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The creation of three logical connectors to reapprove how comprehensive and effective the Neutrosophic logic is compared to the fuzzy logic and the classical logic

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Abstract. The main objective of this research is a simple attempt to suggest three new logical connectors and establish an equation a chart of truth for each of them. Secondly, and using the logical operations of these three connectors, we seek to show how comprehensive and widespread and effective is the Neutrosophic logic (NL) compared to any other logic, taking into account the Fuzzy Logic (FL) as well as the classical logic (CL) as a comparative model.

Keywords: Logical Connectives , Logical Operations , Truth Table , Classical Logic , Fuzzy Logic , Neutrosophic Logic.

1 Introduction:

To begin, it is known that the eight known logical connectors are nothing but conjunctive characters and tools in the natural language which are used to link between two sentences or more in order to form a meaningful speech. Also, it is obvious that by searching through the logic's history and as the specialists strived to build an artificial language that would be alternative for expressing reality more precisely, the thing that pushed them to make these characters and tools take the form of mathematical symbols used to link between two cases or more to build a compound case that can be judged to be truthful or false. But, since the day the American Philosopher C. S. Peirce (1839,1914) established the double negation logic that was named after him: Peirce's connector, we have not encountered any attempt to establish any other connector, and it has become common in the logic and mathematic media the use of these eight logic connectors only, which means that the natural language has only eight conjunctive characters and tools, but the truth is that it has more than that; there are also other conjunctive tools and characters which need to be mathematically written and symbolized. From this logic and the following neutrosophic mottos: "All is possible, the impossible too!; Nothing is perfect, not even the perfect!"[**1**], we have questioned why don't we try to write some of the other conjunctive characters and tools in the natural language mathematically in addition to the other eight known characters and tools. From that, we have attempted to create three logical connectors that we named as follows: probability connector, duplex probability connector, and the falsification connector. We have then chosen the dual-value classical logic and the fuzzy logic as comparative models. Our second aim is to attempt a research for other conjunctive characters and tools in the natural language and establishing it as symbolic logical connectors.

2 The three new logical connectors :

2.1 Probability connector $(\boldsymbol{P})$:

We can define the probability connector in one word: probability or maybe and that can be deduced from our saying: the professor came $\boldsymbol{x}$ and the professor's probability $\boldsymbol{y}$, or maybe the teacher $\boldsymbol{y}$, which means that the probability of the professor coming $\boldsymbol{y}$ ends as soon as the professor comes $\boldsymbol{x}$ so if the professor comes $\boldsymbol{x}$ and the teacher came $\boldsymbol{y}$ is truthful, and if the professor came $\boldsymbol{x}$ and the professor did not come $\boldsymbol{y}$ is also truthful. What matters is that the professor $\boldsymbol{x}$ came and it can be false only if the professor $\boldsymbol{x}$ does not come. Whether the professor $\boldsymbol{y}$ came or did not come, because $\boldsymbol{x}$ is what is important in this case. $\boldsymbol{x}$, however, is secondary and we can see the truth chart of this logical connector in the classical logic, the fuzzy logic and the neutrosophic logic as follows:

2.1.1 Classical Logic :

The result of the probability connector between the two classical propositions (A) and (B) :

$$CL(APB) = CL(A) = \big(A - ((\{1\} - B) - (\{1\} - B))\big)$$

The result of the probability connector between the two classical propositions (A) and (B) in the following truth table :

A	B	APB
1	1	1
1	0	1
0	1	0
0	0	0

2.1.2 Fuzzy Logic :

The result of the probability connector between the two fuzzy propositions (A) and (B) :

$$FL(APB) = FL(A) = \begin{pmatrix} \big(T_A - ((\{1\} - T_B) - (\{1\} - T_B))\big), \\ \big(F_A - ((\{1\} - F_B) - (\{1\} - F_B))\big) \end{pmatrix}$$

The result of the probability connector between the two fuzzy propositions (A) and (B) in the following truth table :

A	B	APB
(1,0)	(1,0)	(1,0)
(1,0)	(0,1)	(1,0)
(0,1)	(1,0)	(0,1)
(0,1)	(0,1)	(0,1)

2.1.3 Neutrosophic Logic :

The result of the probability connector between the two neutrosophic propositions (A) and (B) :

$$NL(APB) = NL(A) = \begin{pmatrix} \big(T_A \ominus ((\{1\} \ominus T_B) \ominus (\{1\} \ominus T_B))\big), \\ \big(I_A \ominus ((\{1\} \ominus I_B) \ominus (\{1\} \ominus I_B))\big), \\ \big(F_A \ominus ((\{1\} \ominus F_B) \ominus (\{1\} \ominus F_B))\big) \end{pmatrix}$$

The result of the probability connector between the two neutrosophic propositions (A) and (B) in the following truth table :

A	B	APB
(1,0,0)	(1,0,0)	(1,0,0)
(1,0,0)	(0,0,1)	(1,0,0)
(0,0,1)	(0,1,0)	(0,0,1)
(0,0,1)	(1,0,0)	(0,0,1)
(0,1,0)	(0,0,1)	(0,1,0)
(0,1,0)	(0,1,0)	(0,1,0)

2.2 Duplex probability connector $(\boldsymbol{PP})$:

We can also refer to the duplex probability connector simply in word: probability or maybe, but this time at the beginning of the sentence, like saying: the probability that the professor $\boldsymbol{x}$ and the professor $\boldsymbol{y}$ come, or maybe the professor $\boldsymbol{x}$ and professor $\boldsymbol{y}$ come. Which means that both professor $\boldsymbol{x}$ and professor $\boldsymbol{y}$ coming is probable. So if they both come together, it is truthful and if they both don't come, it is truthful as well. But if one comes and the other does not, it is still truthful. What matters is that all expected cases of them coming together or not coming at all, or even having only one of them come are expected cases and are always truthful. We can see the truth chart of this logical connector in the classical logic, the fuzzy logic and the neutrosophic logic as follows:

2.2.1 Classical Logic :

The result of the duplex probability connector between the two classical propositions (A) and (B) :

$$CL(APPB) = \big((A + (\{1\} - A)) \times (B + (\{1\} - B))\big)$$

The result of the duplex probability connector between the two classical propositions (A) and (B) in the following truth table :

A	B	$APPB$
1	1	1
1	0	1
0	1	1
0	0	1

2.2.2 Fuzzy Logic :

The result of the duplex probability connector between the two fuzzy propositions (A) and (B) :

$$FL(APPB) = \begin{pmatrix} \big((T_A + (\{1\} - T_A)) \times (T_B + (\{1\} - T_B))\big), \\ \big((F_A + (\{1\} - F_A)) \times (F_B + (\{1\} - F_B))\big) \end{pmatrix}$$

The result of the duplex probability connector between the two fuzzy propositions (A) and (B) in the following truth table :

A	B	$APPB$
(1,0)	(1,0)	(1,1)
(1,0)	(0,1)	(1,1)
(0,1)	(1,0)	(1,1)
(0,1)	(0,1)	(1,1)

2.2.3 Neutrosophic Logic :

The result of the duplex probability connector between the two neutrosophic propositions (A) and (B) :

$$NL(APPB) = \begin{pmatrix} \big((T_A \oplus (\{1\} \ominus T_A)) \odot (T_B \oplus (\{1\} \ominus T_B))\big), \\ \big((I_A \oplus (\{1\} \ominus I_A)) \odot (I_B \oplus (\{1\} \ominus I_B))\big), \\ \big((F_A \oplus (\{1\} \ominus F_A)) \odot (F_B \oplus (\{1\} \ominus F_B))\big) \end{pmatrix}$$

The result of the duplex probability connector between the two neutrosophic propositions (A) and (B) in the following truth table :

A	B	$APPB$
(1,0,0)	(1,0,0)	(1,1,1)
(1,0,0)	(0,0,1)	(1,1,1)
(0,0,1)	(0,1,0)	(1,1,1)
(0,0,1)	(1,0,0)	(1,1,1)
(0,1,0)	(0,0,1)	(1,1,1)
(0,1,0)	(0,1,0)	(1,1,1)

2.3 Falsification connector (0) :

In fact, the falsification connector is simply like us saying: I do not believe in Quantum physics or relative physics, or saying: I totally disapprove of science's results or the philosophical ones, and more precisely, this connector is what is approved of like the right to veto in the United States, i.e. the right to disapprove or falsify any case no matter how truthful or false it is and we can see that in the truth chart of this in the classical logic, the fuzzy logic and the neutrosophic logic as follows:

2.3.1 Classical Logic :

The result of the falsification connector between the two classical propositions (A) and (B) :

$$CL(A0B) = (|A - (\{1\} - A)| - |B - (\{1\} - B)|)$$

The result of the falsification connector between the two classical propositions (A) and (B) in the following truth table :

A	B	$A0B$
1	1	0
1	0	0
0	1	0
0	0	0

2.3.2 Fuzzy Logic :

The result of the falsification connector between the two fuzzy propositions (A) and (B) :

$$FL(A0B) = \begin{pmatrix} |T_A - (\{1\} - T_A)| - |T_B - (\{1\} - T_B)|, \\ |F_A - (\{1\} - F_A)| - |F_B - (\{1\} - F_B)| \end{pmatrix}$$

The result of the falsification connector between the two fuzzy propositions (A) and (B) in the following truth table :

A	B	$A0B$
(1,0)	(1,0)	(0,0)
(1,0)	(0,1)	(0,0)
(0,1)	(1,0)	(0,0)
(0,1)	(0,1)	(0,0)

2.3.3 Neutrosophic Logic :

The result of the falsification connector between the two neutrosophic propositions (A) and (B) :

$$NL(A0B) = \begin{pmatrix} |T_A \ominus (\{1\} \ominus T_A)| \ominus |T_B \ominus (\{1\} \ominus T_B)|, \\ |I_A \ominus (\{1\} \ominus I_A)| \ominus |I_B \ominus (\{1\} \ominus I_B)|, \\ |F_A \ominus (\{1\} \ominus F_A)| \ominus |F_B \ominus (\{1\} \ominus F_B)| \end{pmatrix}$$

The result of the falsification connector between the two neutrosophic propositions (A) and (B) in the following truth table :

A	B	$A0B$
(1,0,0)	(1,0,0)	(0,0,0)
(1,0,0)	(0,0,1)	(0,0,0)
(0,0,1)	(0,1,0)	(0,0,0)
(0,0,1)	(1,0,0)	(0,0,0)
(0,1,0)	(0,0,1)	(0,0,0)
(0,1,0)	(0,1,0)	(0,0,0)

3 Conclusion :

From what has been discussed previously, we can ultimately reach two points:

3.1 We see that the logical operations of the neutrosophic logic (NL) are different from the logical operations of the fuzzy logic (FL) in terms of width, comprehensiveness and effectiveness. The reason behind that is the addition of professor Florentine Samarkendah of a new field to the real values; the truth and falsity interval in (FL) and that is what he called "the indeterminacy interval" which is expressed in the function I_A or I_B in the logical operations of: (NL) as we have seen, and that is what makes (NL) gives the closest and most precise image of the hidden logical structure of the universe like it was mentioned previously.

3.2 We see from our attempt to create three new logical connectors starting from the idea that the natural language has more than eight connecting characters and tools that need to be written in the form of symbols, that the difference in natural languages means a difference and an availability of connecting characters and tools. Consequently, we should not quote connecting characters or tools from a single language like French or English, but we should take all the languages into consideration. For example: the Chinese language has 47035 characters and that number keeps increasing. So, the best decision is to collect different connecting characters and tools from the different international natural languages and give these connectors a form of symbols. Only then will the artificial language evolve progressively compared to how it is today.

References :

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