BIPOLAR INTERVAL VALUED INTUITIONISTIC FUZZY NECESSITY OPERATOR

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Abstract

In this paper we have introduced the necessity operator on a Bipolar Interval Valued Intuitionistic Fuzzy Subset of a Bipolar Interval Valued Intuitionistic Fuzzy Topological space and verified its property.

Keyword

Bipolar Interval Valued Intuitionistic Fuzzy Topological Space, Bipolar Interval Valued Intuitionistic Fuzzy Set.

1. Introduction:

Lee introduced the concept of Bipolar fuzzy set. In Bipolar Intuitionistic Fuzzy Topology the membership and non-membership degree of the fuzzy set lies in the range [0,1] and [-1,0][21]. In this paper we have introduced the Bipolar Interval Valued Intuitionistic Fuzzy necessity operator on a Bipolar Interval Valued Intuitionistic Fuzzy Subset of a Bipolar Interval Valued Intuitionistic Fuzzy Topological space and verified that the necessity operator on a Bipolar Interval Valued Intuitionistic Fuzzy Subset itself forms a Bipolar Interval Valued Intuitionistic Fuzzy Topological space.

2. Definition:

Let X be a non-empty set, and let A be a Bipolar interval valued intuitionistic fuzzy set on a Bipolar Interval Valued Intuitionistic Topological Space BIVIFTS(X), then the necessity operator on A is defined as

i. $$[\ ]A = \left\{\left\langle \begin{matrix} x, \left[\mu_{AL}^{P}(x), \mu_{AU}^{P}(x)\right], \left[1-\mu_{AU}^{P}(x), 1-\mu_{AL}^{P}(x)\right], \\ \left[\mu_{AL}^{N}(x), \mu_{AU}^{N}(x)\right], \left[-1+\mu_{AU}^{N}(x), -1+\mu_{AL}^{N}(x)\right] \end{matrix} \right\rangle \mid x \in x\right\}$$

2.1. Theorem:

Let (X,τ) be a Bipolar Interval Valued Intuitionistic Fuzzy Topological Space (BIVIFTS). Based on the necessity operator on a Bipolar Interval Valued Intuitionistic Fuzzy set A on X, we can also construct several BIVIFTSs on X as

$$\tau_N = \{[\ ]A \mid A \in \tau\}$$

i.e., the necessity operator defined in the above definition itself forms a topology.

Proof:

In order to prove the topology we have to prove the following

Let S be a set and τ be a family of bipolar interval valued intuitionistic fuzzy subset of S. The family τ is called a Bipolar Interval Valued Intuitionistic Fuzzy Topology (BIVIFT) on S if τ satisfies the following axioms

i. $0_s, 1_s \in \tau$

ii. If $\{A_i; i \in I\} \subseteq \tau, then \bigcup_{i=1}^{\infty} A_i \in \tau$

iii. If $A_1, A_2, A_3 ... A_n \in \tau, then \bigcap_{i=1}^{n} A_i \in \tau$

Let $A_1, A_2, ... A_i$ be Bipolar interval valued intuitionistic fuzzy subsets on a Bipolar Interval Valued Intuitionistic Topological Space BIVIFTS(X).

To prove necessity operator is a Bipolar Interval Valued Intuitionistic Topological Space BIVIFTS(X)

i. obviously $0_s, 1_s \in \tau_N$

ii.

$$A \cup B = \left\{ \left\langle \begin{matrix} x, \left[\mu^p_{(A\cup B)L}(x), \mu^p_{(A\cup B)U}(x)\right], \left[\mu^N_{(A\cap B)L}(x), \mu^N_{(A\cap B)U}(x)\right], \\ \left[\gamma^p_{(A\cup B)L}(x), \gamma^p_{(A\cup B)U}(x)\right], \left[\gamma^N_{(A\cap B)L}(x), \gamma^N_{(A\cap B)U}(x)\right] \end{matrix} \right\rangle \mid x \in X \right\}$$

where

$$\mu^p_{(A\cup B)L}(x) = \min\{\mu^p_{AL}(x), \mu^p_{BL}(x)\}$$

$$\mu^{p}_{(A\cup B)U}(x)=\max\{\mu^{p}_{AU}(x),\mu^{p}_{BU}(x)\}$$

$$\mu^{N}_{(A\cap B)L}(x)=\max\{\mu^{N}_{AL}(x),\mu^{N}_{BL}(x)\}$$

$$\mu^{N}_{(A\cap B)U}(x)=\min\{\mu^{N}_{AU}(x),\mu^{N}_{BU}(x)\}$$

$$\gamma^{p}_{(A\cup B)L}(x)=\min\{\gamma^{p}_{AL}(x),\gamma^{p}_{BL}(x)\}$$

$$\gamma^{p}_{(A\cup B)U}(x)=\max\{\gamma^{p}_{AU}(x),\gamma^{p}_{BU}(x)\}$$

$$\gamma^{N}_{(A\cap B)L}(x)=\max\{\gamma^{N}_{AL}(x),\gamma^{N}_{BL}(x)\}$$

$$\gamma^{N}_{(A\cap B)U}(x)=\min\{\gamma^{N}_{AU}(x),\gamma^{N}_{BU}(x)\}$$

$$\Rightarrow [\;]A_1\cup[\;]A_2=\left\{\left\langle \begin{array}{l} x,\left[\mu^{p}_{([\;]A_1\cup[\;]A_2)L}(x),\mu^{p}_{([\;]A_1\cup[\;]A_2)U}(x)\right],\\ \left[\mu^{N}_{([\;]A_1\cap[\;]A_2)L}(x),\mu^{N}_{([\;]A_1\cap[\;]A_2)U}(x)\right],\\ \left[\gamma^{p}_{([\;]A_1\cup[\;]A_2)L}(x),\gamma^{p}_{([\;]A_1\cup[\;]A_2)U}(x)\right],\\ \left[\gamma^{N}_{([\;]A_1\cap[\;]A_2)L}(x),\gamma^{N}_{([\;]A_1\cap[\;]A_2)U}(x)\right] \end{array}\right\rangle \mid x\in X\right\}$$

where

$$\mu^{p}_{([\;]A_1\cup[\;]A_2)L}(x)=\min\{\mu^{p}_{[\;]A_1L}(x),\mu^{p}_{[\;]A_2L}(x)\}$$

$$\mu^{p}_{([\;]A_1\cup[\;]A_2)U}(x)=\max\{\mu^{p}_{[\;]A_1U}(x),\mu^{p}_{[\;]A_2U}(x)\}$$

$$\mu^{N}_{([\;]A_1\cap[\;]A_2)L}(x)=\max\{\mu^{N}_{[\;]A_1L}(x),\mu^{N}_{[\;]A_2L}(x)\}$$

$$\mu^{N}_{([\;]A_1\cap[\;]A_2)U}(x)=\min\{\mu^{N}_{[\;]A_1U}(x),\mu^{N}_{[\;]A_2U}(x)\}$$

$$\gamma^{p}_{([\;]A_1\cup[\;]A_2)L}(x)=\min\{\gamma^{p}_{[\;]A_1L}(x),\gamma^{p}_{[\;]A_2L}(x)\}$$

$$\gamma^{p}_{([\;]A_1\cup[\;]A_2)U}(x)=\max\{\gamma^{p}_{[\;]A_1U}(x),\gamma^{p}_{[\;]A_2U}(x)\}$$

$$\gamma^{N}_{([\;]A_1\cap[\;]A_2)L}(x)=\max\{\gamma^{N}_{[\;]A_1L}(x),\gamma^{N}_{[\;]A_2L}(x)\}$$

$$\gamma^{N}_{([\;]A_1\cap[\;]A_2)U}(x)=\min\{\gamma^{N}_{[\;]A_1U}(x),\gamma^{N}_{[\;]A_2U}(x)\}$$

then

$$\mu^{p}_{([\;]A_1\cup[\;]A_2)L}(x)=\min\{\mu^{p}_{A_1L}(x),\mu^{p}_{A_2L}(x)\}$$

$$\mu^{p}_{([\;]A_1\cup[\;]A_2)U}(x)=\max\{\mu^{p}_{A_1U}(x),\mu^{p}_{A_2U}(x)\}$$

$$\mu^{N}_{([\;]A_1\cap[\;]A_2)L}(x)=\max\{\mu^{N}_{A_1L}(x),\mu^{N}_{A_2L}(x)\}$$

$$\mu^N_{([\ ]A_1\cap[\ ]A_2)U}(x)=\min\{\mu^N_{A_1U}(x),\mu^N_{A_2U}(x)\}$$

$$1-\mu^p_{([\ ]A_1\cup[\ ]A_2)L}(x)=\min\{1-\mu^p_{A_1L}(x),1-\mu^p_{A_2L}(x)\}$$

$$1-\mu^p_{([\ ]A_1\cup[\ ]A_2)U}(x)=\max\{1-\mu^p_{A_1U}(x),1-\mu^p_{A_2U}(x)\}$$

$$1-\mu^N_{([\ ]A_1\cap[\ ]A_2)L}(x)=\max\{1-\mu^N_{A_1L}(x),1-\mu^N_{A_2L}(x)\}$$

$$1-\mu^N_{([\ ]A_1\cap[\ ]A_2)U}(x)=\min\{1-\mu^N_{A_1U}(x),1-\mu^N_{A_2U}(x)\}$$

$$\Rightarrow[\ ]A_1\cup[\ ]A_2=\left\{\left\langle\begin{array}{l}x,\left[\mu^p_{([\ ]A_1\cup[\ ]A_2)L}(x),\mu^p_{([\ ]A_1\cup[\ ]A_2)U}(x)\right],\\ \left[\mu^N_{([\ ]A_1\cap[\ ]A_2)L}(x),\mu^N_{([\ ]A_1\cap[\ ]A_2)U}(x)\right],\\ \left[1-\mu^p_{([\ ]A_1\cup[\ ]A_2)L}(x),1-\mu^p_{([\ ]A_1\cup[\ ]A_2)U}(x)\right],\\ \left[1-\mu^N_{([\ ]A_1\cap[\ ]A_2)L}(x),1-\mu^N_{([\ ]A_1\cap[\ ]A_2)U}(x)\right]\end{array}\right\rangle\mid x\in X\right\}\in\tau_N$$

$$\Rightarrow[\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i=\left\{\left\langle\begin{array}{l}x,\left[\mu^p_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)L}(x),\mu^p_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)U}(x)\right],\\ \left[\mu^N_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)L}(x),\mu^N_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)U}(x)\right],\\ \left[\gamma^p_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)L}(x),\gamma^p_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)U}(x)\right],\\ \left[\gamma^N_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)L}(x),\gamma^N_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)U}(x)\right]\end{array}\right\rangle\mid x\in X\right\}$$

where

$$\mu^p_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)L}(x)=\min\{\mu^p_{[\ ]A_1L}(x),\mu^p_{[\ ]A_2L}(x),\ldots,\mu^p_{[\ ]A_iL}(x)\}$$

$$\mu^p_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)U}(x)=\max\{\mu^p_{[\ ]A_1U}(x),\mu^p_{[\ ]A_2U}(x),\ldots,\mu^p_{[\ ]A_iU}(x)\}$$

$$\mu^N_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)L}(x)=\max\{\mu^N_{[\ ]A_1L}(x),\mu^N_{[\ ]A_2L}(x),\ldots,\mu^N_{[\ ]A_iL}(x)\}$$

$$\mu^N_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)U}(x)=\min\{\mu^N_{[\ ]A_1U}(x),\mu^N_{[\ ]A_2U}(x),\ldots,\mu^N_{[\ ]A_iU}(x)\}$$

$$\gamma^p_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)L}(x)=\min\{\gamma^p_{[\ ]A_1L}(x),\gamma^p_{[\ ]A_2L}(x),\ldots,\gamma^p_{[\ ]A_iL}(x)\}$$

$$\gamma^p_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)U}(x)=\max\{\gamma^p_{[\ ]A_1U}(x),\gamma^p_{[\ ]A_2U}(x),\ldots,\gamma^p_{[\ ]A_iU}(x)\}$$

$$\gamma^N_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)L}(x)=\max\{\gamma^N_{[\ ]A_1L}(x),\gamma^N_{[\ ]A_2L}(x),\ldots,\gamma^N_{[\ ]A_iL}(x)\}$$

$$\gamma^N_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)U}(x)=\min\{\gamma^N_{[\ ]A_1U}(x),\gamma^N_{[\ ]A_2U}(x),\ldots,\gamma^N_{[\ ]A_iU}(x)\}$$

then

$$\mu^p_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)L}(x)=\min\{\mu^p_{A_1L}(x),\mu^p_{A_2L}(x),\ldots,\mu^p_{A_iL}(x)\}$$

$$\mu^{p}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)U}(x)=\max\left\{\mu^{p}_{A_1U}(x),\mu^{p}_{A_2U}(x),\ldots,\mu^{p}_{A_iU}(x)\right\}$$

$$\mu^{N}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)L}(x)=\max\left\{\mu^{N}_{A_1L}(x),\mu^{N}_{A_2L}(x),\ldots,\mu^{N}_{A_iL}(x)\right\}$$

$$\mu^{N}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)U}(x)=\min\left\{\mu^{N}_{A_1U}(x),\mu^{N}_{A_2U}(x),\ldots,\mu^{N}_{A_iU}(x)\right\}$$

$$1-\mu^{p}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)L}(x)=\min\left\{1-\mu^{p}_{A_1L}(x),1-\mu^{p}_{A_2L}(x),\ldots1-\mu^{p}_{A_iL}(x)\right\}$$

$$1-\mu^{p}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)U}(x)=\max\left\{1-\mu^{p}_{A_1U}(x),1-\mu^{p}_{A_2U}(x),\ldots1-\mu^{p}_{A_iU}(x)\right\}$$

$$1-\mu^{N}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)L}(x)=\max\left\{1-\mu^{N}_{A_1L}(x),1-\mu^{N}_{A_2L}(x),\ldots1-\mu^{N}_{A_iL}(x)\right\}$$

$$1-\mu^{N}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)U}(x)=\min\left\{1-\mu^{N}_{A_1U}(x),1-\mu^{N}_{A_2U}(x),\ldots1-\mu^{N}_{A_iU}(x)\right\}$$

$$\Rightarrow[\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i=\left\{\left\langle\begin{array}{l}x,\left[\mu^{p}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)L}(x),\mu^{p}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)U}(x)\right],\\ \left[\mu^{N}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)L}(x),\mu^{N}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)U}(x)\right],\\ \left[1-\mu^{p}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)L}(x),1-\mu^{p}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)U}(x)\right],\\ \left[1-\mu^{N}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)L}(x),1-\mu^{N}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)U}(x)\right]\end{array}\right\rangle\mid x\in X\right\}\in\tau_N$$

Hence the arbitrary union of Bipolar Interval Valued Intuitionistic Necessity Operators is in Bipolar Interval Valued Intuitionistic Fuzzy Topology τ.

iii.

$$A\cap B=\left\{\left\langle\begin{array}{l}x,\left[\mu^{p}_{(A\cap B)L}(x),\mu^{p}_{(A\cap B)U}(x)\right],\left[\mu^{N}_{(A\cup B)L}(x),\mu^{N}_{(A\cup B)U}(x)\right],\\ \left[\gamma^{p}_{(A\cap B)L}(x),\gamma^{p}_{(A\cap B)U}(x)\right],\left[\gamma^{N}_{(A\cup B)L}(x),\gamma^{N}_{(A\cup B)U}(x)\right]\end{array}\right\rangle\mid x\in X\right\}$$

where

$$\mu^{p}_{(A\cap B)L}(x)=\max\left\{\mu^{p}_{AL}(x),\mu^{p}_{BL}(x)\right\}$$

$$\mu^{p}_{(A\cap B)U}(x)=\min\left\{\mu^{p}_{AU}(x),\mu^{p}_{BU}(x)\right\}$$

$$\mu^{N}_{(A\cup B)L}(x)=\min\left\{\mu^{N}_{AL}(x),\mu^{N}_{BL}(x)\right\}$$

$$\mu^{N}_{(A\cup B)U}(x)=\max\left\{\mu^{N}_{AU}(x),\mu^{N}_{BU}(x)\right\}$$

$$\gamma^{p}_{(A\cap B)L}(x)=\max\left\{\gamma^{p}_{AL}(x),\gamma^{p}_{BL}(x)\right\}$$

$$\gamma^{p}_{(A\cap B)U}(x)=\min\left\{\gamma^{p}_{AU}(x),\gamma^{p}_{BU}(x)\right\}$$

$$\gamma^{N}_{(A\cup B)L}(x)=\min\left\{\gamma^{N}_{AL}(x),\gamma^{N}_{BL}(x)\right\}$$

$$\gamma^{N}_{(A\cup B)U}(x)=\max\{\gamma^{N}_{AU}(x),\gamma^{N}_{BU}(x)\}$$

then

$$([\ ]A_1\cap[\ ]A_2)=\left\{\left\langle\begin{array}{l}x,\left[\mu^{p}_{([\ ]A_1\cap[\ ]A_2)L}(x),\mu^{p}_{([\ ]A_1\cap[\ ]A_2)U}(x)\right],\\ \left[\mu^{N}_{([\ ]A_1\cup[\ ]A_2)L}(x),\mu^{N}_{([\ ]A_1\cup[\ ]A_2)U}(x)\right],\\ \left[\gamma^{p}_{([\ ]A_1\cap[\ ]A_2)L}(x),\gamma^{p}_{([\ ]A_1\cap[\ ]A_2)U}(x)\right],\\ \left[\gamma^{N}_{([\ ]A_1\cup[\ ]A_2)L}(x),\gamma^{N}_{([\ ]A_1\cup[\ ]A_2)U}(x)\right]\end{array}\right\rangle \mid x\in X\right\}$$

where

$$\mu^{p}_{([\ ]A_1\cap[\ ]A_2)L}(x)=\max\{\mu^{p}_{[\ ]A_1L}(x),\mu^{p}_{[\ ]A_2L}(x)\}$$

$$\mu^{p}_{([\ ]A_1\cap[\ ]A_2)U}(x)=\min\{\mu^{p}_{[\ ]A_1U}(x),\mu^{p}_{[\ ]A_2U}(x)\}$$

$$\mu^{N}_{([\ ]A_1\cup[\ ]A_2)L}(x)=\min\{\mu^{N}_{[\ ]A_1L}(x),\mu^{N}_{[\ ]A_2L}(x)\}$$

$$\mu^{N}_{([\ ]A_1\cup[\ ]A_2)U}(x)=\max\{\mu^{N}_{[\ ]A_1U}(x),\mu^{N}_{[\ ]A_2U}(x)\}$$

$$\gamma^{p}_{([\ ]A_1\cap[\ ]A_2)L}(x)=\max\{\gamma^{p}_{[\ ]A_1L}(x),\gamma^{p}_{[\ ]A_2L}(x)\}$$

$$\gamma^{p}_{([\ ]A_1\cap[\ ]A_2)U}(x)=\min\{\gamma^{p}_{[\ ]A_1U}(x),\gamma^{p}_{[\ ]A_2U}(x)\}$$

$$\gamma^{N}_{([\ ]A_1\cup[\ ]A_2)L}(x)=\min\{\gamma^{N}_{[\ ]A_1L}(x),\gamma^{N}_{[\ ]A_2L}(x)\}$$

$$\gamma^{N}_{([\ ]A_1\cup[\ ]A_2)U}(x)=\max\{\gamma^{N}_{[\ ]A_1U}(x),\gamma^{N}_{[\ ]A_2U}(x)\}$$

then

$$\mu^{p}_{([\ ]A_1\cap[\ ]A_2)L}(x)=\max\{\mu^{p}_{A_1L}(x),\mu^{p}_{A_2L}(x)\}$$

$$\mu^{p}_{([\ ]A_1\cap[\ ]A_2)U}(x)=\min\{\mu^{p}_{A_1U}(x),\mu^{p}_{A_2U}(x)\}$$

$$\mu^{N}_{([\ ]A_1\cup[\ ]A_2)L}(x)=\min\{\mu^{N}_{A_1L}(x),\mu^{N}_{A_2L}(x)\}$$

$$\mu^{N}_{([\ ]A_1\cup[\ ]A_2)U}(x)=\max\{\mu^{N}_{A_1U}(x),\mu^{N}_{A_2U}(x)\}$$

$$1-\mu^{p}_{([\ ]A_1\cap[\ ]A_2)L}(x)=\max\{1-\mu^{p}_{A_1L}(x),1-\mu^{p}_{A_2L}(x)\}$$

$$1-\mu^{p}_{([\ ]A_1\cap[\ ]A_2)U}(x)=\min\{1-\mu^{p}_{A_1U}(x),1-\mu^{p}_{A_2U}(x)\}$$

$$1-\mu^{N}_{([\ ]A_1\cup[\ ]A_2)L}(x)=\min\{1-\mu^{N}_{A_1L}(x),1-\mu^{N}_{A_2L}(x)\}$$

$$1-\mu^{N}_{([\ ]A_1\cup[\ ]A_2)U}(x)=\max\{1-\mu^{N}_{A_1U}(x),1-\mu^{N}_{A_2U}(x)\}$$

$$\Rightarrow[\ ]A_1\cap[\ ]A_2=\left\{\left\langle\begin{array}{l} x,\left[\mu^{p}_{([\ ]A_1\cap[\ ]A_2)L}(x),\mu^{p}_{([\ ]A_1\cap[\ ]A_2)U}(x)\right],,\\ \left[\mu^{N}_{([\ ]A_1\cup[\ ]A_2)L}(x),\mu^{N}_{([\ ]A_1\cup[\ ]A_2)U}(x)\right],\\ \left[1-\mu^{p}_{([\ ]A_1\cap[\ ]A_2)L}(x),1-\mu^{p}_{([\ ]A_1\cap[\ ]A_2)U}(x)\right],,\\ \left[1-\mu^{N}_{([\ ]A_1\cup[\ ]A_2)L}(x),1-\mu^{N}_{([\ ]A_1\cup[\ ]A_2)U}(x)\right]\end{array}\right\rangle \mid x\in X\right\}\in\tau_N$$

$$\Rightarrow[\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i=\left\{\left\langle\begin{array}{l} x,\left[\mu^{p}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)L}(x),\mu^{p}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)U}(x)\right],\\ \left[\mu^{N}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)L}(x),\mu^{N}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)U}(x)\right],\\ \left[\gamma^{p}_{([\ ]A_1\cap[\ ]A_2\cup\cap\ldots[\ ]A_i)L}(x),\gamma^{p}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)U}(x)\right],\\ \left[\gamma^{N}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)L}(x),\gamma^{N}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)U}(x)\right]\end{array}\right\rangle \mid x\in X\right\}$$

where

$$\mu^{p}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)L}(x)=\max\left\{\mu^{p}_{[\ ]A_1L}(x),\mu^{p}_{[\ ]A_2L}(x),\ldots,\mu^{p}_{[\ ]A_iL}(x)\right\}$$

$$\mu^{p}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)U}(x)=\min\left\{\mu^{p}_{[\ ]A_1U}(x),\mu^{p}_{[\ ]A_2U}(x),\ldots,\mu^{p}_{[\ ]A_iU}(x)\right\}$$

$$\mu^{N}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)L}(x)=\min\left\{\mu^{N}_{[\ ]A_1L}(x),\mu^{N}_{[\ ]A_2L}(x),\ldots,\mu^{N}_{[\ ]A_iL}(x)\right\}$$

$$\mu^{N}_{([\ ]A_1\cup[\ ]A_2\cup..[\ ]A_i)U}(x)=\max\left\{\mu^{N}_{[\ ]A_1U}(x),\mu^{N}_{[\ ]A_2U}(x),\ldots,\mu^{N}_{[\ ]A_iU}(x)\right\}$$

$$\gamma^{p}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)L}(x)=\max\left\{\gamma^{p}_{[\ ]A_1L}(x),\gamma^{p}_{[\ ]A_2L}(x),\ldots,\gamma^{p}_{[\ ]A_iL}(x)\right\}$$

$$\gamma^{p}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)U}(x)=\min\left\{\gamma^{p}_{[\ ]A_1U}(x),\gamma^{p}_{[\ ]A_2U}(x),\ldots,\gamma^{p}_{[\ ]A_iU}(x)\right\}$$

$$\gamma^{N}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)L}(x)=\min\left\{\gamma^{N}_{[\ ]A_1L}(x),\gamma^{N}_{[\ ]A_2L}(x),\ldots,\gamma^{N}_{[\ ]A_iL}(x)\right\}$$

$$\gamma^{N}_{([\ ]A_1\cup[\ ]A_2\cup\ldots[\ ]A_i)U}(x)=\max\left\{\gamma^{N}_{[\ ]A_1U}(x),\gamma^{N}_{[\ ]A_2U}(x),\ldots,\gamma^{N}_{[\ ]A_iU}(x)\right\}$$

then

$$\mu^{p}_{([\ ]A_1\cap[\ ]A_2\cap\ldots[\ ]A_i)L}(x)=\max\left\{\mu^{p}_{A_1L}(x),\mu^{p}_{A_2L}(x),\ldots,\mu^{p}_{A_iL}(x)\right\}$$

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$$\mu^{p}_{([\ ]A_1\cap[\ ]A_2\cap...[\ ]A_i)U}(x)=\min\left\{\mu^{p}_{A_1U}(x),\mu^{p}_{A_2U}(x),...,\mu^{p}_{A_iU}(x)\right\}$$

$$\mu^{N}_{([\ ]A_1\cup[\ ]A_2\cup...[\ ]A_i)L}(x)=\min\left\{\mu^{N}_{A_1L}(x),\mu^{N}_{A_2L}(x),...,\mu^{N}_{A_iL}(x)\right\}$$

$$\mu^{N}_{([\ ]A_1\cup[\ ]A_2\cup...[\ ]A_i)U}(x)=\max\left\{\mu^{N}_{A_1U}(x),\mu^{N}_{A_2U}(x),...,\mu^{N}_{A_iU}(x)\right\}$$

$$1-\mu^{p}_{([\ ]A_1\cap[\ ]A_2\cap...[\ ]A_i)L}(x)=\max\left\{1-\mu^{p}_{A_1L}(x),1-\mu^{p}_{A_2L}(x),...1-\mu^{p}_{A_iL}(x)\right\}$$

$$1-\mu^{p}_{([\ ]A_1\cap[\ ]A_2\cap...[\ ]A_i)U}(x)=\min\left\{1-\mu^{p}_{A_1U}(x),1-\mu^{p}_{A_2U}(x),...1-\mu^{p}_{A_iU}(x)\right\}$$

$$1-\mu^{N}_{([\ ]A_1\cup[\ ]A_2\cup...[\ ]A_i)L}(x)=\min\left\{1-\mu^{N}_{A_1L}(x),1-\mu^{N}_{A_2L}(x),...1-\mu^{N}_{A_iL}(x)\right\}$$

$$1-\mu^{N}_{([\ ]A_1\cup[\ ]A_2\cup...[\ ]A_i)U}(x)=\max\left\{1-\mu^{N}_{A_1U}(x),1-\mu^{N}_{A_2U}(x),...1-\mu^{N}_{A_iU}(x)\right\}$$

$$\Rightarrow[\ ]A_1\cap[\ ]A_2\cap...[\ ]A_i=\left\{\left\langle\begin{array}{l}x,\left[\mu^{p}_{([\ ]A_1\cap[\ ]A_2\cap...[\ ]A_i)L}(x),\mu^{p}_{([\ ]A_1\cap[\ ]A_2\cap...[\ ]A_i)U}(x)\right],\\ \left[\mu^{N}_{([\ ]A_1\cup[\ ]A_2\cup...[\ ]A_i)L}(x),\mu^{N}_{([\ ]A_1\cup[\ ]A_2\cup...[\ ]A_i)U}(x)\right],\\ \left[1-\mu^{p}_{([\ ]A_1\cap[\ ]A_2\cap...[\ ]A_i)L}(x),1-\mu^{p}_{([\ ]A_1\cap[\ ]A_2\cap...[\ ]A_i)U}(x)\right],\\ \left[1-\mu^{N}_{([\ ]A_1\cup[\ ]A_2\cup...[\ ]A_i)L}(x),1-\mu^{N}_{([\ ]A_1\cup[\ ]A_2\cup...[\ ]A_i)U}(x)\right]\end{array}\right\rangle \mid x\in X\right\}\in\tau_N$$

Hence the finite intersection of Bipolar Interval Valued Intuitionistic Necessity Operators is in Bipolar Interval Valued Intuitionistic Fuzzy Topology τ.

Hence the Bipolar Interval Valued Intuitionistic Necessity Operators itself forms a Bipolar Interval Valued Intuitionistic Fuzzy Topology τ.

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