Advances in Fuzzy Mathematics.
ISSN 0973-533X Volume 12, Number 4 (2017), pp. 845-853

http://www.ripublication.com

Interval Valued Intuitionistic Fuzzy Sets of Second Type

K. Rajesh* & R. Srinivasan**

** Full-Time Research Scholar, Department of Mathematics,*
Islamiah College (Autonomous), Vaniyambadi, Tamilnadu, India.
*** Department of Mathematics, Islamiah College (Autonomous), Vaniyambadi,*
Tamilnadu, India.

Abstract

In this paper we, introduce the Interval Valued Intuitionistic Fuzzy Sets of Second Type (IVIFSST) and its basic operations. Also we establish some of their properties.

Keywords: Fuzzy sets (FS), Intuitionistic Fuzzy Sets (IFS), Intuitionistic Fuzzy Sets of Second Type (IFSST), Interval Valued Fuzzy Sets (IVFS), Interval Valued Intuitionistic Fuzzy Sets (IVIFS), Interval Valued Intuitionistic Fuzzy Sets of Second Type (IVIFSST).

2010 AMS Subject Classification: 03E72

1. INTRODUCTION

The concept of intuitionistic fuzzy sets (IFS) was proposed by K. T.Atanassov [2] as an extension of fuzzy sets introduced by L. A. Zadeh. A generalization of the notion of Fuzzy Set so-called Interval Valued Fuzzy Set (IVFS) were proposed by some researchers[4]. Atanassov introduced the theory of Interval Valued Intuitionistic Fuzzy Set and established its operators and their properties.

The authors further introduced the theory so-called Interval Valued Intuitionistic Fuzzy Sets of Second Type and established its basic operations. The rest of the paper is designed as follows: In Section 2, we give some basic definitions. In Section 3, we define the Interval valued Intuitionistic Fuzzy Sets of second type. Also we establish some relation among the existing sets. This paper is concluded in section 4.

2. PRELIMINARIES

In this section, we give some basic definitions.

Definition 2.1[5] Let X be a non- empty set. A Fuzzy Set A in X is characterized by its membership function $\mu_A: X \to [0,1]$ and $\mu_A(x)$ is interpreted as the degree of membership of the element x in fuzzy set A, for each $x \in X$. It is clear that A is completely determined by the set of tuples

$$A = \{< x, \mu_A(x) > | \, x \in X\}$$

Definition 2.2[2]Let X be a non- empty set.An intuitionistic fuzzy set (IFS) A in X is defined as an object of the following form.

$$A = \{< x, \; \mu_A(x), \; \nu_A(x) > | \, x \in X\}$$

Where the functions $\mu_A: X \to [0,1]$ and $\nu_A: X \to [0,1]$ denote the degree of membership and the degree of non-membership of the element $x \in X$, respectively, and for every $x \in X$.

$$0 \le \mu_A(x) + \nu_A(x) \le 1$$

Definition 2.3[2] Let a set X be fixed. An intuitionistic fuzzy set of second type (IFSST) A in X is defined as an object of the following form.

$$A = \{< x, \; \mu_A(x), \; \nu_A(x) > | \, x \in X\}$$

Where the functions $\mu_A: X \to [0,1]$ and $\nu_A: X \to [0,1]$ denote the degree of membership and the degree of non-membership of the element $x \in X$, respectively, and for every $x \in X$.

$$0 \le {\mu_A}^2(x) + {\nu_A}^2(x) \le 1$$

Definition 2.4[2] Let X be an universal set with cardinality n. Let [0, 1] be the set of all closed subintervals of the interval [0, 1] and elements of this set are denoted by uppercase letters. If M ∈ [0,1] then it can be represented as $M = [M_L, M_U]$, where M_L and M_U are the lower and upper limits of M. For M ∈ [0,1], $\bar{M} = 1 - M$ represents the interval $[1 - M_L, 1 - M_U]$ and $W_M = M_U - M_L$ is the width of M.

An interval-valued fuzzy set (IVFS)A in X is given by

$$A = \{< x, M_A(x) > | \, x \in X\}$$

where $M_A : X \to [0,1]$, $M_A(x)$ denote the degree of membership of the element x to the set A.

Definition 2.5[3] An interval-valued intuitionistic fuzzy set (IVIFS) A in X is given by

$$A = \{< x, M_A(x), N_A(x) > | x \in X\}$$

where M_A: X → [0,1], N_A: X → [0,1]. The intervals $M_A(x)$ and $N_A(x)$ denote the degree of membership and the degree of non-membership of the element x to the set A, where $M_A(x) = [M_{AL}(x), M_{AU}(x)]$ and $N_A(x) = [N_{AL}(x), N_{AU}(x)]$ with the condition that

$$M_{AU}(x) + N_{AU}(x) \leq 1 \text{ for all } x \in X.$$

3. INTERVALVALUED INTUITIONISTIC FUZZY SETS OF SECOND TYPE

In this section, we define the IVIFSST and some basic operations. Also we establish some relation among the existing sets.

Definition 3.1 An Interval-Valued Intuitionistic Fuzzy Sets of Second Type (IVIFSST) A in X is given by

$$A = \{< x, M_A(x), N_A(x) > | x \in X\}$$

Where M_A: X → [0,1], N_A: X → [0,1]. The intervals $M_A(x)$ and $N_A(x)$ denote the degree of membership and the degree of non-membership of the element x to the set A, where $M_A(x) = [M_{AL}(x), M_{AU}(x)]$ and $N_A(x) = [N_{AL}(x), N_{AU}(x)]$ with the condition that

$$M^2{}_{AU}(x) + N^2{}_{AU}(x) \leq 1 \text{ for all } x \in X.$$

Definition 3.2 For every two IVIFSST A and B the following relations, operations and operators are valid:

1. $A \subset B$ iff $M_{AU}(x) \leq M_{BU}(x)$ & $M_{AL}(x) \leq M_{BL}(x)$&

   $N_{AU}(x) \geq N_{BU}(x)$ & $N_{AL}(x) \geq N_{BL}(x)$
2. $B \subset A$ iff $M_{AU}(x) \geq M_{BU}(x)$ & $M_{AL}(x) \geq M_{BL}(x)$&

   $N_{AU}(x) \leq N_{BU}(x)$ & $N_{AL}(x) \leq N_{BL}(x)$
3. $A = B$ iff $A \subset B$ & $B \subset A$
4. $\bar{A} = \{< x, [N_{AL}(x), N_{AU}(x)], [M_{AL}(x), M_{AU}(x)] > | x \in X\}$
5. $A \cup B = \{< x, [\max(M_{AL}(x), M_{BL}(x)), \max(M_{AU}(x), M_{BU}(x))],$

   $[\min(N_{AL}(x), N_{BL}(x)), \min(N_{AU}(x), N_{BU}(x))] > | x \in X\}$

6. $A \cap B = \{< x, [\min(\mathrm{M_{AL}}(x),\ \mathrm{M_{BL}}(x)), \min(\mathrm{M_{AU}}(x),\ \mathrm{M_{BU}}(x))],$

$[\max(\mathrm{N_{AL}}(x),\ \mathrm{N_{BL}}(x)), \max(\mathrm{N_{AU}}(x),\ \mathrm{N_{BU}}(x))] > |\ x \in \mathrm{X}\}$

Proposition 3.1 *For every IVIFSST A and B, we have the following*

1. $\mathrm{A} \cup \mathrm{B} = B \cup A$
2. $A \cap B = B \cap A$
3. $(\mathrm{A} \cup \mathrm{B}) \cup C = \mathrm{A} \cup (B \cup C)$
4. $(\mathrm{A} \cap \mathrm{B}) \cap C = \mathrm{A} \cap (B \cap C)$
5. $\overline{(\bar{A} \cup \bar{B})} = A \cap B$
6. $\overline{(\bar{A} \cap \bar{B})} = A \cup B$

Proof:

Let A = {< x, [$\mathrm{M_{AL}}(x)$, $\mathrm{M_{AU}}(x)$], [$\mathrm{N_{AL}}(x)$, $\mathrm{N_{AU}}(x)$] > | $x \in$ X} and

B = {< x, [$\mathrm{M_{BL}}(x)$, $\mathrm{M_{BU}}(x)$], [$\mathrm{N_{BL}}(x)$, $\mathrm{N_{BU}}(x)$] > | $x \in$ X}

1. $A \cup B = \{< x, [\max(\mathrm{M_{AL}}(x),\ \mathrm{M_{BL}}(x)), \max(\mathrm{M_{AU}}(x),\ \mathrm{M_{BU}}(x))],$

$[\min(\mathrm{N_{AL}}(x),\ \mathrm{N_{BL}}(x)), \min(\mathrm{N_{AU}}(x), \mathrm{N_{BU}}(x))] > |\ x \in \mathrm{X}\}$

$= \{< x, [\max(\mathrm{M_{BL}}(x), \mathrm{M_{AL}}(x)), \max(\mathrm{M_{BU}}(x), \mathrm{M_{AU}}(x))],$

$[\min(\mathrm{N_{BL}}(x), \mathrm{N_{AL}}(x)), \min(\mathrm{N_{BU}}(x), \mathrm{N_{AU}}(x))] > |\ x \in \mathrm{X}\}$

$= B \cup A$

2. $A \cap B = \{< x, [\min(\mathrm{M_{AL}}(x), \mathrm{M_{BL}}(x)), \min(\mathrm{M_{AU}}(x), \mathrm{M_{BU}}(x))],$

$[\max(\mathrm{N_{AL}}(x), \mathrm{N_{BL}}(x)), \max(\mathrm{N_{AU}}(x), \mathrm{N_{BU}}(x))] > |\ x \in \mathrm{X}\}$

$= \{< x, [\min(\mathrm{M_{BL}}(x), \mathrm{M_{AL}}(x)), \min(\mathrm{M_{BU}}(x), \mathrm{M_{AU}}(x))],$

$[\max(\mathrm{N_{BL}}(x), \mathrm{N_{AL}}(x)), \max(\mathrm{N_{BU}}(x), \mathrm{N_{AU}}(x))] > |\ x \in \mathrm{X}\}$

$= B \cap A$

3. $(A \cup B) \cup C = \{< x, [\max(\mathrm{M_{AL}}(x), \mathrm{M_{BL}}(x)), \max(\mathrm{M_{AU}}(x), \mathrm{M_{BU}}(x))],$

$[\min(\mathrm{N_{AL}}(x), \mathrm{N_{BL}}(x)), \min(\mathrm{N_{AU}}(x), \mathrm{N_{BU}}(x))] > |\ x \in \mathrm{X}\} \cup C$

$$= \{< x, [\max(M_{AL}(x), M_{BL}(x), M_{CL}(x)), \max(M_{AU}(x), M_{BU}(x), M_{CL}(x))], [\min(N_{AL}(x), N_{BL}(x), N_{CL}(x)), \min(N_{AU}(x), N_{BU}(x), N_{CU}(x))] > | x \in X\}$$

$$= A \cup \{< x, [\max(M_{BL}(x), M_{CL}(x)), \max(M_{BU}(x), M_{CU}(x))], [\min(N_{BL}(x), N_{CL}(x)), \min(N_{BU}(x), N_{CU}(x))] > | x \in X\}$$

$$= A \cup (B \cup C)$$

4. $(A \cap B) \cap C = \{< x, [\min(M_{AL}(x), M_{BL}(x)), \min(M_{AU}(x), M_{BU}(x))], [\max(N_{AL}(x), N_{BL}(x)), \max(N_{AU}(x), N_{BU}(x))] > | x \in X\} \cap C$

$$= \{< x, [\min(M_{AL}(x), M_{BL}(x), M_{CL}(x)), \min(M_{AU}(x), M_{BU}(x), M_{CL}(x))], [\max(N_{AL}(x), N_{BL}(x), N_{CL}(x)), \max(N_{AU}(x), N_{BU}(x), N_{CU}(x))] > | x \in X\}$$

$$= A \cap \{< x, [\min(M_{BL}(x), M_{CL}(x)), \min(M_{BU}(x), M_{CU}(x))], [\max(N_{BL}(x), N_{CL}(x)), \max(N_{BU}(x), N_{CU}(x))] > | x \in X\}$$

$$= A \cap (B \cap C)$$

5. Let $\bar{A} = \{< x, [N_{AL}(x), N_{AU}(x)], [M_{AL}(x), M_{AU}(x)] > | x \in X\}$ and

$$\bar{B} = \{< x, [N_{BL}(x), N_{BU}(x)], [M_{BL}(x), M_{BU}(x)] > | x \in X\}$$

$$\bar{A} \cup \bar{B} = \{< x, [N_{AL}(x), N_{AU}(x)], [M_{AL}(x), M_{AU}(x)] > | x \in X\} \cup \{< x, [N_{BL}(x), N_{BU}(x)], [M_{BL}(x), M_{BU}(x)] > | x \in X\}$$

$$= \{< x, [\max(N_{AL}(x), N_{BL}(x)), \max(N_{AU}(x), N_{BU}(x))], [\min(M_{AL}(x), M_{BL}(x)), \min(M_{AU}(x), M_{BU}(x))] > | x \in X$$

$$\overline{(\bar{A} \cup \bar{B})} = \{< x, [\min(M_{AL}(x), M_{BL}(x)), \min(M_{AU}(x), M_{BU}(x))], [\max(N_{AL}(x), N_{BL}(x)), \max(N_{AU}(x), N_{BU}(x))] > | x \in X\}$$

$$= A \cap B$$

6. Let$\bar{A} = \{< x, [N_{AL}(x), N_{AU}(x)], [M_{AL}(x), M_{AU}(x)] > | x \in X\}$ and

$$\bar{B} = \{< x, [\mathrm{N_{BL}}(x), \mathrm{N_{BU}}(x)], [\mathrm{M_{BL}}(x), \mathrm{M_{BU}}(x)] > | \; x \in \mathrm{X}\}$$

$$\bar{A} \cap \bar{B} = \{< x, [\mathrm{N_{AL}}(x), \mathrm{N_{AU}}(x)], [\mathrm{M_{AL}}(x), \mathrm{M_{AU}}(x)] > | \; x \in \mathrm{X}\} \cap \{< x, [\mathrm{N_{BL}}(x), \mathrm{N_{BU}}(x)], [\mathrm{M_{BL}}(x), \mathrm{M_{BU}}(x)] > | \; x \in \mathrm{X}\}$$

$$= \{< x, [\min(\mathrm{N_{AL}}(x), \mathrm{N_{BL}}(x)), \min(\mathrm{N_{AU}}(x), \mathrm{N_{BU}}(x))], [\max(\mathrm{M_{AL}}(x), \mathrm{M_{BL}}(x)), \max(\mathrm{M_{AU}}(x), \mathrm{M_{BU}}(x))] > | \; x \in \mathrm{X}\}$$

$$\overline{(\bar{A} \cap \bar{B})} = \{< x, [\max(\mathrm{M_{AL}}(x), \mathrm{M_{BL}}(x)), \max(\mathrm{M_{AU}}(x), \mathrm{M_{BU}}(x))], [\min(\mathrm{N_{AL}}(x), \mathrm{N_{BL}}(x)), \min(\mathrm{N_{AU}}(x), \mathrm{N_{BU}}(x))] > | \; x \in \mathrm{X}\}$$

$$= A \cup B$$

Proposition 3.2 The following law holds good for *every IVIFSST A:*

1. $\mathrm{A} \cup \mathrm{A} = \mathrm{A}$
2. $\mathrm{A} \cap \mathrm{A} = \mathrm{A}$

Proof:

1. Let $\mathrm{A} = \{< x, [\mathrm{M_{AL}}(x), \mathrm{M_{AU}}(x)], [\mathrm{N_{AL}}(x), \mathrm{N_{AU}}(x)] > | \; x \in \mathrm{X}\}$

$$\mathrm{A} \cup \mathrm{A} = \{< x, [\mathrm{M_{AL}}(x), \mathrm{M_{AU}}(x)], [\mathrm{N_{AL}}(x), \mathrm{N_{AU}}(x)] > | \; x \in \mathrm{X}\} \cup \{< x, [\mathrm{M_{AL}}(x), \mathrm{M_{AU}}(x)], [\mathrm{N_{AL}}(x), \mathrm{N_{AU}}(x)] > | \; x \in \mathrm{X}\}$$

$$= \{< x, [\max(\mathrm{M_{AL}}(x), \mathrm{M_{AL}}(x)), \max(\mathrm{M_{AU}}(x), \mathrm{M_{AU}}(x))], [\min(\mathrm{N_{AL}}(x), \mathrm{N_{AL}}(x)), \min(\mathrm{N_{AU}}(x), \mathrm{N_{AU}}(x))] > | \; x \in \mathrm{X}\}$$

$$= \{< x, [\mathrm{M_{AL}}(x), \mathrm{M_{AU}}(x)], [\mathrm{N_{AL}}(x), \mathrm{N_{AU}}(x)] > | \; x \in \mathrm{X}\}$$

$$= A$$

2. $\mathrm{A} \cap \mathrm{A} = \{< x, [\mathrm{M_{AL}}(x), \mathrm{M_{AU}}(x)], [\mathrm{N_{AL}}(x), \mathrm{N_{AU}}(x)] > | \; x \in \mathrm{X}\} \cap \{< x, [\mathrm{M_{AL}}(x), \mathrm{M_{AU}}(x)], [\mathrm{N_{AL}}(x), \mathrm{N_{AU}}(x)] > | \; x \in \mathrm{X}\}$

$$= \{< x, [\min(\mathrm{M_{AL}}(x), \mathrm{M_{AL}}(x)), \min(\mathrm{M_{AU}}(x), \mathrm{M_{AU}}(x))], [\max(\mathrm{N_{AL}}(x), \mathrm{N_{AL}}(x)), \max(\mathrm{N_{AU}}(x), \mathrm{N_{AU}}(x))] > | \; x \in \mathrm{X}\}$$

$$= \{< x, [\mathrm{M_{AL}}(x), \mathrm{M_{AU}}(x)], [\mathrm{N_{AL}}(x), \mathrm{N_{AU}}(x)] > | \; x \in \mathrm{X}\}$$

$$= A$$

Proposition 3.3 *The following relations are valid for every IVIFSST A, B and C:*

1. $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$
2. $(A \cap B) \cup C = (A \cup C) \cap (B \cup C)$

Proof: Let A = {< x, [$M_{AL}(x)$, $M_{AU}(x)$], [$N_{AL}(x)$, $N_{AU}(x)$] > | $x \in X$},

B = {< x, [$M_{BL}(x)$, $M_{BU}(x)$], [$N_{BL}(x)$, $N_{BU}(x)$] > | $x \in X$} and

C = {< x, [$M_{CL}(x)$, $M_{CU}(x)$], [$N_{CL}(x)$, $N_{CU}(x)$] > | $x \in X$}

1. $(A \cup B) \cap C = \{< x, [\max(M_{AL}(x), M_{BL}(x)), \max(M_{AU}(x), M_{BU}(x))],$

$[\min(N_{AL}(x), N_{BL}(x)), \min(N_{AU}(x), N_{BU}(x))] > | \; x \in X\} \cap C$

$= \{< x, [\min(\max(M_{AL}(x), M_{BL}(x)), M_{CL}(x)),$
$\min(\max(M_{AU}(x), M_{BU}(x)), M_{CU}(x))],$

$[\max(\min(N_{AL}(x), N_{BL}(x)), N_{CL}(x)), \; \max(\min(N_{AU}(x), N_{BU}(x)), N_{CU}(x))] > | \; x \in X\}$

$= \{< x, [\min(M_{AL}(x), M_{BL}(x), M_{CL}(x)), \min(M_{AU}(x), M_{BU}(x), M_{CU}(x))],$

$[\max(N_{AL}(x), N_{BL}(x), N_{CL}(x)), \; \max(N_{AU}(x), N_{BU}(x), N_{CU}(x))] > | \; x \in X\}$

Now, $A \cap C = \{< x, [\min(M_{AL}(x), M_{CL}(x)), \min(M_{AU}(x), M_{CU}(x))],$

$[\max(N_{AL}(x), N_{CL}(x)), \max(N_{AU}(x), N_{CU}(x))] > | \; x \in X\}$

$B \cap C = \{< x, [\min(M_{BL}(x), M_{CL}(x)), \min(M_{BU}(x), M_{CU}(x))],$

$[\max(N_{BL}(x), N_{CL}(x)), \max(N_{BU}(x), N_{CU}(x))] > | \; x \in X\}$

$(A \cap C) \cup (B \cap C) = \{< x, [\max(\min(M_{AL}(x), M_{CL}(x)), \min(M_{BL}(x), M_{CL}(x))),$

$\max(\min(M_{AU}(x), M_{CU}(x)), \min(M_{BU}(x), M_{CU}(x)))],$

$[\min(\max(N_{AU}(x), N_{CU}(x)), \max(N_{BU}(x), N_{CU}(x))),$

$\min(\max(N_{AU}(x), N_{CU}(x)), \max(N_{BU}(x), N_{CU}(x)))] > | \; x \in X\}$

$= \{< x, [\min(M_{AL}(x), M_{BL}(x), M_{CL}(x)), \min(M_{AU}(x), M_{BU}(x), M_{CU}(x))],$

$[\max(N_{AL}(x), N_{BL}(x), N_{CL}(x)), \; \max(N_{AU}(x), N_{BU}(x), N_{CU}(x))] > | \; x \in X\}$

Hence,$(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$

2. $(A \cap B) \cup C = \{< x, [\min(\mathrm{M_{AL}}(x), \mathrm{M_{BL}}(x)), \min(\mathrm{M_{AU}}(x), \mathrm{M_{BU}}(x))],$

$[\max(\mathrm{N_{AL}}(x), \mathrm{N_{BL}}(x)), \max(\mathrm{N_{AU}}(x), \mathrm{N_{BU}}(x))] > | x \in \mathrm{X}\} \cup C$

$= \{< x, [\max(\min(\mathrm{M_{AL}}(x), \mathrm{M_{BL}}(x)), \mathrm{M_{CL}}(x)),$
$\max(\min(\mathrm{M_{AU}}(x), \mathrm{M_{BU}}(x)), \mathrm{M_{CU}}(x))],$

$[\min(\max(\mathrm{N_{AL}}(x), \mathrm{N_{BL}}(x)), \mathrm{N_{CL}}(x)), \min(\max(\mathrm{N_{AU}}(x), \mathrm{N_{BU}}(x)), \mathrm{N_{CU}}(x))] > | x \in \mathrm{X}\}$

$= \{< x, [\max(\mathrm{M_{AL}}(x), \mathrm{M_{BL}}(x), \mathrm{M_{CL}}(x)), \max(\mathrm{M_{AU}}(x), \mathrm{M_{BU}}(x), \mathrm{M_{CU}}(x))],$

$[\min(\mathrm{N_{AL}}(x), \mathrm{N_{BL}}(x), \mathrm{N_{CL}}(x)), \min(\mathrm{N_{AU}}(x), \mathrm{N_{BU}}(x), \mathrm{N_{CU}}(x))] > | x \in \mathrm{X}\}$

Now, $A \cup C = \{< x, [\max(\mathrm{M_{AL}}(x), \mathrm{M_{CL}}(x)), \max(\mathrm{M_{AU}}(x), \mathrm{M_{CU}}(x))],$

$[\min(\mathrm{N_{AL}}(x), \mathrm{N_{CL}}(x)), \min(\mathrm{N_{AU}}(x), \mathrm{N_{CU}}(x))] > | x \in \mathrm{X}\}$

$B \cup C = \{< x, [\max(\mathrm{M_{BL}}(x), \mathrm{M_{CL}}(x)), \max(\mathrm{M_{BU}}(x), \mathrm{M_{CU}}(x))],$

$[\min(\mathrm{N_{BL}}(x), \mathrm{N_{CL}}(x)), \min(\mathrm{N_{BU}}(x), \mathrm{N_{CU}}(x))] > | x \in \mathrm{X}\}$

$(A \cup C) \cap (B \cup C) = \{< x, [\min(\max(\mathrm{M_{AL}}(x), \mathrm{M_{CL}}(x)), \max(\mathrm{M_{BL}}(x), \mathrm{M_{CL}}(x))),$

$\min(\max(\mathrm{M_{AU}}(x), \mathrm{M_{CU}}(x)), \max(\mathrm{M_{BU}}(x), \mathrm{M_{CU}}(x)))],$

$[\max(\min(\mathrm{N_{AU}}(x), \mathrm{N_{CU}}(x)), \min(\mathrm{N_{BU}}(x), \mathrm{N_{CU}}(x))),$

$\max(\min(\mathrm{N_{AU}}(x), \mathrm{N_{CU}}(x)), \min(\mathrm{N_{BU}}(x), \mathrm{N_{CU}}(x)))] > | x \in \mathrm{X}\}$

$= \{< x, [\max(\mathrm{M_{AL}}(x), \mathrm{M_{BL}}(x), \mathrm{M_{CL}}(x)), \max(\mathrm{M_{AU}}(x), \mathrm{M_{BU}}(x), \mathrm{M_{CU}}(x))],$

$[\min(\mathrm{N_{AL}}(x), \mathrm{N_{BL}}(x), \mathrm{N_{CL}}(x)), \min(\mathrm{N_{AU}}(x), \mathrm{N_{BU}}(x), \mathrm{N_{CU}}(x))] > | x \in \mathrm{X}\}$

Hence, $(\mathrm{A} \cap \mathrm{B}) \cup \mathrm{C} = (\mathrm{A} \cup \mathrm{C}) \cap (\mathrm{B} \cup \mathrm{C})$.

4. CONCLUSION

We have defined a new extension of IVIFS, namely, IVIFSST and studied the various basic operations like union, intersection, subset and complement. We have proved the commutatively and Associative of union and intersections and the distributive law of one over the other. Also we have proved the idempotence law and demorgan’s law. The defined IVIFSST is useful in many applications. It is open to check the newly defined IVIFSST in the real time applications such as medical diagnosis, electrolsystem, career determination and pattern recognition and so on.

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