Neutrosophic combinatorics and its applications

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Abstract: Based on the combined method in Chinese ancient I-Ching and theory of *Taiji*, this paper presents the Neutrosophic combinatorics by means of the combinations of the truth, the falsehood, and the indeterminacy in Smarandache's Neutrosophy. For the Neutrosophic combinatorics we can say that "Changes originate in the *Taiji*; from the *Taiji* come the 3 spheres. From the 3 spheres come the 9 elements, and from the 9 elements come the 27 diagrams." As the application examples, discussing the further revision to Gödel's Incompleteness Theorem; Based on one divides into two, three, more than three, pointing out that one can divide into the mixed fraction parts even hypercomplex numbers parts, such as one divides into two point five parts, one divides into (1+9i+25000j+1700k) parts; By using Neutrosophic combinatorics, also presents the digitized *Taiji* figure, fractal *Taiji* figure and the special digitized *Taiji* figure (one kind of asymmetry *Taiji* figure). Finally, discussing the rule in the application of Neutrosophic combinatorics, namely the truth uniqueness, for example, if considering that the principle of conservation of energy is a truth, then the principle of conservation of momentum or the principle of conservation of angular momentum no longer can be considered as a truth.

Key words: Smarandache, Neutrosophy, I-Ching, theory of *Taiji*, Neutrosophic combinatorics, Gödel's Incompleteness Theorem

0 Introduction

Neutrosophy is proposed by Florentin Smarandache in 1995.

Neutrosophy is a new branch of philosophy that studies the origin, nature, and scope of neutralities, as well as their interactions with different ideational spectra.

This theory considers every notion or idea <A> together with its opposite or negation <Anti-A> and the spectrum of "neutralities" <Neut-A> (i.e. notions or ideas located between the two extremes, supporting neither <A> nor <Anti-A>). The <Neut-A> and <Anti-A> ideas together are referred to as <Non-A>.

Neutrosophy is the base of neutrosophic logic, neutrosophic set, neutrosophic probability and statistics used in engineering applications (especially for software and information fusion), medicine, military, cybernetics, and physics.

Neutrosophic Logic is a general framework for unification of many existing logics, such as fuzzy logic (especially intuitionistic fuzzy logic), paraconsistent logic, intuitionistic logic, etc. The main idea of NL is to characterize each logical statement in a 3D Neutrosophic Space, where each dimension of the space represents respectively the truth (T), the falsehood (F), and the indeterminacy (I) of the statement under consideration, where T, I, F are standard or non-standard real subsets of $]^{-}0, 1^{+}[$ without necessarily connection between them.

More about Neutrosophy may be found in references [1-3].

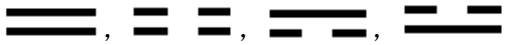
While in the Chinese ancient philosophy, according to I-Ching (Book of Changes) and theory of *Taiji* (Primal chaos theory), "Changes originate in the *Taiji* (Primal chaos, Ultimate, Source); from the *Taiji* come the two spheres. From the two spheres come the four elements, and from the four elements come the eight diagrams (eight combinations of three whole or broken lines formerly used in divination)."

Lao Tzu also said in Tao Te Ching that, "Tao generates one, one generates two, two generates three, and three generates everythings."

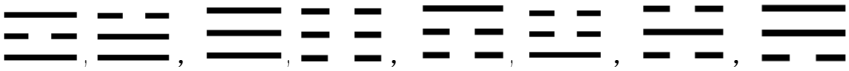
The formula of I-Ching and theory of *Taiji* may be expressed briefly as follows, “one divides into two”, the two parts or two spheres are “*Yin*” and “*Yang*”, the two opposing principles in nature, the former means feminine, negative and so on, that was indicated by a broken line (--) ; the latter means masculine, positive and so on, indicated by a simple unbroken line (—).

Similarly, the formula of Neutrosophy may be expressed briefly as follows, “one divides into three”, the three parts or three spheres are “truth”, “falsehood” and “indeterminacy”, respectively expressed by letter T, F and I.

In I-Ching and theory of *Taiji*, for greater differentiation, the single lines were combined in pairs, namely the combinations of the two parts or two spheres were considered. The second-order combinations were the following four elements:



The third-order combinations were the following eight diagrams:



Now, based on combined method in I-Ching and theory of *Taiji*, to consider the combinations of the three parts or three spheres in Neutrosophy, namely the truth (T), the falsehood (F), and the indeterminacy (I), then we obtain the basic content of Neutrosophic combinatorics.

Thus, corresponding with the I-Ching and theory of *Taiji*, for the Neutrosophic combinatorics we can say that “Changes originate in the *Taiji* (Primal chaos, Ultimate, Source); from the *Taiji* come the 3 spheres. From the 3 spheres come the 9 elements, and from the 9 elements come the 27 diagrams.”

Now we will discuss some concrete questions.

1 Basic content of Neutrosophic combinatorics

The first-order combinations of the truth (T), the falsehood (F), and the indeterminacy (I) are themselves, namely

T, I, F

As mentioned above, this is the case that “one divides into three”.

The second-order combinations are as follows

TT, TI, TF, IT, II, IF, FT, FI, FF

This is the case that “one divides into nine”.

If we don’t consider the sequence, i.e. TI=IT, TF=FT, IF=FT, then obtain the simplified second-order combinations as follows

TT, TI, TF, II, IF, FF

This is the case that “one divides into six”.

For these six kinds of combinations, may have various explanations. For example they may be explained according to the percentage as follows

100% truth, 50% truth and 50% indeterminacy, 50% truth and 50% falsehood, 100% indeterminacy, 50% indeterminacy and 50% falsehood, 100% falsehood

They also may be explained according to the time sequence as follows

Truth first and truth afterwards (truth from beginning to end), truth first and indeterminacy afterwards, truth first and falsehood afterwards, indeterminacy first and indeterminacy afterwards (indeterminacy from beginning to end), indeterminacy first and falsehood afterwards, falsehood first and falsehood afterwards (falsehood from beginning to end)

Certainly other explanations also may be given.

For the simple idea, we will only consider the simplified combinations.

The simplified third-order combinations are as follows

TTT, TTI, TTF, TII, TIF, TFF, III, IIF, IFF, FFF

This is the case that “one divides into ten”.

The higher order combinations may be processed similarly.

Now we will discuss the applications of Neutrosophic combinatorics.

2 A Further Revision to Gödel's Incompleteness Theorem

The most celebrated results of Gödel are as follows.

Gödel's First Incompleteness Theorem: Any adequate axiomatizable theory is incomplete.

Gödel's Second Incompleteness Theorem: In any consistent axiomatizable theory which can encode sequences of numbers, the consistency of the system is not provable in the system.

In literature, the Gödel's incompleteness theorem is usually briefly stated as follows: Any formal mathematical axiom system is "incomplete", because it always has one proposition that can neither be proved, nor disproved.

Gödel's incompleteness theorem is a significant result in history of mathematical logic and has greatly influenced mathematics, physics and philosophy among others.

But, any theory cannot be the ultimate truth. With the progress of science, new theories will be proposed to replace the old ones. Gödel's incompleteness theorem cannot be an exception. In references [4, 5], with the Smarandache’s neutrosophy we already revised the Gödel's Incompleteness theorem into the incompleteness axiom as follows.

Considering all possible situations with Smarandache’s neutrosophy, one may revise the Gödel's Incompleteness theorem into the incompleteness axiom: Any proposition in any formal mathematical axiom system will represent, respectively, the truth (T), the falsehood (F), and the indeterminacy (I) of the statement under consideration, where T, I, F are standard or non-standard real subsets of $]^{-}0, 1^{+}[$.

Now, by using the method of Neutrosophic combinatorics, Gödel's incomplete theorem may be further revised and expanded into the following complete axiom (its

applicable scope isn't only limited to mathematics).

Any proposition in mathematics, physics and the like will represent, respectively, the truth (T), the falsehood (F), the indeterminacy (I), and their various combinations (such as ti, the combination of truth and indeterminacy; as well as the similar tf, if, tif and so on) of the statement under consideration, where T, I, F, ti, tf, if, tif and so on are standard or non-standard real subsets of $]^{-}0, 1^{+}[$.

Now we discuss a physical example to show the application of the new complete axiom.

Example 1, for the Newton law of universal gravitation $F = \frac{GMm}{r^2}$, considering its truth (T), falsehood (F), indeterminacy (I), and the like of the following seven kinds of cases.

Case 1 (probability is 20%): r =1;

Case 2 (probability is 17%): r =0;

Case 3 (probability is 16%): Sometimes r =1, sometimes r =0;

Case 4 (probability is 15%): r =1; as well as sometimes r =1, sometimes r =0;

Case 5 (probability is 14%): r =1; as well as r =0;

Case 6 (probability is 13%): r =0; as well as sometimes r =1, sometimes r =0;

Case 7 (probability is 5%): r =1; r =0; as well as sometimes r =1, sometimes r =0.

We know that, as r =1 the law of universal gravitation is correct; as r =0 it isn't correct; as sometimes r =1, sometimes r =0, whether or not the law is correct cannot be determined, we have obviously: T=20%, I=16%, F=17%, ti=15%, tf=14%, if=13%, tif=5%.

3 Could one divide into how many parts actually

Above we discussed the cases that one divides into two, three, six, nine, ten, and other integral parts.

The question is that could one divide into how many parts actually?

Firstly we discuss the case that one divides into the mixed fraction parts with Neutrosophic combinatorics.

In Example 1, we discussed a question with seven cases, namely the situation of one divides into seven. In which the seven cases (or seven elements) are T, I, F, ti, tf, if, tif. Now suppose we only have the four cases (or four elements) of T, I, if, tif; and change the gauging method, namely three letters are equal to one part. Thus, the tif is equal to one part (including three letters), the if is equal to 2/3 part (including two letters), the T or I is equal to 1/3 part (including one letter), the sum is equal to two and a third parts, namely one divides into two and a third parts.

Example 2, one divides into two point five parts (two and a half parts).

A couple travel with a child needs to buy a half-price ticket and a baby doesn't need a ticket, suppose that T is the price of full-price ticket, I is the price of half-price ticket, F represents it doesn't need a ticket. If take the full-price ticket as a measuring unit, namely T=1, I=0.5, F=0, then the sum of all tickets (taking as "one") divides into "two point five parts" or "two and a half parts". This is the case that "one divides into two point five arts" or "one divides into two and a half arts".

Example 3, one divides into (1+9i+25000j+1700k) parts.

As processing two kinds or many kinds of heterogeneity things with Neutrosophic combinatorics, in order to avoid confusing, we must introduce the concept of complex number or the hypercomplex number.

As well-known, the solar system is composed mainly by the sun, the nine planets and their satellites, the approximate 25000 planetoids and the approximate 1700 comets, thus the solar system (taking as “one”) may divide into (1+9i+25000j+1700k) parts. In which the real component “1” represents the sun, the imaginary part “9i” represents the nine planets and their satellites, the imaginary part “25000j” represents 25000 planetoids, the imaginary part “1700k” represents 1700 comets, this is the case that “one divides into (1+9i+25000j+1700k) parts”.

At present the most “complex” number is the hypercomplex number. If it will present a more complex number in the future, then “one” might divide into the more complex parts.

Example 4, to re-handle the *Taiji* figure.

With the method of Neutrosophic combinatorics, the *Taiji* figure may be divided further, and to perform the combination of the *Taiji* figures.

Figure 1 shows the original *Taiji* figure and its digitized result. Figure 2 shows the fractal *Taiji* figure and the special digitized *Taiji* figure (one kind of asymmetry *Taiji* figure) in which the feminine part is greater than the masculine part.

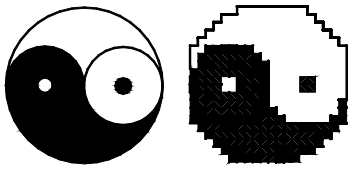


Figure 1. The original *Taiji* figure and its digitized result

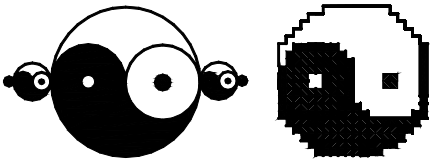


Figure 2. The fractal *Taiji* figure and the special digitized *Taiji* figure

For the original *Taiji* figure, it is difficult to divide into more parts. In this aspect, the digitized *Taiji* figure demonstrates its advantage. For example, in Figure 1, the digitized *Taiji* figure is composed by 338 small grids (169 grids for masculine fish and 169 grids for feminine fish). According to these small grids, it is very easy to divide the masculine fish and feminine fish into the different parts.

In addition, the digitized *Taiji* figure may also conveniently process the case that the number of the parts (spheres) isn’t an integer. For example, for the digitized *Taiji* figure in Figure 1, if each sphere contains 50 small grids, then the 338 small grids equal to 6.76 spheres (each of masculine and feminine fish equals to 3.38 spheres), while for the special digitized *Taiji* figure in Figure 2, the feminine fish equals to 3.52 spheres, and the

masculine fish equals to 3.24 spheres.

In the original *Taiji* figure, the "*Yin*" (feminine) and "*Yang*" (masculine) are symmetrical. But in many situations, the "*Yin*" (feminine) and "*Yang*" (masculine) are asymmetrical. It is very easy for the digitized *Taiji* figure to process this kind of situation. For example, for the right one in Figure 2, the feminine fish's tail raises up, thus the feminine fish occupies 176 grids, while the masculine fish only occupies 162 grids, therefore it forms the special digitized *Taiji* figure (one kind of asymmetry *Taiji* figure) in which the feminine part is greater than the masculine part.

4 Rule in the application of Neutrosophic combinatorics

The truth uniqueness should be insisted on in the application of Neutrosophic combinatorics.

As determine the truth, falsehood, and indeterminacy, only one truth (law, principle) shall be taken as the standard, instead of two truths (laws, principles); otherwise it will create the confusion. For example, if taking the principle of conservation of energy as a truth, then all the physical questions may divide into three kinds: The questions that the principle of conservation of energy is suitable (in any closed system), the questions that the principle isn't suitable (in any non-closed system), the questions that the principle cannot be determined as suitable or non-suitable (in any system cannot be determined as closed or non-closed).

Perhaps some people will argue that the principle of conservation of momentum and the principle of conservation of angular momentum also are the truth.

In fact, if considering that the principle of conservation of energy is a truth, then the principle of conservation of momentum and the principle of conservation of angular momentum no longer are the truth (i.e. they cannot be used to solve all the questions that are suitable for principle of conservation of energy, only part of the questions cab be solved by them). In reference [4,6], the example has already given that the results of principle of conservation of energy contradict the results of principle of conservation of momentum as well as principle of conservation of angular momentum.

5 Conclusion

The Neutrosophic combinatorics has absorbed the advantages of China ancient I-Ching and theory of *Taiji*, as well as the modern Neutrosophy, considering various complex situations and their combinations, thus possibly it can be used in dealing with the more complex problems.

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