetilde{H} \end{bmatrix} = \begin{bmatrix} \tilde{0} & \tilde{0} & -\tilde{1} & -\tilde{1} \\ \tilde{0} & \tilde{0} & -\tilde{2} & -\tilde{3} \\ \tilde{1} & \tilde{2} & \tilde{4} & \tilde{4} \\ \tilde{1} & \tilde{3} & \tilde{4} & \tilde{6} \end{bmatrix}, \tilde{q} = \begin{bmatrix} \tilde{b} \\ -\tilde{c} \end{bmatrix} = \begin{bmatrix} \tilde{1} \\ \tilde{4} \\ -\tilde{6} \\ -\tilde{3} \end{bmatrix}$$

Now, the fuzzy linear complementary problem is solved by the proposed algorithm and the results are tabulated below.

C_B	W_1	W_2	W_3	W_4	Z_1	Z_2	Z_3	Z_4	Q
W_1	[(1,1,1);.5,.3,.5]	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	-[(1,1,1);.5,.3,.5]	-[(1,1,1);.5,.3,.5]	[(1,1,1);.5,.3,.5]
W_2	[(0,0,0);0,0,0]	[(1,1,1);.5,.3,.5]	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	-[(1,2,3);0.5,0.7,0.5]	-[(2,3,4);0.6,0.5,0.5]	[(3,4,5);0.6,0.5,0.5]
W_3	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(1,1,1);.5,.3,.5]	[(0,0,0);0,0,0]	[(1,1,1);.5,.3,.5]	[(1,2,3);0.5,0.7,0.5]	[(3,4,5);0.6,0.5,0.5]	[(3,4,5);0.6,0.5,0.5]	-[(5,6,7);0.5,0.6,0.5]
W_4	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(1,1,1);.5,.3,.5]	[(1,1,1);.5,.3,.5]	[(2,3,4);0.6,0.5,0.5]	[(3,4,5);0.6,0.5,0.5]	[(3,6,9);0.5,0.7,0.5	-[(2,3,4);0.6,0.5,0.5]

We pivot at row 3 and the $\widetilde{Z}_4$ column, for the next tableau we have $\tilde{y}_s = \tilde{z}_3$

C_B	W_1	W_2	W_3	W_4	Z_1	Z_2	Z_3	Z_4	Q
W_1	[(1,1,1);.5,.3,.5]	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(1,1,1);.5,.3,.5]	[(0,0,0);0,0,0]	[(2,5,8);0.5,0.7,0.5]
W_2	[(0,0,0);0,0,0]	[(1,1,1);.5,.3,.5]	-[(1,1,1);.5,.3,.5]	[(0,0,0);0,0,0]	[(1,2,3);0.5,0.7,0.5]	[(1,1,1);.5,.3,.5]	[(2,3,4);0.5,0.6,0.5]	[(0,0,0);0,0,0]	[(1,3,5);0.5,0.5,0.5]
Z_4	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[(-1,-1/4,-1/7);0.5,0.6,0.5]	[(0,0,0);0,0,0]	[(1/7,1/2,3);0.5,0.7,0.5]	[(1/7,1/4,1);0.5,0.6,0.5]	[(1/7,1/2,3);0.5,0.5,0.5]	[(1,1,1);.5,.3,.5]	[(1/7,3/4,5);0.6,0.5,0.5]
W_4	[(0,0,0);0,0,0]	[(0,0,0);0,0,0]	[-(3/7,3/2,9);0.6,0.5,0.5]	[(1,1,1);.5,.3,.5]	[(-4/7,2,26);0.5,0.7,0.50	[(10/7,11/2,16);0.6,0.5,0.5]	[(-4/7,-1,20);0.5,0.5,0.5]	[(0,0,0);0,0,0]	[(3/7,9/2,45);0.6,0.5,0.5]

Proceding in this way we get those results

Iteration 3:

Here $\tilde{y}_s = \tilde{z}_3$ enters the basis, by the minimum ratio test $\tilde{w}_2$ leaves the basis and for the next iteration $\tilde{y}_s = \tilde{z}_2$ we pivot at row 2 and the $\tilde{z}_3$ column

Iteration 4:

Here $\tilde{y}_s = \tilde{z}_2$ enters the basis, by the minimum ratio test $\tilde{w}_4$ leaves the basis

Finally we get that result Min $\tilde{f}$ =[(-893,-10.27, 2858.12);0.5,0.6,0.7]

5. CONCLUSION

In this paper, a new approach for solving BLMOIFNLPP (Bi Level Multi Objective Intuitionistic Fuzzy Neutrosophic Linear Programming Problem) by converting it into a Neutrosophic linear complementarity problem with fuzzy parameters is suggested. Even though we are considering the Single Valued Neutrosophic Triangular Number, this method can also be extended to multi- objective programming with Neutrosophic Trapezoidal fuzzy coefficients.

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