New single valued decagonal neutrosophic number and its applications

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New Single Valued Decagonal Neutrosophic Number and its Applications

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Abstract. In this paper a new Neutrosophic number is defined single valued decagonal Neutrosophic number and its De-Neutrosophication formula has been derived which helps to convert the Neutrosophic number to a crisp number also an example is illustrated for the better understanding of the number

KEYWORDS: Neutrosophic set, single valued decagonal Neutrosophic, area removal

INTRODUCTION

World is everywhere uncertain and objects we encounter in the real physical life has vague situation. The degree of belongness helps to understand the vagueness of the situation fuzzy sets clears ambiguous case L.A Zadeh in the year 1965 introduced fuzzy set which became an eye opening in the field of fuzzy logic. This fuzzy logic is one of the tools to solve the imprecision problem in a computational way. To handle the vagueness and ambiguity traditional method of set theory and number are inadequate to solve it fuzzy is one of the concepts for this purpose.

Lotfi.A.Zadeh introduced the concept of fuzzy set later Atanassov introduced intuitionistic fuzzy set which deals with membership and non-membership function. Later in the year 1995 Florentin Smarandache introduced the Neutrosophic logic which has a large number of impacts in the indeterminate part of the life since it deals with truth membership function, falsity membership function and indeterminate membership function. Recently several forms of Neutrosophic number like triangular, trapezoidal, pentagonal, hexagonal membership function which are both dependent or independent have been manifested several multi-criteria decision-making problems (MCDM) are solved with indeterminacy using novel Neutrosophic number. Researcher all around the globe finding it difficult to convert the Neutrosophic number into crisp number (see [1]- [10]). In this paper the single valued linear decagonal Neutrosophic number and its crisp value is evaluated using removal area method.

PRELIMINARIES:

Definition 1: ***Neutrosophic Set (NS)*****:** A set $\tilde{N}$ is called a Neutrosophic set if,
$\tilde{N} = \{a; \langle [\rho_{\tilde{N}}(a), \ \sigma_{\tilde{N}}(a), \ \omega_{\tilde{N}}(a)] \rangle : a \in X\}$, where $\rho_{\tilde{N}}(a) : X \to [0,1]$
Where is said to be the truth membership function, $\sigma_{\tilde{N}}(a) : X \to [0,1]$ is said to be the indeterminacy membership function and $\omega_{\tilde{N}}(a) : X \to [0,1]$ is said to be the falsity membership function.

$$-0 \leq \rho_{\tilde{N}}(a) + \sigma_{\tilde{N}}(a) + \omega_{\tilde{N}}(a) \leq 3+$$

Definition 2: ***Single Valued linear Neutrosophic Set (SVNS)*****:** A Neutrosophic set $\tilde{N}$ in the definition 1 is said to be a Single-Valued linear Neutrosophic Set $\tilde{N}_{NS}$ if a is a single-valued independent variable. $\tilde{N}_{NS} = \left\{a; \left\langle \left[\rho_{\tilde{N}_{NS}}(a), \ \sigma_{\tilde{N}_{NS}}(a), \ \omega_{\tilde{N}_{NS}}(a)\right] \right\rangle : a \in X \right\}$, where $\rho_{\tilde{N}_{NS}}(a)$, $\sigma_{\tilde{N}_{NS}}(a)$, $\omega_{\tilde{N}_{NS}}(a)$ denoted the concept of trueness, indeterminacy and falsity memberships function respectively.

SINGLE VALUED LINEAR DECAGONAL NEUTROSOPHIC NUMBER:

Definition: ***Single Valued Linear Decagonal Neutrosophic Number (SVLDNN)*****:** A Single Valued Linear Decagonal

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Neutrosophic number $\overline{A}$ is defined and described as

$$\tilde{\boldsymbol{A}} =< [(\zeta_{11},\zeta_{21},\zeta_{31},\zeta_{41},\zeta_{51},\zeta_{61},\zeta_{71,}\zeta_{81},\zeta_{91},\zeta_{101});\rho],\\ [(\vartheta_{11},\vartheta_{21},\vartheta_{31},\vartheta_{41},\vartheta_{51},\vartheta_{61},\vartheta_{71,}\vartheta_{81},\vartheta_{91},\vartheta_{101});\sigma],\\ [(\rho_{11},\rho_{21},\rho_{31},\rho_{41},\rho_{51},\rho_{61},\rho_{71},\rho_{81},\rho_{91,},\rho_{101});\omega] >,$$

where $\rho,\ \sigma,\ \omega\ \varepsilon\ [0,1]$
The truth membership function $\aleph_{\tilde{A}}\ : R\ \to [0,\rho]$, the indeterminacy membership function $\Upsilon_{\tilde{A}}\ : R \to [\sigma,1]$, the falsity membership function $\Theta_{\tilde{A}}\ : R \to [\omega,1]$ are given as

$$\aleph_{\tilde{A}}(x) = \begin{cases} \frac{x-\zeta_{11}}{\zeta_{21}-\zeta_{11}} & \zeta_{11} \le x \le \zeta_{21} \\ \frac{x-\zeta_{21}}{\zeta_{31}-\zeta_{21}} & \zeta_{21} \le x \le c_{31} \\ \frac{x-\zeta_{31}}{\zeta_{41}-\zeta_{31}} & \zeta_{31} \le x \le \zeta_{41} \\ \frac{x-\zeta_{41}}{\zeta_{51}-\zeta_{41}} & \zeta_{41} \le x \le \zeta_{51} \\ 1 & x = \zeta_{51} \\ 1 & x = \zeta_{61} \\ \frac{\zeta_{61}-x}{\zeta_{61}-\zeta_{71}} & \zeta_{61} \le x \le \zeta_{71} \\ \frac{\zeta_{71}-x}{\zeta_{71}-\zeta_{81}} & \zeta_{71} \le x \le \zeta_{81} \\ \frac{\zeta_{81}-x}{\zeta_{81}-\zeta_{91}} & \zeta_{81} \le x \le \zeta_{91} \\ \frac{\zeta_{91}-x}{\zeta_{91}-\zeta_{101}} & \zeta_{91} \le x \le \zeta_{101} \\ 0 & otherwise \end{cases}$$

$$\Upsilon_{\tilde{A}}(x) = \begin{cases} \frac{x-\vartheta_{11}}{\vartheta_{21}-\vartheta_{11}} & \vartheta_{11} \le x \le \vartheta_{21} \\ \frac{x-\vartheta_{21}}{\vartheta_{31}-\vartheta_{21}} & \vartheta_{21} \le x \le \vartheta_{31} \\ \frac{x-\vartheta_{31}}{\vartheta_{41}-\vartheta_{31}} & \vartheta_{31} \le x \le \vartheta_{41} \\ \frac{x-\vartheta_{41}}{\vartheta_{51}-\vartheta_{41}} & \vartheta_{41} \le x \le \vartheta_{51} \\ 0 & x = \vartheta_{51} \\ 0 & x = \vartheta_{61} \\ \frac{\vartheta_{61}-x}{\vartheta_{61}-\vartheta_{71}} & \vartheta_{61} \le x \le \vartheta_{71} \\ \frac{\vartheta_{71}-x}{\vartheta_{71}-\vartheta_{81}} & \vartheta_{71} \le x \le \vartheta_{81} \\ \frac{\vartheta_{81}-x}{\vartheta_{81}-\vartheta_{91}} & \vartheta_{81} \le x \le \vartheta_{91} \\ \frac{\vartheta_{91}-x}{\vartheta_{91}-\vartheta_{101}} & \vartheta_{91} \le x \le \vartheta_{101} \\ 1 & otherwise \end{cases}$$

$$\Theta_{\tilde{A}}(x) = \begin{cases} \frac{x-\rho_{11}}{\rho_{21}-\rho_{11}} & \rho_{11} \le x \le \rho_{21} \\ \frac{x-\rho_{21}}{\rho_{31}-\rho_{21}} & \rho_{21} \le x \le \rho_{31} \\ \frac{x-\rho_{31}}{\rho_{41}-\rho_{31}} & \rho_{31} \le x \le \rho_{41} \\ \frac{x-\rho_{41}}{\rho_{51}-\rho_{41}} & \rho_{41} \le x \le \rho_{51} \\ 0 & x = \rho_{51} \\ 0 & x = \rho_{61} \\ \frac{\rho_{61}-x}{\rho_{61}-\rho_{71}} & \rho_{61} \le x \le \rho_{71} \\ \frac{\rho_{71}-x}{\rho_{71}-\rho_{81}} & \rho_{71} \le x \le \rho_{81} \\ \frac{\rho_{81}-x}{\rho_{81}-\rho_{91}} & \rho_{81} \le x \le \rho_{91} \\ \frac{\rho_{91}-x}{\rho_{91}-\rho_{101}} & \rho_{91} \le x \le \rho_{101} \\ 1 & otherwise \end{cases}$$

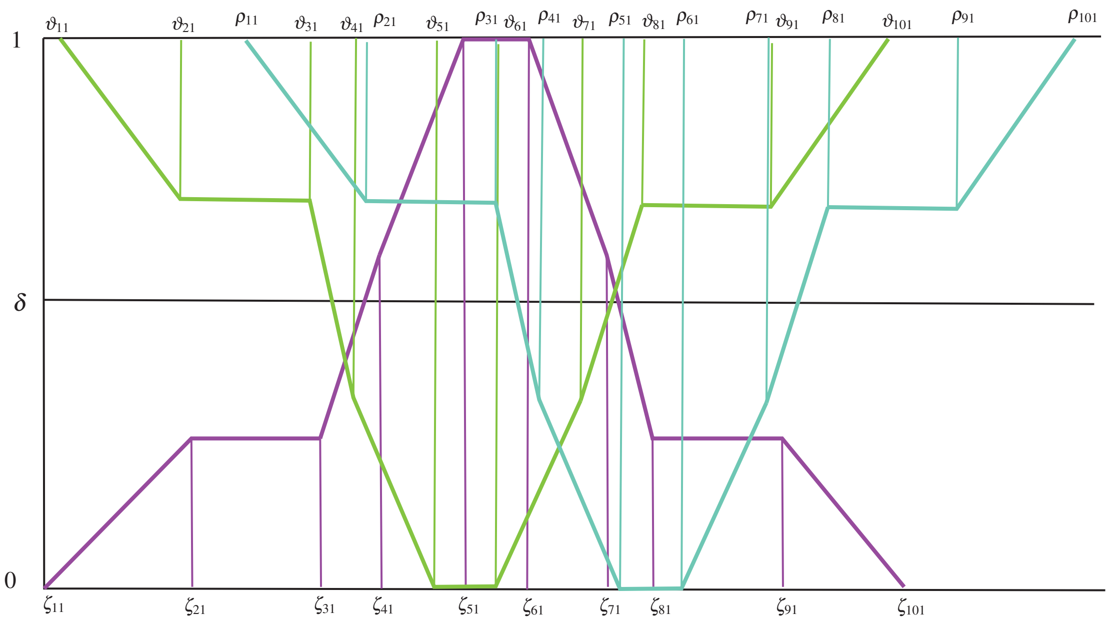

FIGURE 1. Graphical representation of single valued linear decagonal Neutrosophic number

Where purple represent truth membership, green color represents indeterminant membership, blue represent falsity membership function.

CONVERSION OF NEUTROSOPHIC NUMBER TO A CRISP NUMBER OF SINGLE VALUED DECAGONAL NEUTROSOPHIC NUMBER USING REMOVAL AREA METHOD

Using removal area method, the nanogonal Neutrosophic number is converted into the crisp value

Consider the single valued nanogonal Neutrosophic number:

$$\begin{aligned}\widetilde{\boldsymbol{A}} =&< [(\zeta_{11},\zeta_{21},\zeta_{31},\zeta_{41},\zeta_{51},\zeta_{61},\zeta_{71},\zeta_{81},\zeta_{91},\zeta_{101});\rho],\\ &[(\vartheta_{11},\vartheta_{21},\vartheta_{31},\vartheta_{41},\vartheta_{51},\vartheta_{61},\vartheta_{71,}\vartheta_{81},\vartheta_{91},\vartheta_{101});\sigma]\\ &[(\rho_{11},\rho_{21},\rho_{31},\rho_{41},\rho_{51},\rho_{61},\rho_{71},\rho_{81},\rho_{91,},\rho_{101});\omega] >\end{aligned}$$

$$\tilde{A}_{Decaneu}\left(\overline{O_r},0\right) = \frac{1}{2}\left\{\frac{(\zeta_{51}+\zeta_{61})}{2}(1)+\frac{(\zeta_{61}+\zeta_{71})}{2}(1-\delta)+\frac{(\zeta_{71}+\zeta_{81})}{2}\delta+\frac{(\zeta_{81}+\zeta_{91})}{2}\delta+\frac{(\zeta_{91}+\zeta_{101})}{2}\delta\right\}$$

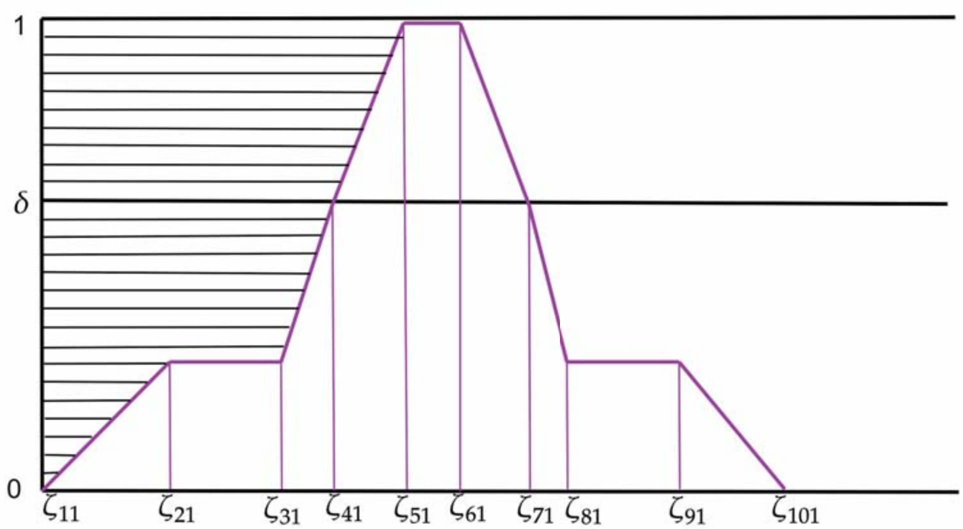

FIGURE 2. $\tilde{A}_{Decaneu}\left(\overline{O_l},0\right)$

$$\tilde{A}_{Decaneu}\left(\overline{O_l},0\right)=\frac{1}{2}\left\{\frac{(\zeta_{11}+\zeta_{21})}{2}\delta+\frac{(\zeta_{21}+\zeta_{31})}{2}\delta+\frac{(\zeta_{31}+\zeta_{41})}{2}\delta+\frac{(\zeta_{41}+\zeta_{51})}{2}(1-\delta)+\frac{(\zeta_{51}+\zeta_{61})}{2}(1)\right\}$$

$$\tilde{A}_{Decaneu}\left(\overline{O_r},0\right)=\frac{1}{2}\left\{\frac{(\zeta_{51}+\zeta_{61})}{2}(1)+\frac{(\zeta_{61}+\zeta_{71})}{2}(1-\delta)+\frac{(\zeta_{71}+\zeta_{81})}{2}\delta+\frac{(\zeta_{81}+\zeta_{91})}{2}\delta+\frac{(\zeta_{91}+\zeta_{101})}{2}\delta\right\}$$

$$\tilde{A}_{Decaneu}\left(\overline{O},0\right)=\frac{1}{4}\left[(\zeta_{11}+2\zeta_{21}+2\zeta_{31}+\zeta_{41}+\zeta_{71}+2\zeta_{81}+2\zeta_{91}+\zeta_{101})\delta+(\zeta_{41}+\zeta_{51}+\zeta_{61}+\zeta_{71})(1-\delta)\right]+2(\zeta_{51}+\zeta_{61})$$

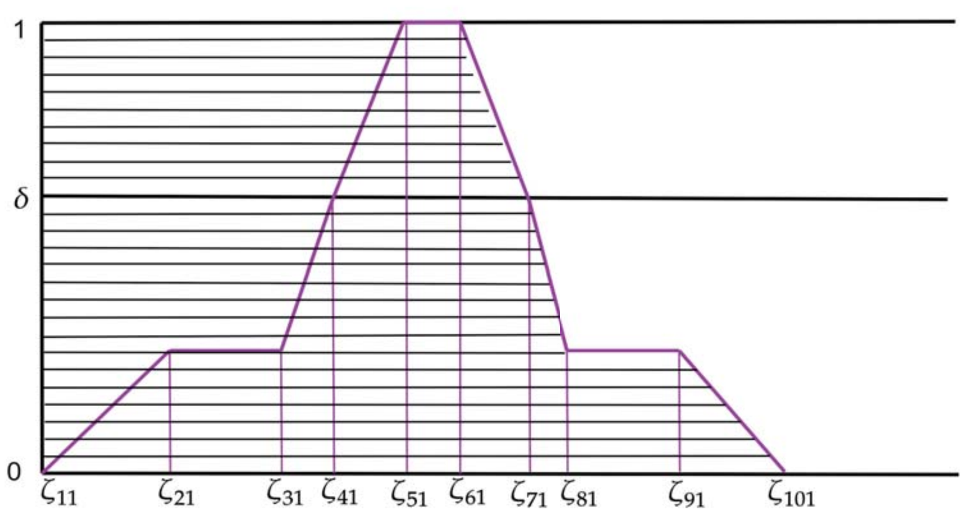

FIGURE 3. $\tilde{A}_{Decaneu}\left(\overline{O_r},0\right)$

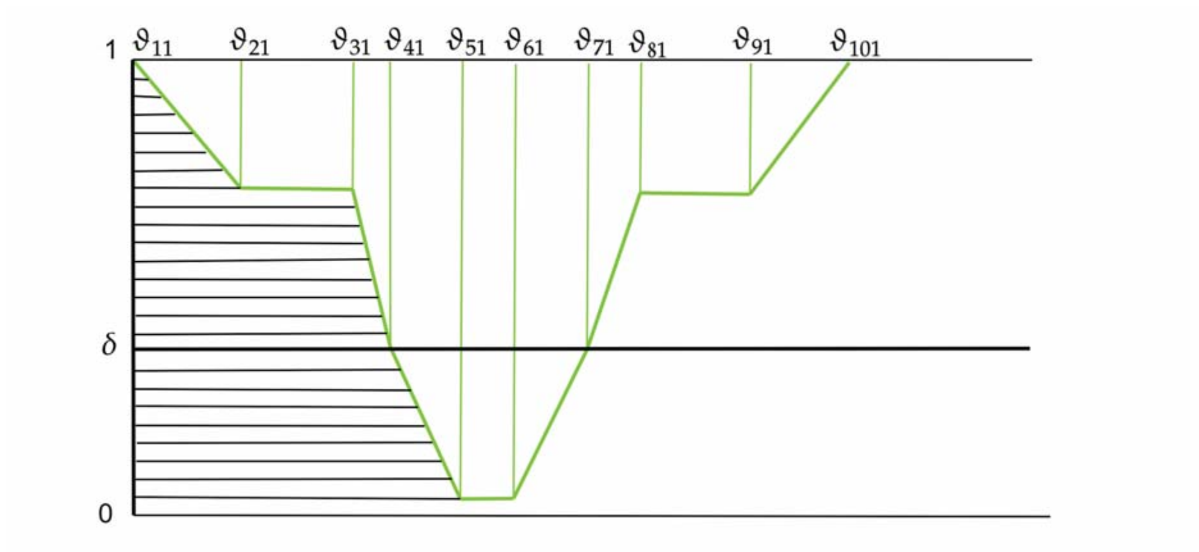

FIGURE 4. $\tilde{A}_{Decaneu}\left(\overline{T_l},0\right)$

$$\tilde{A}_{Decaneu}\left(\overline{T_l},0\right)=\frac{1}{2}\left\{\frac{(\vartheta_{11}+\vartheta_{21})}{2}(1-\delta)+\frac{(\vartheta_{21}+\vartheta_{31})}{2}(1-\delta)+\frac{(\vartheta_{31}+\vartheta_{41})}{2}(1-\delta)+\frac{(\vartheta_{41}+\vartheta_{51})}{2}(\delta)+\frac{(\vartheta_{51}+\vartheta_{61})}{2}(1)\right\}$$

$$\tilde{A}_{Decaneu}\left(\overline{T_r},0\right)=\frac{1}{2}\left\{\frac{(\vartheta_{51}+\vartheta_{61})}{2}(1)+\frac{(\vartheta_{61}+\vartheta_{71})}{2}(\delta)+\frac{(\vartheta_{71}+\vartheta_{81})}{2}(1-\delta)+\frac{(\vartheta_{81}+\vartheta_{91})}{2}(1-\delta)+\frac{(\vartheta_{91}+\vartheta_{101})}{2}(1-\delta)\right\}$$

$$\tilde{A}_{Decaneu}\left(\overline{T},0\right)=\frac{1}{4}\left[(\vartheta_{11}+2\vartheta_{21}+2\vartheta_{31}+\vartheta_{41}+\vartheta_{71}+2\vartheta_{81}+2\vartheta_{91}+\vartheta_{101})(1-\delta)+(\vartheta_{41}+\vartheta_{51}+\vartheta_{61}+\vartheta_{71})(\delta)\right]+2(\vartheta_{51}+\vartheta_{61})$$

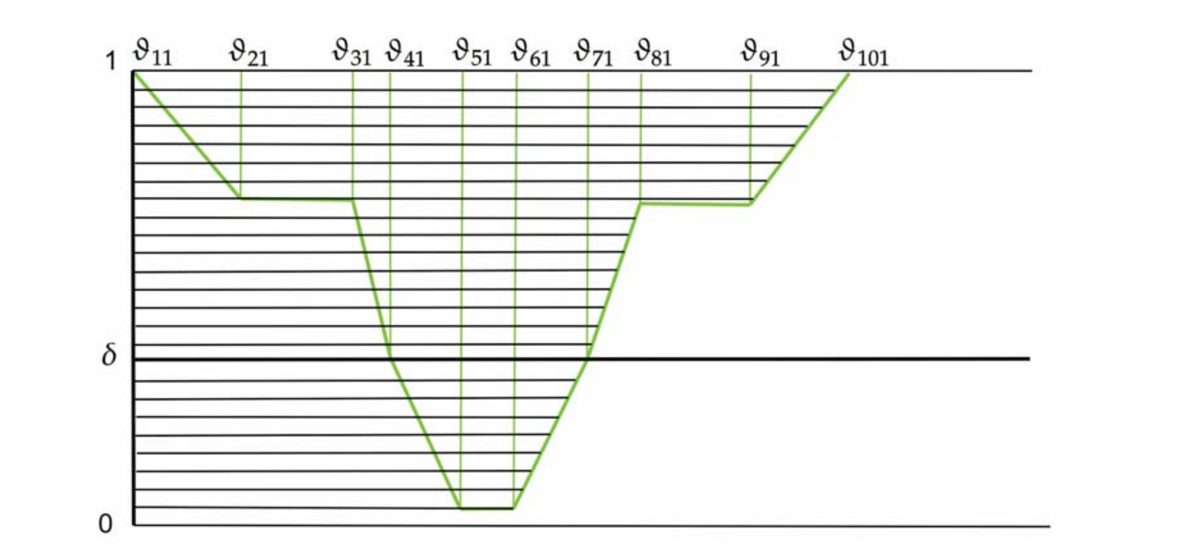

FIGURE 5. $\tilde{A}_{Decaneu}\left(\overline{T_r},0\right)$

$$\tilde{A}_{Decaneu}\left(\overline{P_l},0\right)=\frac{1}{2}\left\{\frac{(\rho_{11}+\rho_{21})}{2}(1-\delta)+\frac{(\rho_{21}+\rho_{31})}{2}(1-\delta)+\frac{(\rho_{31}+\rho_{41})}{2}(1-\delta)+\frac{(\rho_{41}+\rho_{51})}{2}(\delta)+\frac{(\rho_{51}+\rho_{61})}{2}(1)\right\}$$

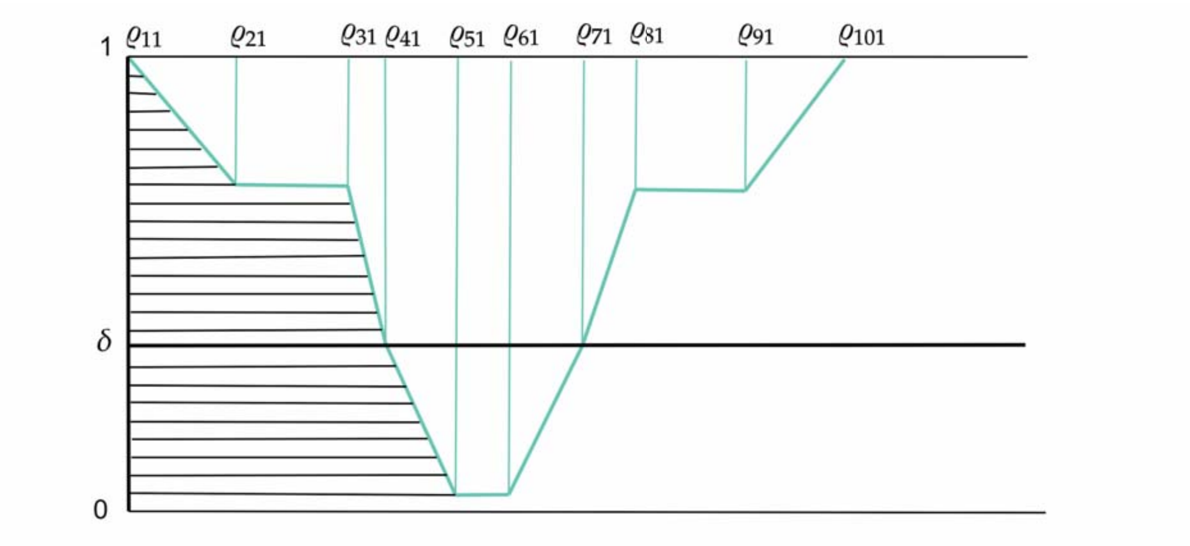

FIGURE 6. $\tilde{A}_{Decaneu}\left(\overline{P_l},0\right)$

$$\tilde{A}_{Decaneu}\left(\overline{P_r},0\right)=\frac{1}{2}\left\{\frac{(\rho_{51}+\rho_{61})}{2}(1)+\frac{(\rho_{61}+\rho_{71})}{2}(\delta)+\frac{(\rho_{71}+\rho_{81})}{2}(1-\delta)+\frac{(\rho_{81}+\rho_{91})}{2}(1-\delta)+\frac{(\rho_{91}+\rho_{101})}{2}(1-\delta)\right\}$$

$$\tilde{A}_{Decaneu}\left(\overline{T},0\right)=\frac{1}{4}\left[(\rho_{11}+2\rho_{21}+2\rho_{31}+\rho_{41}+\rho_{71}+2\rho_{81}+2\rho_{91}+\rho_{101})(1-\delta)+(\rho_{41}+\rho_{51}+\rho_{61}+\rho_{71})(\delta)\right]+2(\rho_{51}+\rho_{61})$$

The score function of the Single Valued Linear Decagonal Neutrosophic Number

$$\begin{aligned}\tilde{\boldsymbol{A}}_{\boldsymbol{Decaneu}}=<&[(\zeta_{11},\zeta_{21},\zeta_{31},\zeta_{41},\zeta_{51},\zeta_{61},\zeta_{71,}\zeta_{81},\zeta_{91},\zeta_{101});\rho],\\&[(\vartheta_{11},\vartheta_{21},\vartheta_{31},\vartheta_{41},\vartheta_{51},\vartheta_{61},\vartheta_{71,}\vartheta_{81},\vartheta_{91},\vartheta_{101});\sigma]\\&[(\rho_{11},\rho_{21},\rho_{31},\rho_{41},\rho_{51},\rho_{61},\rho_{71},\rho_{81},\rho_{91,},\rho_{101});\omega]>.\end{aligned}$$

$$\begin{aligned}\tilde{A}_{Decaneu}=\frac{1}{32}\{&(\zeta_{11}+2\zeta_{21}+2\zeta_{31}+\zeta_{41}+\zeta_{71}+2\zeta_{81}+\zeta_{91}+\zeta_{101}+\vartheta_{41}+\vartheta_{51}+\vartheta_{61}+\vartheta_{71}+\rho_{41}+\rho_{51}+\rho_{61}+\rho_{71})\,\delta\\&+(\zeta_{41}+\zeta_{51}+\zeta_{61}+\zeta_{71}+\vartheta_{11}+2\vartheta_{21}+2\vartheta_{31}+\vartheta_{41}+\vartheta_{71}+2\vartheta_{81}+2\vartheta_{91}+\vartheta_{101}+\rho_{31}+2\rho_{21}+2\rho_{31}+\rho_{41}\\&+\rho_{71}+2\rho_{81}+2\rho_{91}+\rho_{101})+(1-\delta)+2(\zeta_{51}+\zeta_{61}+\vartheta_{51}+\vartheta_{61}+\rho_{51}+\rho_{61})\}.\end{aligned}$$

NUMERICAL EXAMPLE

Consider the single valued linear decagonal Neutrosophic number

$$\tilde{A}=\{(2,3,6,4,9,11,12,13,16,18)(0.9,5,6,9,13,16,18,21,23,25),$$
$$(9,5,8,6,11,10,21,23,26,27)\}$$

Using the De-Neutrosophication formula we obtain the crisp value of the this Neutrosophic number

$$\tilde{A}=13.623$$

CONCLUSION:

In this article the single valued linear decagonal Neutrosophic number have been introduced and its crisp value is determined using the removal area method. And a numerical example is illustrated for the better understanding of the Neutrosophic number.

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