MCDM Problem using Generalized Dodecagonal Neutrosophic Number using Max – Min and Min – Max Principle

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Abstract

Deciding is the most vital part in any situation or problem that we face in our real time atmosphere. It is the situation where we must decide on the available choices. We have introduced Dodecagonal Neutrosophic Number and its properties. The concept of max-min and min-max principle is applied to the problem that is taken. The concept of heavy ordered weighted averaging operator by assigning equal weights to the attributes and a solution is found for a MCDM problem.

Keywords: Multi-criteria decision making; Neutrosophic Number; Dodecagonal Neutrosophic Number; Max – min principle; Min – max principle; heavy ordered weighted averaging operator.

1. Introduction

"The conception of fuzzy was overpowered by the conviction of Intuitionistic fuzzy set which added more meaning to complicated problems". It was developed by Atanassov [1] and it, furthermore, gave an opportunity for the young researchers to go ahead a lot more while handling uncertain information. The concept of neutrosophy [2] and [3] was given to study more of inexact information. It involves three types of membership function namely accuracy, vagueness, and falsehood. In its symmetric form, the functions are independent to each other. The conditions when they are not dependent was also considered and studied.

"The notion [4] in their paper "Aggregation operators on intuitionistic trapezoidal fuzzy number and its application to multi-criteria decision-making problems" have proposed operational laws on Tfns. Grounded with the laws proposed, they have introduced the theory of addition operators and weighted geometric accumulation operators". The score and accuracy function for defuzzifying the fuzzy values. To idealize their proposition, they have illustrated an example and have applied their theory to best prove it. R. R. Yager [6], "On Ordered Weighted Averaging Aggregation Operators in Multi- Criteria Decision Making" expanded the operators into a generalized form of OWA operators. It acts as a

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subsidiary criterion administering the attribute values taken. T. Maeda [8], “On Characterization of equilibrium strategy of two-person zero sum games with fuzzy payoffs” have considered games with fuzzy matrix. They have explored the possibilities of using equilibrium strategies in the concept of minimax games. In this study [12], we build the fundamental ideas of the neutrosophic crisp topology and generalise the notion of neutrosophic theory to sharp topological space clear topological area. “We also present the neutrosophic crisp definitions of compact spaces and continuous neutrosophic crisp functions. Finally, numerous descriptions of neutrosophic crisp compact spaces are given, and numerous features are obtained”. We briefly discuss potential applications to GIS topological rules. The author in paper [13] “generalises fuzzy logic (especially intuitionistic fuzzy logic), fuzzy set (especially intuitionistic fuzzy set), classical and imprecise probabilities to, respectively, neutrosophic logic, neutrosophic set, and neutrosophic probability”. Neutrosophy is a dialectical extension that is based on neutrality between opposites as well as the union of opposites. “The truth value, “T”, the indeterminate value, “I”, and the false value, “F”, are three standard or non-standard subsets of]0-, 1+[representing the proposition P in neutrosophic logic”. “There is no general link between T, I, and F, making it possible to characterise fuzzy logic or syllogistic logic (when the addition of terms is more than 1), or intuitionistic logic (when the addition of terms is than 1)”. This study [14] & [15] establishes that “Neutrosophic Set (NS) is an extension of Intuitionistic Fuzzy Set (IFS), regardless of whether the total single-valued neutrosophic components are greater than 1, equal to 1, or less than 1”. “Since the intuitionistic fuzzy operators ignore the indeterminacy, the neutrosophic aggregation operators consider the indeterminacy at the same level as truth-membership and falsehood-non membership are taken, one obtains a different result for the case where the sum of components is 1 (as in IFS) after applying the neutrosophic aggregation operators”. In the paper [16], “the growth of neutrosophic theory and applications has been astounding, especially since the publication of the journal Neutrosophic Sets and Systems. Rapid development of new theories, methods, and algorithms has occurred”. “The hybridization of the neutrosophic set with other potential sets, such as the rough set, bipolar set, soft set, hesitant fuzzy set, etc., is one of the most noticeable themes in the neutrosophic theory”. “In many different fields, including data mining, decision-making, e-learning, engineering, medical, social science, and others, the neutrosophic set has proved a highly useful tool”. In [18], the Neutrosophics find a home in modern inquiry since the world is rife with uncertainty. Here, we define “Neutrosophic Crisp Sets and Neutrosophic Topology for the first time”. “Crisp Sets, the 2012 concept of Neutrosophic Topological is developed by us and provide a lot of real-world examples. It's conceivable to specify the neutrosophic measure and, in turn, the neutrosophic. In many aspects, integral and neutrosophic probability are similar various indeterminacies exist, depending on the issue we must solve”.

2. Discussion

It is commonly known that in order to achieve the best result for any fuzzy game matrix, a formula should be used when processing an algorithm. The game matrix problem should be a standardised one and it should be approachable enough to process the newly defined algorithm. The attributes considered in the game matrix problem obliges to the standard form and thus dodecagonal neutrosophic number is taken. The problem is converted into a fuzzy game problem by using dodecagonal neutrosophic number as values of the matrix.

1- The payoff matrix which is to be considered should be changed to a formalized matrix by using the below formula:
Minimum formalized matrix =
$$N(min) = \frac{A_{mn}(i) - minimum(A_{mn}(i))}{maximum\ (A_{mn}(i)) - minimum(A_{mn}(i))}; where\ m, n = 1,2,3,4,5,6$$
Maximum formalized matrix =
$$N(max) = \frac{maximum\ (A_{mn}(i)) - (A_{mn}(i))}{maximum\ (A_{mn}(i)) - minimum(A_{mn}(i))}; where\ m, n = 1,2,3,4,5,6$$

2- Aggregate the formalized matrix values by using the weights allotted to each player and calculate the heavy ordered weighted average value for each player.
3- Finally, the ranking value of accuracy membership, vagueness membership and falsehood membership are calculated using the proposed ranking technique.

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4- The ranking for all players is found with the values found from the above step.

3. Uni – Valued Dodecagonal Neutrosophic Number:

A uni – valued Dodecagonal Neutrosophic Number (DNN),

$$\bar{D} = \left\{ \begin{array}{c} [(\chi_{dod}{}^1, \chi_{dod}{}^2, \chi_{dod}{}^3, \chi_{dod}{}^4, \chi_{dod}{}^5, \chi_{dod}{}^6, \chi_{dod}{}^7, \chi_{dod}{}^8, \chi_{dod}{}^9, \chi_{dod}{}^{10}, \chi_{dod}{}^{11}, \chi_{dod}{}^{12}); T], \\ [(\mathrm{O}_{dod}{}^1, \mathrm{O}_{dod}{}^2, \mathrm{O}_{dod}{}^3, \mathrm{O}_{dod}{}^4, \mathrm{O}_{dod}{}^5, \mathrm{O}_{dod}{}^6, \mathrm{O}_{dod}{}^7, \mathrm{O}_{dod}{}^8, \mathrm{O}_{dod}{}^9, \mathrm{O}_{dod}{}^{10}, \mathrm{O}_{dod}{}^{11}, \mathrm{O}_{dod}{}^{12}); I], \\ [(\Xi_{dod}{}^1, \Xi_{dod}{}^2, \Xi_{dod}{}^3, \Xi_{dod}{}^4, \Xi_{dod}{}^5, \Xi_{dod}{}^6, \Xi_{dod}{}^7, \Xi_{dod}{}^8, \Xi_{dod}{}^9, \Xi_{dod}{}^{10}, \Xi_{dod}{}^{11}, \Xi_{dod}{}^{12}); F] \end{array} \right\} \text{ where } [T, I, F \in (0,1)]$$

Also, Accuracy membership - $\propto_d : R \to [0, T]$, Vagueness membership - $\beta_d : R \to [I, 1]$, and Falsehood - $\gamma_d : R \to [F, 1]$ is:

$$T_{\tilde{D}}(A) = \begin{cases} \propto_{\overline{d0}}(\varkappa) & \chi_{dod}{}^1 \le \varkappa \le \chi_{dod}{}^2 \\ \propto_{\overline{d1}}(\varkappa) & \chi_{dod}{}^2 \le \varkappa \le \chi_{dod}{}^3 \\ \propto_{\overline{d2}}(\varkappa) & \chi_{dod}{}^3 \le \varkappa \le \chi_{dod}{}^4 \\ \propto_{\overline{d3}}(\varkappa) & \chi_{dod}{}^4 \le \varkappa \le \chi_{dod}{}^5 \\ \propto_{\overline{d4}}(\varkappa) & \chi_{dod}{}^5 \le \varkappa \le \chi_{dod}{}^6 \\ \propto_{\overline{d5}}(\varkappa) & \chi_{dod}{}^6 \le \varkappa \le \chi_{dod}{}^7 \\ 1 & \varkappa = \chi_{dod}{}^7 \\ \propto_{\overline{d5}}(\varkappa) & \chi_{dod}{}^7 \le \varkappa \le \chi_{dod}{}^8 \\ \propto_{\overline{d4}}(\varkappa) & \chi_{dod}{}^8 \le \varkappa \le \chi_{dod}{}^9 \\ \propto_{\overline{d3}}(\varkappa) & \chi_{dod}{}^9 \le \varkappa \le \chi_{dod}{}^{10} \\ \propto_{\overline{d2}}(\varkappa) & \chi_{dod}{}^{10} \le \varkappa \le \chi_{dod}{}^{11} \\ \propto_{\overline{d1}}(\varkappa) & \chi_{dod}{}^{11} \le \varkappa \le \chi_{dod}{}^{12} \\ 0 & otherwise \end{cases} \quad I_{\tilde{D}}(\mathrm{B}) = \begin{cases} \beta_{\overline{d0}}(\varkappa) & \mathrm{O}_{dod}{}^1 \le \varkappa \le \mathrm{O}_{dod}{}^2 \\ \beta_{\overline{d1}}(\varkappa) & \mathrm{O}_{dod}{}^2 \le \varkappa \le \mathrm{O}_{dod}{}^3 \\ \beta_{\overline{d2}}(\varkappa) & \mathrm{O}_{dod}{}^3 \le \varkappa \le \mathrm{O}_{dod}{}^4 \\ \beta_{\overline{d3}}(\varkappa) & \mathrm{O}_{dod}{}^4 \le \varkappa \le \mathrm{O}_{dod}{}^5 \\ \beta_{\overline{d4}}(\varkappa) & \mathrm{O}_{dod}{}^5 \le \varkappa \le \mathrm{O}_{dod}{}^6 \\ \beta_{\overline{d5}}(\varkappa) & \mathrm{O}_{dod}{}^6 \le \varkappa \le \mathrm{O}_{dod}{}^7 \\ 0 & \varkappa = \mathrm{O}_{dod}{}^7 \\ \beta_{\overline{d5}}(\varkappa) & \mathrm{O}_{dod}{}^7 \le \varkappa \le \mathrm{O}_{dod}{}^8 \\ \beta_{\overline{d4}}(\varkappa) & \mathrm{O}_{dod}{}^8 \le \varkappa \le \mathrm{O}_{dod}{}^9 \\ \beta_{\overline{d3}}(\varkappa) & \mathrm{O}_{dod}{}^9 \le \varkappa \le \mathrm{O}_{dod}{}^{10} \\ \beta_{\overline{d2}}(\varkappa) & \mathrm{O}_{dod}{}^{10} \le \varkappa \le \mathrm{O}_{dod}{}^{11} \\ \beta_{\overline{d1}}(\varkappa) & \mathrm{O}_{dod}{}^{11} \le \varkappa \le \mathrm{O}_{dod}{}^{12} \\ 1 & otherwise \end{cases} \quad T_{\tilde{D}}(C)$$

$$= \begin{cases} \gamma_{\overline{d0}}(\varkappa) & \Xi_{dod}{}^1 \le \varkappa \le \Xi_{dod}{}^2 \\ \gamma_{\overline{d1}}(\varkappa) & \Xi_{dod}{}^2 \le \varkappa \le \Xi_{dod}{}^3 \\ \gamma_{\overline{d2}}(\varkappa) & \Xi_{dod} \le \varkappa \le \Xi_{dod}{}^4 \\ \gamma_{\overline{d3}}(\varkappa) & \Xi_{dod}{}^4 \le \varkappa \le \Xi_{dod}{}^5 \\ \gamma_{\overline{d4}}(\varkappa) & \Xi_{dod}{}^5 \le \varkappa \le \Xi_{dod}{}^6 \\ \gamma_{\overline{d5}}(\varkappa) & \Xi_{dod}{}^6 \le \varkappa \le \Xi_{dod}{}^7 \\ 0 & \varkappa = \Xi_{dod}{}^7 \\ \gamma_{\overline{d5}}(\varkappa) & \Xi_{dod}{}^7 \le \varkappa \le \Xi_{dod}{}^8 \\ \gamma_{\overline{d4}}(\varkappa) & \Xi_{dod}{}^8 \le \varkappa \le \Xi_{dod}{}^9 \\ \gamma_{\overline{d3}}(\varkappa) & \Xi_{dod}{}^9 \le \varkappa \le \Xi_{dod}{}^{10} \\ \gamma_{\overline{d2}}(\varkappa) & \Xi_{dod}{}^{10} \le \varkappa \le \Xi_{dod}{}^{11} \\ \gamma_{\overline{d1}}(\varkappa) & \Xi_{dod}{}^{11} \le \varkappa \le \Xi_{dod}{}^{12} \\ 1 & otherwise \end{cases}$$

Definition of a Dodecagonal Neutrosophic Number:

DNN is given by,

$$\hat{D} = \left\{ \begin{array}{c} [\chi_{dod}{}^1, \chi_{dod}{}^2, \chi_{dod}{}^3, \chi_{dod}{}^4, \chi_{dod}{}^5, \chi_{dod}{}^6, \chi_{dod}{}^7, \chi_{dod}{}^8, \chi_{dod}{}^9, \chi_{dod}{}^{10}, \chi_{dod}{}^{11}, \chi_{dod}{}^{12} ; \propto], \\ [\mathrm{O}_{dod}{}^1, \mathrm{O}_{dod}{}^2, \mathrm{O}_{dod}{}^3, \mathrm{O}_{dod}{}^4, \mathrm{O}_{dod}{}^5, \mathrm{O}_{dod}{}^6, \mathrm{O}_{dod}{}^7, \mathrm{O}_{dod}{}^8, \mathrm{O}_{dod}{}^9, \mathrm{O}_{dod}{}^{10}, \mathrm{O}_{dod}{}^{11}, \mathrm{O}_{dod}{}^{12} ; \beta], \\ [\Xi_{dod}{}^1, \Xi_{dod}{}^2, \Xi_{dod}{}^3, \Xi_{dod}{}^4, \Xi_{dod}{}^5, \Xi_{dod}{}^6, \Xi_{dod}{}^7, \Xi_{dod}{}^8, \Xi_{dod}{}^9, \Xi_{dod}{}^{10}, \Xi_{dod}{}^{11}, \Xi_{dod}{}^{12} ; \gamma] \end{array} \right\}$$ should satisfy the following conditions:

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Rule 1:

1. $\propto_{\bar{d}}$: accuracy membership function $\propto_{\bar{d}} : R \rightarrow [0,1]$
2. $\beta_{\bar{d}}$: vagueness membership function $\beta_{\bar{d}} \ : R \rightarrow [0,1]$
3. $\gamma_{\bar{d}}$: falsehood membership function $\gamma_{\bar{d}} \ : R \rightarrow [0,1]$

Rule 2:

1. $\propto_{\bar{d}}$: accuracy MF ought to be strictly rising function in $[{\chi_{dod}}^1, {\chi_{dod}}^{12}]$
2. $\beta_{\bar{d}}$: vagueness MF ought to be strictly rising function in $[{\mathrm{O}_{dod}}^1, {\mathrm{O}_{dod}}^{12}]$
3. $\gamma_{\bar{d}}$: falsehood MF ought to be strictly rising function in $[{\Xi_{dod}}^1, {\Xi_{dod}}^{12}]$

Rule 3:

1. $\propto_{\bar{d}}$: accuracy MF ought to be strictly declining function in $[{\chi_{dod}}^1, {\chi_{dod}}^{12}]$
2. $\beta_{\bar{d}}$: vagueness MF ought to be strictly declining function in $[{\mathrm{O}_{dod}}^1, {\mathrm{O}_{dod}}^{12}]$
3. $\gamma_{\bar{d}}$: falsehood MF ought to be strictly declining function in $[{\Xi_{dod}}^1, {\Xi_{dod}}^{12}]$

Neutrosophic Operations of a DNN:

Let $\tilde{n}_1 = \begin{bmatrix} ({\chi_{dod}}^1, {\chi_{dod}}^2, {\chi_{dod}}^3, {\chi_{dod}}^4, {\chi_{dod}}^5, {\chi_{dod}}^6, {\chi_{dod}}^7, {\chi_{dod}}^8, {\chi_{dod}}^9, {\chi_{dod}}^{10}, {\chi_{dod}}^{11}, {\chi_{dod}}^{12}), \\ ({\mathrm{O}_{dod}}^1, {\mathrm{O}_{dod}}^2, {\mathrm{O}_{dod}}^3, {\mathrm{O}_{dod}}^4, {\mathrm{O}_{dod}}^5, {\mathrm{O}_{dod}}^6, {\mathrm{O}_{dod}}^7, {\mathrm{O}_{dod}}^8, {\mathrm{O}_{dod}}^9, {\mathrm{O}_{dod}}^{10}, {\mathrm{O}_{dod}}^{11}, {\mathrm{O}_{dod}}^{12}), \\ ({\Xi_{dod}}^1, {\Xi_{dod}}^2, {\Xi_{dod}}^3, {\Xi_{dod}}^4, {\Xi_{dod}}^5, {\Xi_{dod}}^6, {\Xi_{dod}}^7, {\Xi_{dod}}^8, {\Xi_{dod}}^9, {\Xi_{dod}}^{10}, {\Xi_{dod}}^{11}, {\Xi_{dod}}^{12}) \end{bmatrix}$ and

$\tilde{n}_2 = \begin{bmatrix} ({\Phi_{dod}}^1, {\Phi_{dod}}^2, {\Phi_{dod}}^3, {\Phi_{dod}}^4, {\Phi_{dod}}^5, {\Phi_{dod}}^6, {\Phi_{dod}}^7, {\Phi_{dod}}^8, {\Phi_{dod}}^9, {\Phi_{dod}}^{10}, {\Phi_{dod}}^{11}, {\Phi_{dod}}^{12}), \\ ({\psi_{dod}}^1, {\psi_{dod}}^2, {\psi_{dod}}^3, {\psi_{dod}}^4, {\psi_{dod}}^5, {\psi_{dod}}^6, {\psi_{dod}}^7, {\psi_{dod}}^8, {\psi_{dod}}^9, {\psi_{dod}}^{10}, {\psi_{dod}}^{11}, {\psi_{dod}}^{12}), \\ ({\Omega_{dod}}^1, {\Omega_{dod}}^2, {\Omega_{dod}}^3, {\Omega_{dod}}^4, {\Omega_{dod}}^5, {\Omega_{dod}}^6, {\Omega_{dod}}^7, {\Omega_{dod}}^8, {\Omega_{dod}}^9, {\Omega_{dod}}^{10}, {\Omega_{dod}}^{11}, {\Omega_{dod}}^{12}) \end{bmatrix}$ be two dodecagonal Neutrosophic numbers. Then, we have

1. $\tilde{n}_1 \oplus \tilde{n}_2 = [(\chi_1 + \Phi_1 - \chi_1\Phi_1, \chi_2 + \Phi_2 - \chi_2\Phi_2, \chi_3 + \Phi_3 - \chi_3\Phi_3, \chi_4 + \Phi_4 - \chi_4\Phi_4, \chi_5 + \Phi_5 - \chi_5\Phi_5, \chi_6 + \Phi_6 - \chi_6\Phi_6, \chi_7 + \Phi_7 - \chi_7\Phi_7, \chi_8 + \Phi_8 - \chi_8\Phi_8, \chi_9 + \Phi_9 - \chi_9\Phi_9, \chi_{10} + \Phi_{10} - \chi_{10}\Phi_{10}, \chi_{11} + \Phi_{11} - \chi_{11}\Phi_{11}, \chi_{12} + \Phi_{12} - \chi_{12}\Phi_{12}), (\mathrm{O}_1\psi_1, \mathrm{O}_2\psi_2, \mathrm{O}_3\psi_3, \mathrm{O}_4\psi_4, \mathrm{O}_5\psi_5, \mathrm{O}_6\psi_6, \mathrm{O}_7\psi_7, \mathrm{O}_8\psi_8, \mathrm{O}_9\psi_9, \mathrm{O}_{10}\psi_{10}, \mathrm{O}_{11}\psi_{11}, \mathrm{O}_{12}\psi_{12}), (\Xi_1\Omega_1, \Xi_2\Omega_2, \Xi_3\Omega_3, \Xi_4\Omega_4, \Xi_5\Omega$
2. $\tilde{n}_1 \otimes \tilde{n}_2 = [(\chi_1\Phi_1, \chi_2\Phi_2, \chi_3\Phi_3, \chi_4\Phi_4, \chi_5\Phi_5, \chi_6\Phi_6, \chi_7\Phi_7, \chi_8\Phi_8, \chi_9\Phi_9, \chi_{10}\Phi_{10}, \chi_{11}\Phi_{11}, \chi_{12}\Phi_{12}), (\mathrm{O}_1 + n_1 - \mathrm{O}_1 n_1, \mathrm{O}_2 + n_2 - \mathrm{O}_2 n_2, \mathrm{O}_3 + n_3 - \mathrm{O}_3 n_3, \mathrm{O}_4 + n_4 - \mathrm{O}_4 n_4, \mathrm{O}_5 + n_5 - \mathrm{O}_5 n_5, \mathrm{O}_6 + n_6 - \mathrm{O}_6 n_6, \mathrm{O}_7 + n_7 - \mathrm{O}_7 n_7, \mathrm{O}_8 + n_8 - \mathrm{O}_8 n_8, \mathrm{O}_9 + n_9 - \mathrm{O}_9 n_9, \mathrm{O}_{10} + n_{10} - \mathrm{O}_{10} n_{10}, \mathrm{O}_{11} + n_{11} - \mathrm{O}_{11} n_{11}, \mathrm{O}_{12} + n_{12} - \mathrm{O}_{12} n_{12}), (\Xi_1 + o_1 - \Xi_1 o_1, \Xi_2 + o_2 - \Xi_2 o_2, \Xi_3 + o_3 - \Xi_3 o_3, \Xi_4 + o_4 - \Xi_4 o_4, \Xi_5 + o_5 - \Xi_5 o_5, \Xi_6 + o_6 - \Xi_6 o_6, \Xi_7 + o_7 - \Xi_7 o_7, \Xi_8 + o_8 - \Xi_8 o_8, \Xi_9 + o_9 - \Xi_9 o_9, \Xi_{10} + o_{10} - \Xi_{10} o_{10}, \Xi_{11} + o_{11} - \Xi_{11} o_{11}, \Xi_{12} + o_{12} - \Xi_{12} o_{12})]$
3. $\lambda\tilde{n}_1 = [\text{"}1 - (1 - \chi_1)^\lambda, 1 - (1 - \chi_2)^\lambda, 1 - (1 - \chi_3)^\lambda, 1 - (1 - \chi_4)^\lambda, 1 - (1 - \chi_5)^\lambda, 1 - (1 - \chi_6)^\lambda, 1 - (1 - \chi_7)^\lambda, 1 - (1 - \chi_8)^\lambda, 1 - (1 - \chi_9)^\lambda, 1 - (1 - \chi_{10})^\lambda, 1 - (1 - \chi_{11})^\lambda, 1 - (1 - \chi_{12})^\lambda\text{"}, (\mathrm{O}_1^\lambda, \mathrm{O}_2^\lambda, \mathrm{O}_3^\lambda, \mathrm{O}_4^\lambda, \mathrm{O}_5^\lambda, \mathrm{O}_6^\lambda, \mathrm{O}_7^\lambda, \mathrm{O}_8^\lambda, \mathrm{O}_9^\lambda, \mathrm{O}_{10}^\lambda, \mathrm{O}_{11}^\lambda, \mathrm{O}_{12}^\lambda), (\Xi_1^\lambda, \Xi_2^\lambda, \Xi_3^\lambda, \Xi_4^\lambda, \Xi_5^\lambda, \Xi_6^\lambda, \Xi_7^\lambda, \Xi_8^\lambda, \Xi_9^\lambda, \Xi_{10}^\lambda, \Xi_{11}^\lambda, \Xi_{12}^\lambda)]$
4. $\tilde{n}_1^\lambda = [(\chi_1^\lambda, \chi_2^\lambda, \chi_3^\lambda, \chi_4^\lambda, \chi_5^\lambda, \chi_6^\lambda, \chi_7^\lambda, \chi_8^\lambda, \chi_9^\lambda, \chi_{10}^\lambda, \chi_{11}^\lambda, \chi_{12}^\lambda), \text{"}1 - (1 - \mathrm{O}_1)^\lambda, 1 - (1 - \mathrm{O}_2)^\lambda, 1 - (1 - \mathrm{O}_3)^\lambda, 1 - (1 - \mathrm{O}_4)^\lambda, 1 - (1 - \mathrm{O}_5)^\lambda, 1 - (1 - \mathrm{O}_6)^\lambda, 1 - (1 - \mathrm{O}_7)^\lambda, 1 - (1 - \mathrm{O}_8)^\lambda, 1 - (1 - \mathrm{O}_9)^\lambda, 1 - (1 - \mathrm{O}_{10})^\lambda, 1 - (1 - \mathrm{O}_{11})^\lambda, 1 - (1 - \mathrm{O}_{12})^\lambda, 1 - (1 - \Xi_1)^\lambda, 1 - (1 - \Xi_2)^\lambda, 1 - (1 - \Xi_3)^\lambda, 1 - (1 - \Xi_4)^\lambda, 1 - (1 - \Xi_5)^\lambda, 1 - (1 - \Xi_6)^\lambda, 1 - (1 - \Xi_7)^\lambda, 1 - (1 - \Xi_8)^\lambda, 1 - (1 - \Xi_9)^\lambda, 1 - (1 - \Xi_{10})^\lambda, 1 - (1 - \Xi_{11})^\lambda, 1 - (1 - \Xi_{12})^\lambda\text{"}]$

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Score and Accuracy Function for Dodecagonal Neutrosophic Number:

$$S(\tilde{n}) = \frac{1}{3}\Bigg[2 + \frac{(\chi_{dod_1} + \chi_{dod_2} + \chi_{dod_3} + \chi_{dod_4} + \chi_{dod_5} + \chi_{dod_6} + \chi_{dod_7} + \chi_{dod_8} + \chi_{dod_9} + \chi_{dod_{10}} + \chi_{dod_{11}} + \chi_{dod_{12}})}{12} - \frac{(\mathrm{O}_{dod_1} + \mathrm{O}_{dod_2} + \mathrm{O}_{dod_3} + \mathrm{O}_{dod_4} + \mathrm{O}_{dod_5} + \mathrm{O}_{dod_6} + \mathrm{O}_{dod_7} + \mathrm{O}_{dod_8} + \mathrm{O}_{dod_9} + \mathrm{O}_{dod_{10}} + \mathrm{O}_{dod_{11}} + \mathrm{O}_{dod_{12}})}{12} - \frac{(\Xi_{dod_1} + \Xi_{dod_2} + \Xi_{dod_3} + \Xi_{dod_4} + \Xi_{dod_5} + \Xi_{dod_6} + \Xi_{dod_7} + \Xi_{dod_8} + \Xi_{dod_9} + \Xi_{dod_{10}} + \Xi_{dod_{11}} + \Xi_{dod_{12}})}{12}\Bigg]$$

$$A(\tilde{n}) = \Bigg[\frac{(\chi_{dod_1} + \chi_{dod_2} + \chi_{dod_3} + \chi_{dod_4} + \chi_{dod_5} + \chi_{dod_6} + \chi_{dod_7} + \chi_{dod_8} + \chi_{dod_9} + \chi_{dod_{10}} + \chi_{dod_{11}} + \chi_{dod_{12}})}{12} - \frac{(\Xi_{dod_1} + \Xi_{dod_2} + \Xi_{dod_3} + \Xi_{dod_4} + \Xi_{dod_5} + \Xi_{dod_6} + \Xi_{dod_7} + \Xi_{dod_8} + \Xi_{dod_9} + \Xi_{dod_{10}} + \Xi_{dod_{11}} + \Xi_{dod_{12}})}{12}\Bigg]$$

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$$T_{W_{\tilde{a}}(x)} = \begin{cases} 0 & \text{for x} < a_1 \\ k_1.\dfrac{(x-a_1)}{(a_2-a_1)} & a_1 \le x \le a_2 \\ k_1 & a_2 \le x \le a_3 \\ k_1+(k_2-k_1).\dfrac{(x-a_3)}{(a_4-a_3)} & a_3 \le x \le a_4 \\ k_2 & a_4 \le x \le a_5 \\ k_2+(w_a-k_2).\dfrac{(x-a_5)}{(a_6-a_5)} & a_5 \le x \le a_6 \\ w_a & a_6 \le x \le a_7 \\ k_2+(w_a-k_2).\dfrac{(a_7-x)}{(a_8-a_7)} & a_7 \le x \le a_8 \\ k_2 & a_8 \le x \le a_9 \\ k_1+(k_2-k_1).\dfrac{(a_9-x)}{(a_{10}-a_9)} & a_9 \le x \le a_{10} \\ k_1 & a_{10} \le x \le a_{11} \\ k_1.\dfrac{(a_{11}-x)}{(a_{12}-a_{11})} & a_{11} \le x \le a_{12} \\ 0 & \text{for x} > a_{12} \end{cases}
\quad I_{\mu_{\tilde{a}}(x)} = \begin{cases} 1 & \text{for x} < b_1 \\ 1+(1-k_2).\dfrac{(b_1-x)}{(b_2-b_1)} & b_1 \le x \le b_2 \\ k_2 & b_2 \le x \le b_3 \\ k_1+(k_1-k_2).\dfrac{(b_3-x)}{(b_4-b_3)} & b_3 \le x \le b_4 \\ k_1 & b_4 \le x \le b_5 \\ k_1+(k_1-u_a).\dfrac{(b_5-x)}{(b_6-b_5)} & b_5 \le x \le b_6 \\ 0 & b_6 \le x \le b_7 \\ u_a+(k_1-u_a).\dfrac{(x-b_7)}{(b_8-b_7)} & b_7 \le x \le b_8 \\ k_1 & b_8 \le x \le b_9 \\ k_2+(k_1-k_2).\dfrac{(x-b_9)}{(b_{10}-b_9)} & b_9 \le x \le b_{10} \\ k_2 & b_{10} \le x \le b_{11} \\ k_2+(1-k_2).\dfrac{(x-b_{11})}{(b_{12}-b_{11})} & b_{11} \le x \le b_{12} \\ 1 & \text{for x} > b_{12} \end{cases}$$

$$F_{y_{\tilde{a}}(x)} = \begin{cases} 1 & \text{for x} < c_1 \\ 1+(1-k_2).\dfrac{(c_1-x)}{(c_2-c_1)} & c_1 \le x \le c_2 \\ k_2 & c_2 \le x \le c_3 \\ k_1+(k_1-k_2).\dfrac{(c_3-x)}{(c_4-c_3)} & c_3 \le x \le c_4 \\ k_1 & c_4 \le x \le c_5 \\ k_1+(k_1-u_a).\dfrac{(c_5-x)}{(c_6-c_5)} & c_5 \le x \le c_6 \\ 0 & c_6 \le x \le c_7 \\ u_a+(k_1-u_a).\dfrac{(x-c_7)}{(c_8-c_7)} & c_7 \le x \le c_8 \\ k_1 & c_8 \le x \le c_9 \\ k_2+(k_1-k_2).\dfrac{(x-c_9)}{(c_{10}-c_9)} & c_9 \le x \le c_{10} \\ k_2 & c_{10} \le x \le c_{11} \\ k_2+(1-k_2).\dfrac{(x-c_{11})}{(c_{12}-c_{11})} & c_{11} \le x \le c_{12} \\ 1 & \text{for x} > c_{12} \end{cases}$$

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Ranking Technique:

Let

$\widetilde{D_{dod}}^{N} = [(D_{dod}{}^{1}, D_{dod}{}^{2}, D_{dod}{}^{3}, D_{dod}{}^{4}, D_{dod}{}^{5}, D_{dod}{}^{6}, D_{dod}{}^{7}, D_{dod}{}^{8}, D_{dod}{}^{9}, D_{dod}{}^{10}, D_{dod}{}^{11}, D_{dod}{}^{12});\ W_a, \mu_a, \gamma_a]$ a generalized single valued dodecagonal neutrosophic number. The ranking R of $\tilde{A}^{N}$ on the set of single valued dodecagonal neutrosophic number is defined as follows:

$$R(\tilde{A}^{N}) = \left(\frac{W_a + (1-\mu_a) + (1-\gamma_a)}{3}\right).\left(\frac{D_{dod}{}^{1} + D_{dod}{}^{2} + D_{dod}{}^{3} + D_{dod}{}^{4} + D_{dod}{}^{5} + D_{dod}{}^{6} + D_{dod}{}^{7} + D_{dod}{}^{8} + D_{dod}{}^{9} + D_{dod}{}^{10} + D_{doo}}{12}\right.$$

Proposed Ranking Technique:

Accuracy Membership Function

$$T_{w_{\tilde{a}}}(x) = w_{\tilde{a}}.\left\{\frac{k_1(\chi_{dod_1} + \chi_{dod_2} + \chi_{dod_3} + \chi_{dod_{10}} + \chi_{dod_{11}} + \chi_{dod_{12}}) + (1-k_2)(\chi_{dod_4} + \chi_{dod_5} + \chi_{dod_6} + \chi_{dod_7} + \chi_{dod_8} + \chi_{dod_9})}{6}\right.$$

Vagueness Membership Function

$$I_{u_{\tilde{a}}}(x) = (1 - u_{\tilde{a}}).\left\{\frac{k_1(\mathrm{O}_{dod_1} + \mathrm{O}_{dod_2} + \mathrm{O}_{dod_3} + \mathrm{O}_{dod_{10}} + \mathrm{O}_{dod_{11}} + \mathrm{O}_{dod_{12}}) + (1-k_2)(\mathrm{O}_{dod_4} + \mathrm{O}_{dod_5} + \mathrm{O}_{dod_6} + \mathrm{O}_{dod_7} + \mathrm{O}_{dod_8} + \mathrm{O}_{doo}}{6}\right.$$

Falsehood Membership Function

$$F_{y_{\tilde{a}}}(x) = (1 - y_{\tilde{a}}).\left\{\frac{k_1(\Xi_{dod_1} + \Xi_{dod_2} + \Xi_{dod_3} + \Xi_{dod_{10}} + \Xi_{dod_{11}} + \Xi_{dod_{12}}) + (1-k_2)(\Xi_{dod_4} + \Xi_{dod_5} + \Xi_{dod_6} + \Xi_{dod_7} + \Xi_{dod_8} + \Xi_{dod_9})}{6}\right.$$

4. Practical Example

A. The Neutrosophic Context of the Problem

NO – Not Out; HS – Highest Score; SR – Strike Rate; Inns – Innings; Mat - Matches

Players	NO	Runs	HS	SR	Inns	Mat
V Kohli	(2,3,4,5,6,7,8,9,10,11,12,13; 0.5,0.3,0.2)	(5,6,7,8,9,10,11,12,13,14,15,16;0.8,0.4,0.5)	(9,10,11,12,13,14,15,16,17,18,19,20; 0.6,0.3,0.4)	(10,11,12,13,14,15,16,17,18,19,20,21; 0.5,0.2,0.4)	(14,15,16,17,18,19,20,21,22,23,24,25; 0.6,0.3,0.4)	(14,15,16,17,18,19,20,21,22,23,24,25; 0.7,0.4,0.5)
SK Raina	(2,3,4,5,6,7,8,9,10,11,12,13; 0.7,0.4,0.2)	(5,6,7,8,9,10,11,12,13,14,15,16; 0.7,0.3,0.4)	(8,9,10,11,12,13,14,15,16,17,18,19; 0.4,0.2,0.4)	(11,12,13,14,15,16,17,18,19,20,21,22; 0.6,0.3,0.4)	(15,16,17,18,19,20,21,22,23,24,25,26; 0.9,0.5,0.7)	(16,17,18,19,20,21,22,23,24,25,26,27; 0.9,0.5,0.4)
RG Sharma	(2,3,4,5,6,7,8,9,10,11,12,13; 0.7,0.4,0.2)	(4,5,6,7,8,9,10,11,12,13,14,15; 0.6,0.2,0.3)	(9,10,11,12,13,14,15,16,17,18,19,20; 0.5,0.2,0.4)	(10,11,12,13,14,15,16,17,18,19,20,21; 0.5,0.2,0.4)	(15,16,17,18,19,20,21,22,23,24,25,26; 0.8,0.4,0.6)	(15,16,17,18,19,20,21,22,23,24,25,26; 0.8,0.4,0.6)
DA Warner	(1,2,3,4,5,6,7,8,9,10,11,12; 0.4,0.2,0.3)	(4,5,6,7,8,9,10,11,12,13,14,15; 0.6,0.2,0.3)	(10,11,12,13,14,15,16,17,18,19,20,21; 0.7,0.3,0.5)	(11,12,13,14,15,16,17,18,19,20,21,22; 0.7,0.3,0.5)	(10,11,12,13,14,15,16,17,18,19,20,21; 0.3,0.1,0.3)	(10,11,12,13,14,15,16,17,18,19,20,21; 0.3,0.1,0.2)
S Dhawan	(1,2,3,4,5,6,	(4,5,6,7,8,9,1	(8,9,10,11,12,1	(10,11,12,13,14	(13,14,15,16,17	(13,14,15,16,17

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	7,8,9,10,11, 12; 0.6,0.4,0.3)	0,11,12,13,14 ,15; 0.5,0.2,0.3)	3,14,15,16,17, 18,19; 0.4,0.2,0.4)	,15,16,17,18,19, 20,21; 0.3,0.1,0.2)	,18,19,20,21,22, 23,24; 0.5,0.2,0.4)	,18,19,20,21,22, 23,24; 0.5,0.2,0.3)
AB De Villiers	(2,3,4,5,6,7, 8,9,10,11,12 ,13; 0.8,0.4,0.5)	(4,5,6,7,8,9,1 0,11,12,13,14 ,15; 0.5,0.2,0.3)	(11,12,13,14,1 5,16,17,18,19, 20,21,22; 0.8,0.4,0.6)	(12,13,14,15,16 ,17,18,19,20,21, 22,23; 0.8,0.4,0.6)	(11,12,13,14,15 ,16,17,18,19,20, 21,22; 0.4,0.1,0.3)	(12,13,14,15,16 ,17,18,19,20,21, 22,23; 0.5,0.2,0.3)

Calculation:

$$N(min) = \frac{A_{mn}(i) - minimum(A_{mn}(i))}{maximum\ (A_{mn}(i)) - minimum(A_{mn}(i))}; where\ m, n = 1,2,3,4,5,6\ \&\ i = 1,2,3,4,5,6$$

$$A_1 = \frac{A_{11} - \min(A_{11}(1))}{maximum\ \left(A_{11}(1)\right) - minimum(A_{11}(1))} = \frac{2-2}{25-2} = \frac{0}{23} = 0$$

A1											
2	0.00	5	0.13	9	0.30	10	0.35	14	0.52	14	0.52
3	0.04	6	0.17	10	0.35	11	0.39	15	0.57	15	0.57
4	0.09	7	0.22	11	0.39	12	0.43	16	0.61	16	0.61
5	0.13	8	0.26	12	0.43	13	0.48	17	0.65	17	0.65
6	0.17	9	0.30	13	0.48	14	0.52	18	0.70	18	0.70
7	0.22	10	0.35	14	0.52	15	0.57	19	0.74	19	0.74
8	0.26	11	0.39	15	0.57	16	0.61	20	0.78	20	0.78
9	0.30	12	0.43	16	0.61	17	0.65	21	0.83	21	0.83
10	0.35	13	0.48	17	0.65	18	0.70	22	0.87	22	0.87
11	0.39	14	0.52	18	0.70	19	0.74	23	0.91	23	0.91
12	0.43	15	0.57	19	0.74	20	0.78	24	0.96	24	0.96
13	0.48	16	0.61	20	0.78	21	0.83	25	1.00	25	1.00

	0.0000	0.0074	0.0148	0.0222	0.0296	0.0370	0.0443	0.0517	0.0591	0.0665	0.0739	0.0813
	0.0222	0.0296	0.0370	0.0443	0.0517	0.0591	0.0665	0.0739	0.0813	0.0887	0.0961	0.1035
	0.0517	0.0591	0.0665	0.0739	0.0813	0.0887	0.0961	0.1035	0.1109	0.1183	0.1257	0.1330
	0.0591	0.0665	0.0739	0.0813	0.0887	0.0961	0.1035	0.1109	0.1183	0.1257	0.1330	0.1404
	0.0887	0.0961	0.1035	0.1109	0.1183	0.1257	0.1330	0.1404	0.1478	0.1552	0.1626	0.1700
	0.0887	0.0961	0.1035	0.1109	0.1183	0.1257	0.1330	0.1404	0.1478	0.1552	0.1626	0.1700
H(A_1)	**0.3104**	**0.3548**	**0.3991**	**0.4435**	**0.4878**	**0.5322**	**0.5765**	**0.6209**	**0.6652**	**0.7096**	**0.7539**	**0.7983**

H(A1) = (.3104,.3548,.3991,.4435,.4878,.5322,.5765,.6209,.6652,.7096,.7539,.7983; 0.5,0.4,0.5)

H($A2$) = (.3060,.3468,.3876,.4284,.4692,.5100,.5508,.5916,.6324,.6732,.7140,.7548; 0.4,0.5,0.7)

H(A3) = (.3046,.3471,.3896,.4321,.4746,.5171,.5596,.6021,.6446,.6871,.7296,.7721; 0.5,0.4,0.6)

H(A4) = (0.3238,0.3724,0.4210,0.4695,0.5181,0.5667,0.6152,0.6638,0.7124,0.7610,0.8095,0.8581; 0.3,0.3,0.5)

H(A5) = (0.3178,0.3622,0.4065,0.4509,0.4952,0.5396,0.5839,0.6283,0.6726,0.7170,0.7613,0.8057; 0.4,0.4,0.4)

H($A6$) = (0.3238,0.3724,0.4210,0.4695,0.5181,0.5667,0.6152,0.6638,0.7124,0.7610,0.8095,0.8581; 0.4,0.4,0.6)

$$N(max) = \frac{maximum\ (A_{mn}(i)) - (A_{mn}(i))}{maximum\ (A_{mn}(i)) - minimum(A_{mn}(i))}; where\ m, n = 1,2,3,4,5,6$$

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$$B_1 = \frac{maximum\ (A_{11}(1)) - (A_{11}(1))}{maximum\ (A_{11}(1)) - minimum(A_{11}(1))} = \frac{25-2}{25-2} = \frac{23}{23} = 1$$

B1													
2	1.00	5	0.87	9	0.70	10	0.65	14	0.48	14	0.48
3	0.96	6	0.83	10	0.65	11	0.61	15	0.43	15	0.43
4	0.91	7	0.78	11	0.61	12	0.57	16	0.39	16	0.39
5	0.87	8	0.74	12	0.57	13	0.52	17	0.35	17	0.35
6	0.83	9	0.70	13	0.52	14	0.48	18	0.30	18	0.30
7	0.78	10	0.65	14	0.48	15	0.43	19	0.26	19	0.26
8	0.74	11	0.61	15	0.43	16	0.39	20	0.22	20	0.22
9	0.70	12	0.57	16	0.39	17	0.35	21	0.17	21	0.17
10	0.65	13	0.52	17	0.35	18	0.30	22	0.13	22	0.13
11	0.61	14	0.48	18	0.30	19	0.26	23	0.09	23	0.09
12	0.57	15	0.43	19	0.26	20	0.22	24	0.04	24	0.04
13	0.52	16	0.39	20	0.22	21	0.17	25	0.00	25	0.00

	0.089	0.096	0.103	0.111	0.118	0.126	0.133	0.140	0.148	0.155	0.163	0.170
	0.067	0.074	0.081	0.089	0.096	0.103	0.111	0.118	0.126	0.133	0.140	0.148
	0.037	0.044	0.052	0.059	0.067	0.074	0.081	0.089	0.096	0.103	0.111	0.118
	0.030	0.037	0.044	0.052	0.059	0.067	0.074	0.081	0.089	0.096	0.103	0.111
	0.000	0.007	0.015	0.022	0.030	0.037	0.044	0.052	0.059	0.067	0.074	0.081
	0.000	0.007	0.015	0.022	0.030	0.037	0.044	0.052	0.059	0.067	0.074	0.081
H(B_1)	**0.222**	**0.266**	**0.310**	**0.355**	**0.399**	**0.443**	**0.488**	**0.532**	**0.577**	**0.621**	**0.665**	**0.710**

H($B1$) = (.222,.266,.310,.355,.399,.443,.488,.532,.577,.621,.665,.710; 0.5,0.4,0.5)
H($B2$) = (.265,.306,.347,.388,.428,.469,.510,.551,.592,.632,.673,.714; 0.4,0.5,0.7)
H(B3) = (.248,.290,.333,.375,.418,.460,.503,.545,.588,.630,.673,.715; 0.5,0.4,0.6)
H($B4$) = (0.128,0.170,0.221,0.272,0.323,0.374,0.425,0.476,0.527,0.578,0.629,0.680; 0.3,0.3,0.5)
H($B5$) = (0.214,0.259,0.303,0.347,0.392,0.436,0.480,0.525,0.569,0.613,0.658,0.702; 0.4,0.4,0.4)
H($B6$) = (0.162,0.210,0.259,0.308,0.356,0.405,0.453,0.502,0.550,0.599,0.648,0.696; 0.4,0.4,0.6)

Calculation of Accuracy Membership Function:

$$T_{w_{\tilde{a}}}(x) = w_{\tilde{a}} \cdot \left\{ \frac{k_1(\chi_{dod_1} + \chi_{dod_2} + \chi_{dod_3} + \chi_{dod_{10}} + \chi_{dod_{11}} + \chi_{dod_{12}}) + (1-k_2)(\chi_{dod_4} + \chi_{dod} + \chi_{dod_6} + \chi_{dod_7} + \chi_{dod_8} + \chi_{dod_9})}{6} \right\}$$

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$$= 0.5 * \left\{ \frac{0.5(0.3104 + 0.3548 + 0.3991 + 0.7096 + 0.7539 + 0.7983) + (0.5)(0.4435 + 0.4878 + 0.5322 + 0.5765 + 0.6209 + 0.}{6} \right.$$

$$= 0.5 * \left\{ \frac{0.5(3.3261) + (0.5)(3.3261)}{6} \right\} = 0.28$$

Calculation of Vagueness Membership Function:

$$I_{u_{\tilde{a}}}(x) = (1 - u_{\tilde{a}}).\left\{ \frac{k_1\left(\mathrm{O}_{dod_1} + \mathrm{O}_{dod_2} + \mathrm{O}_{dod_3} + \mathrm{O}_{dod_{10}} + \mathrm{O}_{dod_{11}} + \mathrm{O}_{dod_{12}}\right) + (1 - k_2)\left(\mathrm{O}_{dod_4} + \mathrm{O}_{dod_5} + \mathrm{O}_{dod_6} + \mathrm{O}_{dod_7} + \mathrm{O}_{dod_8} + \mathrm{O}_{dod}\right.}{6} \right.$$

$$= (1 - 0.4) * \left\{ \frac{0.5(0.3104 + 0.3548 + 0.3991 + 0.7096 + 0.7539 + 0.7983) + (0.5)(0.4435 + 0.4878 + 0.5322 + 0.5765 + 0.6209 + 0.}{6} \right.$$

$$= 0.6 * \left\{ \frac{0.5(3.3261) + (0.5)(3.3261)}{6} \right\} = 0.33$$

Calculation of Falsehood Membership Function:

$$F_{y_{\tilde{a}}}(x) = (1 - y_{\tilde{a}}).\left\{ \frac{k_1\left(\Xi_{dod_1} + \Xi_{dod_2} + \Xi_{dod_3} + \Xi_{dod_{10}} + \Xi_{dod_{11}} + \Xi_{dod_{12}}\right) + (1 - k_2)\left(\Xi_{dod_4} + \Xi_{dod_5} + \Xi_{dod_6} + \Xi_{dod_7} + \Xi_{dod_8} + \Xi_{dod_9}\right)}{6} \right.$$

$$= (1 - 0.5) * \left\{ \frac{0.5(0.3104 + 0.3548 + 0.3991 + 0.7096 + 0.7539 + 0.7983) + (0.5)(0.4435 + 0.4878 + 0.5322 + 0.5765 + 0.6209 + 0.6652)}{6} \right\}$$

$$= 0.5 * \left\{ \frac{0.5(3.3261) + (0.5)(3.3261)}{6} \right\} = 0.28$$

Truth H(A_1) = 0.28	**Indeterminacy H(A_1) = 0.17**	**Falsity H(A_1) = 0.14**
Truth H(A_2) = 0.21	**Indeterminacy H(A_2) = 0.27**	**Falsity H(A_2) = 0.16**
Truth H(A_3) = 0.27	**Indeterminacy H(A_3) = 0.32**	**Falsity H(A_3) = 0.22**
Truth H(A_4) = 0.18	**Indeterminacy H(A_4) = 0.41**	**Falsity H(A_4) = 0.30**
Truth H(A_5) = 0.22	**Indeterminacy H(A_5) = 0.22**	**Falsity H(A_5) = 0.22**
Truth H(A_6) = 0.24	**Indeterminacy H(A_6) = 0.53**	**Falsity H(A_6) = 0.24**
Truth H(B_1) = 0.47	**Indeterminacy H(B_1) = 0.56**	**Falsity H(B_1) = 0.47**
Truth H(B_2) = 0.39	**Indeterminacy H(B_2) = 0.49**	**Falsity H(B_2) = 0.29**
Truth H(B_3) = 0.48	**Indeterminacy H(B_3) = 0.58**	**Falsity H(B_3) = 0.39**
Truth H(B_4) = 0.24	**Indeterminacy H(B_4) = 0.56**	**Falsity H(B_4) = 0.40**
Truth H(B_5) = 0.37	**Indeterminacy H(B_5) = 0.37**	**Falsity H(B_5) = 0.37**
Truth H(B_6) = 0.34	**Indeterminacy H(B_6) = 0.51**	**Falsity H(B_6) = 0.34**

Names	**Rank**
V Kohli	1
RG Sharma	2
AB De Villiers	3
S Dhawan	4
SK Raina	5

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DA Warner	6

6. Conclusion

The properties of generalized dodecagonal neutrosophic number are completely analysed with their respective membership functions. These characteristics helps us to bring in a better result for the MCDM. The concept of maximum and minimum helps us to do a complete overall study of the players taken. The attributes which are considered to rank the players gives us a proper ranking and at arrive at decisions while choosing a player. The same methodology can be applied considering the bowling and fielding attributes as well. We will able to use the suggested algorithm and formula to do the overall ranking using batting, fielding and bowling attributes.

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References

[1] F. Smarandache, "Neutrosophy and Neutrosophic Logic, First International Conference on Neutrosophy, Neutrosophic Logic Set, Probability & Statistics", University of New Mexico, Gallup, NM 87301, USA (2002).
[2] F. Smarandache, "Neutrosophic Set, a generalization of Intuitionistic Fuzzy Sets", International Journal of Pure and Applied Mathematics, 24, 287 – 297, (2005).
[3] H. J. Zimmermann, Fuzzy Set Theory and Its Applications, Kluwer-Nijhoff, Boston, Mass, USA, 2nd edition, 1991.
[4] J. Q. Wang, Z. Zhang, "Aggregation operators on intuitionistic trapezoidal fuzzy number and its application to multi-criteria decision-making problems", Journal of Systems Engineering and Electronics, 20 (2009) 321-326.
[5] K. Selvakumari, S. Lavanya, "Solving Fuzzy Game Problem in Octagonal Neutrosophic Numbers using Heavy OWA Operator", International Journal of Engineering and Technology, 7 (4.39), 497 – 499, 2018.
[6] R. R. Yager, "On Ordered Weighted Averaging Aggregation Operators in Multi- Criteria Decision Making". IEEE Transactions on Systems, Man and Cybernetics, 1988, 18: 183-190.
[7] R. R. Yager, "Heavy OWA operators," Fuzzy Optimization and decision making, vol.1, no.4, pp.379-397,2002.
[8] T. Maeda, "On Characterization of equilibrium strategy of two-person zero sum games with fuzzy payoffs", Fuzzy Sets and Systems, 139(2), 2004, 283 – 296.
[9] V. Vijay, S. Chandra, C.R. Bector, "Matrix games with fuzzy goals and fuzzy payoffs", Omega,33(5) (2005), 425-429.
[10] Zadeh L. A. "Fuzzy Sets". Information and control, 1965, 8(3): 338-353.
[11] Atanassov, K., Intuitionistic fuzzy sets. In V. Sgurev, ed., ITKRS Session, Sofia, June 1983, Central Sci. and Techn. Library, Bulg. Academy of Sciences, 1984.
[12] Smarandache, F., Neutrosophy and Neutrosophic Logic, First International Conference on Neutrosophy, Neutrosophic Logic, Set, Probability, and Statistics University of New Mexico, Gallup, NM 87301, USA,2002.
[13] Smarandache, F. A Unifying Field in Logics: Neutrosophic Logic. Neutrosophy, Neutrosophic Set, Neutrosophic Probability. American Research Press, Rehoboth, NM, 1999.
[14] Smarandache, F., Neutrosophic set a generalization of the intuitionistic fuzzy sets. Inter. J. Pure Appl. Math., 24, 287 – 297, 2005.
[15] Salama, A. A., Smarandache, F., & Kroumov, V., Neutrosophic crisp Sets & Neutrosophic crisp Topological Spaces. Sets and Systems, 2(1), 25-30, 2014.
[16] Smarandache, F. & Pramanik, S. (Eds). (2016). New trends in neutrosophic theory and applications. Brussels: Pons Editions.

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[17] Salama, A. A., Smarandache, F., Neutrosophic Crisp Set Theory, Educational. Education Publishing 1313 Chesapeake, Avenue, Columbus, Ohio 43212, (2015).
[18] Salama, A. A., & Smarandache, F. Neutrosophic crisp probability theory & decision-making process, Critical Review: A Publication of Society for Mathematics of Uncertainty, vol. 12, p. 34-48, 2016.

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