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PENTAPARTITIONED FERMATEAN NEUTROSOPHIC SOFT-ROUGH SET AND ITS APPLICATIONS

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Abstract: This article's goal is to present a mathematical paradigm, Pentapartitioned Fermatean Neutrosophic Soft-Rough Set (PFN-SRS). PFN-SRS integrates elements of neutrosophic sets, Fermatean sets, Soft sets and Rough sets, providing a robust tool for addressing the intricate issues of data inconsistency, imprecision and ambiguity. We present a comprehensive exploration of PFN-SRS, encompassing its definition, properties and mathematical structures. To demonstrate the practical utility of PFN-SRS, we introduce and apply the ANMABA method. The PFN-SRS framework empowers a more nuanced and adaptable approach to handling uncertainty and imprecision in decision making problems. ANMABA method for PFN-SRS provides actionable perception and can be applied to solve various problems in industries in different contexts. By utilizing ANMABA method for PFN-SRS, organizations can improve their services by using data-driven decision-making and gain insightful knowledge about consumer satisfaction.

Keywords and Phrases: Pentapartitioned fermatean neutrosophic soft rough sets, UPFN-SR operator, LPFN-SR operator.

2020 Mathematics Subject Classification: 18B30, 03E72.

1. Introduction

The fuzzy set was first presented by Zadeh [26] in 1965. In 1998, Smarandache [22] developed the notion of neutrosophic sets by utilizing the ideas of intuitionistic-fuzzy-sets [1] and fuzzy sets. The foundation for the ideas of Neutrosophic Topological Space was established in 2012 by Salama et al. [19]. Das et al. [12] proposed the concept of neutrosophic simply soft open sets in neutrosophic soft topological spaces. In 2020, the introduction of Pentapartitioned Neutrosophic sets and associated properties was done by Pramanik et al. [14]. Followed in their footsteps, Das et al. [1] delved into the Pentapartitioned Neutrosophic Sets in 2020. The main objective of this article is to provide more refined and accurate representations of real- world problems, enabling informed decisions.

ANMABA method can be used in decision-making processes in various domains particularly in the service sector. We have contributed a novel method, termed the ANMABA-method, designed to enhance customer satisfaction-based decision-making processes. This innovative approach synergistically integrates fuzzy sets, neutrosophic sets, soft sets and rough sets to provide a more comprehensive and precise understanding of customer needs and preferences. By accurately capturing customer preferences and needs, the ANMABA-method enables organizations to deliver tailored solutions, ultimately driving higher customer satisfaction and fostering long-term loyalty. In this article ANMABA method enables decision-makers to assess candidates based on multiple, often conflicting, criteria. Its precise approach helps organizations identify top talent, streamlining the selection process and improving hiring outcomes. This work intended to present the ideas behind Pentapartitioned Fermatean Neutrosophic Soft-Rough sets and explore its properties. Additionally, the ANMABA method's applicability to the Pentapartitioned Fermatean Neutrosophic Soft-Rough set is examined in this paper through an example.

3. Preliminaries

Definition 3.1. [20] *Let* $I = [0, 1]$ *and* $B \neq \emptyset$. *The form of a fermatean fuzzy set* M_F *is* $\{(\chi, \phi_{M_F}(\chi), \psi_{M_F}(\chi)) : \chi \in B\}$, *where the truth membership and fal-*

sity memberships are represented by $\phi, \psi : B \to [0,1]$ *respectively. Additionally,* $0 \le {\phi_{M_F}}^3(\chi) + {\psi_{M_F}}^3(\chi) \le 1\ \forall \chi \in B$.

Definition 3.2. [22] *The explication of neutrosophic set(single valued)* M_N *over a fixed set* B *is as follows:* $M_N = \{(\chi, \phi_{M_N}(\chi), \eta_{M_N}(\chi), \psi_{M_N}(\chi)) : \chi \in B\}$, *where the truth membership function, indeterminacy function and falsity membership functions are denoted by* $\phi_{M_N}, \eta_{M_N}, \psi_{M_N} : B \to [0,1]$ *respectively,* $0 \le \phi_{M_N} + \eta_{M_N} + \psi_{M_N} \le 3$.

Definition 3.3. [10] *If* B *is any fixed set, then the following defines a pentapartitioned neutrosophic set (abbreviated PNS)* M *over* B. $M = \{(\chi, \phi_M(\chi), \nu_M(\chi), \eta_M(\chi), \zeta_M(\chi), \psi_M(\chi)) : \chi \in B\}$, *where the truth function, contradiction function, ignorance function, unknown function, falsity membership values of each* $\chi \in B$ *are denoted by* $\phi_M(\chi), \nu_M(\chi), \eta_M(\chi), \zeta_M(\chi), \psi_M(\chi)[\in [0,1]]$ *respectively satisfying* $0 \le \phi_M(\chi) + \nu_M(\chi) + \eta_M(\chi) + \zeta_M(\chi) + \psi_M(\chi) \le 5$, *for all* $\chi \in B$.

Definition 3.4. [13] *Let* B *be a fixed set. Then, a pentapartitioned fermatean neutrosophic set (in short PF-NS)* M *over* B *is defined as follows :* $M = \{(\chi, \phi_M(\chi), \nu_M(\chi), \eta_M(\chi), \zeta_M(\chi), \psi_M(\chi) : \chi \in B\}$, *where the truth function, contradiction function, ignorance function, unknown function, falsity membership function values for* $\chi \in B$ *are denoted by* $\phi_M(\chi), \nu_M(\chi), \eta_M(\chi), \zeta_M(\chi), \psi_M(\chi)[\in [0,1]]$ *satisfying* $0 \le \phi_M(\chi) + \nu_M(\chi) + \eta_M(\chi) + \zeta_M(\chi) + \psi_M(\chi) \le 4$, *for all* $\chi \in B$. $0 \le \phi^3_M(\chi) + \psi^3_M(\chi) \le 1, 0 \le \nu^3_M(\chi) + \eta^3_M(\chi) + \zeta^3_M(\chi) \le 3$.

4. Pentapartitioned Fermatean Neutrosophic Soft-Rough Set

Definition 4.1. $\bar{\theta}(A) = \{\phi_{\bar{\theta}(A)}(\chi), \nu_{\bar{\theta}(A)}(\chi), \eta_{\bar{\theta}(A)}(\chi), \zeta_{\bar{\theta}(A)}(\chi), \psi_{\bar{\theta}(A)}(\chi) : \chi \in B\}$,
$\underline{\theta}(A) = \{\phi_{\underline{\theta}(A)}(\chi), \nu_{\underline{\theta}(A)}(\chi), \eta_{\underline{\theta}(A)}(\chi), \zeta_{\underline{\theta}(A)}(\chi), \psi_{\underline{\theta}(A)}(\chi) : \chi \in B\}$,
where, $\phi_{\bar{\theta}(A)}(\chi) = \bigvee_{\sigma \in M}[\phi_{\theta(A)}(\chi, \sigma) \wedge \phi_A(\sigma)]$, $\nu_{\bar{\theta}}(\chi) = \bigvee_{\sigma \in M}[\nu_\theta(A)(\chi, \sigma) \wedge \nu_A(\sigma)]$, $\eta_{\bar{\theta}(A)}(\chi) = \bigwedge_{\sigma \in M}[\eta_{\theta(A)}(\chi, \sigma) \vee \eta_A(\sigma)]$, $\zeta_{\bar{\theta}(A)}(\chi) = \bigwedge_{\sigma \in M}[1 - \zeta_{\theta(A)}(\chi, \sigma) \vee \zeta_A(\sigma)]$, $\psi_{\bar{\theta}(A)}(\chi) = \bigwedge_{\sigma \in M}[\psi_{\theta(A)}(\chi, \sigma) \vee \psi_A(\sigma)]$, $\phi_{\underline{\theta}(A)}(\chi) = \bigwedge_{\sigma \in M}[\psi_{\theta(A)}(\chi, \sigma) \vee \phi_A(\sigma)]$, $\nu_{\underline{\theta}(A)}(\chi) = \bigwedge_{\sigma \in M}[\nu_{\theta(A)}(\chi, \sigma) \vee \nu_A(\sigma)]$, $\eta_{\underline{\theta}(A)}(\chi) = \bigvee_{\sigma \in M}[\eta_{\theta(A)}(\chi, \sigma) \wedge \eta_A(\sigma)]$, $\zeta_{\underline{\theta}(A)}(\chi) = \bigvee_{\sigma \in M}[1 - \zeta_{\theta(A)}(\chi, \sigma) \wedge \zeta_A(\sigma)]$, $\psi_{\underline{\theta}(A)}(\chi) = \bigvee_{\sigma \in M}[\phi_{\theta(A)}(\chi, \sigma) \wedge \psi_A(\sigma)]$, *Satisfying* $0 \le \phi_{\bar{\theta}(A)}(\chi) + \nu_{\bar{\theta}(A)}(\chi) + \eta_{\bar{\theta}(A)}(\chi) + \zeta_{\bar{\theta}(A)}(\chi) + \psi_{\bar{\theta}(A)}(\chi) \le 4$; $0 \le {\phi_{\bar{\theta}(A)}}^3(\chi) + {\psi_{\bar{\theta}(A)}}^3(\chi) \le 1; 0 \le {\nu_{\bar{\theta}(A)}}^3(\chi) + {\eta_{\bar{\theta}(A)}}^3(\chi) + {\zeta_{\bar{\theta}(A)}}^3(\chi) \le 2$. $0 \le \phi_{\underline{\theta}(A)}(\chi) + \nu_{\underline{\theta}(A)}(\chi) + \eta_{\underline{\theta}(A)}(\chi) + \zeta_{\underline{\theta}(A)}(\chi) + \psi_{\underline{\theta}(A)}(\chi) \le 4$; $0 \le {\phi_{\underline{\theta}(A)}}^3(\chi) + {\psi_{\underline{\theta}(A)}}^3(\chi) \le 1$; $0 \le {\nu_{\underline{\theta}(A)}}^3(\chi) + {\eta_{\bar{\theta}(A)}}^3(\chi) + {\zeta_{\bar{\theta}(A)}}^3(\chi) \le 2$. $(\bar{\theta}(A), \underline{\theta}(A))$ *is said to be pentapartitioned fermatean neutrosophic soft-rough set.* $\bar{\theta}$ *is called UPFN-SR operator and* $\underline{\theta}$ *is called LPFN-SR operator. The operators* $\bigvee$ *and* $\bigwedge$ *stands for max or join and*

min or meet operators respectively. Clearly, $\bar{\theta}(A)$ *and* $\underline{\theta}(A)$ *are undoubtedly two PF-NSs over B.*

Definition 4.2. *Pentapartitioned fermatean neutrosophic soft-rough number (in short PFN-SRN) for all* $\chi \in B$ *is defined as follows* $[<\phi_{\bar{\theta}(A)}(\chi), \nu_{\bar{\theta}(A)}(\chi), \eta_{\bar{\theta}(A)}(\chi), \zeta_{\bar{\theta}(A)}(\chi), \psi_{\bar{\theta}(A)}(\chi)>, <\phi_{\underline{\theta}(A)}(\chi), \nu_{\underline{\theta}(A)}(\chi), \eta_{\underline{\theta}(A)}(\chi), \zeta_{\underline{\theta}(A)}(\chi), \psi_{\underline{\theta}(A)}(\chi)>]$.

Definition 4.3. *If B be a fixed set. Then,* 1_{PFN} *and* 0_{PFN} *over B are given below:*

1. $1_{PFN} = \{[(\chi, 1, 1, 0, 0, 0), (\chi, 0, 0, 1, 1, 1)] : \chi \in B\}$;
2. $0_{PFN} = \{[(\chi, 0, 0, 1, 1, 1), (\chi, 1, 1, 0, 0, 0)] : \chi \in B\}$.

Remark 4.1. *Clearly,* $0_{PFN} \subseteq M \subseteq 1_{PFN}$*, for every PF-NS M over B.*

Example 4.1. Suppose that Mr.Rahul wants to choose the most appropriate career out of the set of careers $M = \{\chi_1, \chi_2, \chi_3, \chi_4\}$. N is equal to $\{\sigma_1, \sigma_2, \sigma_3\}$. N is a group of criteria for decisions. As demonstrated below, Mr.Rahul defines a pentapartitoned fermatean neutrosophic soft set (M,N) on B, which is a pentapartitoned fermatean neutrosophic relation in order to characterize the most suitable career from B to M. Let $A = \{(\sigma_1, 0.4, 0.4, 0.2, 0.7, 0.4), (\sigma_2, 0.3, 0.4, 0.4, 0.7, 0.2), (\sigma_3, 0.3, 0.4, 0.3,$

	χ_1	χ_2	χ_3	χ_4
σ_1	(0.2,0.3,0.4,0.6,0.5)	(0.3,0.1,0.3,0.4,0.3)	(0.2,0.1,0.4,0.3,0.4)	(0.4,0.2,0.3,0.3,0.4)
σ_2	(0.2,0.2,0.5,0.5,0.4)	(0.3,0.2,0.3,0.3,0.6)	(0.4,0.1,0.3,0.3,0.4)	(0.5,0.2,0.3,0.3,0.8)
σ_3	(0.3,0.1,0.3,0.6,0.2)	(0.4,0.2,0.5,0.5,0.6)	(0.4,0.1,0.6,0.3,0.4)	(0.5,0.2,0.4,0.3,0.6)

$0.7, 0.3)\}$ Then $\bar{\theta}(A) = \{(\chi_1, 0.3, 0.3, 0.3, 0.7, 0.3), (\chi_2, 0.3, 0.2, 0.3, 0.7, 0.4), (\chi_3, 0.3, 0.1, 0.4, 0.3, 0.4), (\chi_4, 0.4, 0.2, 0.3, 0.3, 0.4)\}$. $\underline{\theta}(A) = \{(\chi_1, 0.3, 0.4, 0.4, 0.5, 0.3), (\chi_2, 0.4, 0.4, 0.3, 0.7, 0.3), (\chi_3, 0.4, 0.4, 0.3, 0.7, 0.3), (\chi_4, 0.4, 0.4, 0.3, 0.7, 0.4)\}$.

Definition 4.4. *If* $(\bar{\theta}(M), \underline{\theta}(M))$ *&* $(\bar{\theta}(N), \underline{\theta}(N))$ *be any two PFN-SRS over B, then* $(\bar{\theta}(M), \underline{\theta}(M)) \subseteq \bar{\theta}(N), \underline{\theta}(N))$ *iff* $\phi_{\bar{\theta}(M)}(\chi) \leq \phi_{\bar{\theta}(N)}(\chi)$, $\nu_{\bar{\theta}(M)}(\chi) \leq \nu_{\bar{\theta}(N)}(\chi), \eta_{\bar{\theta}(M)}(\chi) \geq \eta_{\bar{\theta}(N)}(\chi), \zeta_{\bar{\theta}(M)}(\chi) \geq \zeta_{\bar{\theta}(N)}(\chi)$, $\psi_{\bar{\theta}(M)}(\chi) \geq \psi_{\bar{\theta}(N)}(\chi)$, $\phi_{\underline{\theta}(M)}(\chi) \leq \phi_{\underline{\theta}(N)}(\chi), \nu_{\underline{\theta}(M)}(\chi) \leq \nu_{\underline{\theta}(N)}(\chi), \eta_{\underline{\theta}(M)} \geq \eta_{\underline{\theta}(N)}(\chi), \zeta_{\underline{\theta}(M)}(\chi) \geq \zeta_{\underline{\theta}(N)}(\chi)$, $\psi_{\underline{\theta}(M)}(\chi), \geq \psi_{\underline{\theta}(N)}(\chi)$ *for all* $\chi \in B$.

Example 4.2. Consider two PFN-SRS $(\bar{\theta}(M), \underline{\theta}(M)) = \{[(\chi_1, 0.3, 0.4, 0.5, 0.7, 0.3), (\chi_2, 0.3, 0.6, 0.4, 0.8, 0.4)], [(\chi_1, 0.1, 0.2, 0.5, 0.4, 0.6), (\chi_2, 0.2, 0.2, 0.4, 0.4, 0.5)\}$ and

$(\bar{\theta}(N), \underline{\theta}(N)) = \{[\chi_1, 0.4, 0.7, 0.1, 0.5, 0.2), (\chi_2, 0.8, 0.9, 0.2, 0.1, 0.2)], [(\chi_1, 0.2, 0.3, 0.4, 0.3, 0.5), (\chi_2, 0.3, 0.3, 0.4, 0.3, 0.3)]\}$ over a fixed set $B = \{\chi_1, \chi_2\}$. Then $(\bar{\theta}(M), \underline{\theta}(M)) \subseteq (\bar{\theta}(N), \underline{\theta}(N))$.

Definition 4.5. *Let* $(\bar{\theta}(M), \underline{\theta}(M))$ *&* $(\bar{\theta}(N), \underline{\theta}(N))$ *be any two PFN-SRS over B. Then, the intersection of* $(\bar{\theta}(M), \underline{\theta}(M))$ *and* $(\bar{\theta}(M), \underline{\theta}(M))$ *is* $[\bar{\theta}(M \cap N), \underline{\theta}(M \cap N)] = \{[\phi_{\bar{\theta}(M)}(\chi) \wedge \phi_{\bar{\theta}(N)}(\chi), \nu_{\bar{\theta}(M)}(\chi) \wedge \nu_{\bar{\theta}(N)}(\chi), \eta_{\bar{\theta}(M)}(\chi) \vee \eta_{\bar{\theta}(N)}(\chi), \zeta_{\bar{\theta}(M)}(\chi) \vee \zeta_{\bar{\theta}(N)}(\chi), \psi_{\bar{\theta}(M)}(\chi) \vee \psi_{\bar{\theta}(N)}(\chi)], [\phi_{\underline{\theta}(M)}(\chi) \wedge \phi_{\underline{\theta}(N)}(\chi), \nu_{\underline{\theta}(M)}(\chi) \wedge \nu_{\underline{\theta}(N)}(\chi), \eta_{\underline{\theta}(M)}(\chi) \vee \eta_{\underline{\theta}(N)}(\chi), \zeta_{\underline{\theta}(M)}(\chi) \vee \zeta_{\underline{\theta}(N)}(\chi), \psi_{\underline{\theta}(M)}(\chi) \vee \psi_{\underline{\theta}(N)}(\chi)]/\chi \in B\}$.

Example 4.3. Consider two PFN-SRS $(\bar{\theta}(M), \underline{\theta}(M)) = \{[(\chi_1, 0.4, 0.4, 0.5, 0.6, 0.3), (\chi_2, 0.2, 0.6, 0.3, 0.8, 0.4)], [(\chi_1, 0.1, 0.3, 0.5, 0.1, 0.6), (\chi_2, 0.2, 0.2, 0.2, 0.4, 0.1)]\}$ and $(\bar{\theta}(N), \underline{\theta}(N)) = \{[(\chi_1, 0.4, 0.4, 0.1, 0.4, 0.2), (\chi_2, 0.7, 0.5, 0.2, 0.1, 0.2)], [(\chi_1, 0.1, 0.3, 0.4, 0.3, 0.4), (\chi_2, 0.2, 0.3, 0.2, 0.3, 0.3)]\}$ over a fixed set $B = \{\chi_1, \chi_2\}$. Then $(\bar{\theta}(M), \underline{\theta}(M)) \cap (\bar{\theta}(N), \underline{\theta}(N)) = \{[(\chi_1, 0.4, 0.4, 0.5, 0.6, 0.3), (\chi_2, 0.2, 0.5, 0.3, 0.8, 0.4)], [(\chi_1, 0.1, 0.3, 0.5, 0.3, 0.6)(\chi_2, 0.2, 0.2, 0.2, 0.4, 0.3)]\}$

Definition 4.6. *Let* $(\bar{\theta}(M), \underline{\theta}(M))$ *&* $(\bar{\theta}(N), \underline{\theta}(N))$ *be any two PFN-SRS over B. Then, the union of M and N is* $[\bar{\theta}(M \cup N), \underline{\theta}(M \cup N)] = \{[\phi_{\bar{\theta}(M)}(\chi) \vee \phi_{\bar{\theta}(N)}(\chi), \nu_{\bar{\theta}(M)}(\chi) \vee \nu_{\bar{\theta}(N)}(\chi), \eta_{\bar{\theta}(M)}(\chi) \wedge \eta_{\bar{\theta}(N)}(\chi), \zeta_{\bar{\theta}(M)}(\chi) \wedge \zeta_{\bar{\theta}(N)}(\chi), \psi_{\bar{\theta}(M)}(\chi) \wedge \psi_{\bar{\theta}(N)}(\chi)], [\phi_{\underline{\theta}(M)}(\chi) \vee \phi_{\underline{\theta}(N)}(\chi), \eta_{\underline{\theta}(M)}(\chi) \wedge \eta_{\underline{\theta}(N)}(\chi), \zeta_{\underline{\theta}(M)}(\chi) \wedge \zeta_{\underline{\theta}(N)}(\chi), \psi_{\underline{\theta}(M)}(\chi) \wedge \psi_{\underline{\theta}(N)}(\chi)]/\chi \in B\}$.

Example 4.4. Consider two PFN-SRS $(\bar{\theta}(M), \underline{\theta}(M)) = \{[(\chi_1, 0.2, 0.2, 0.5, 0.6, 0.3), (\chi_2, 0.2, 0.6, 0.3, 0.8, 0.4)], [(\chi_1, 0.1, 0.3, 0.5, 0.1, 0.6), (\chi_2, 0.2, 0.2, 0.2, 0.4, 0.1)]\}$ and $(\bar{\theta}(N), \underline{\theta}(N)) = \{[\chi_1, 0.4, 0.4, 0.1, 0.4, 0.2), (\chi_2, 0.7, 0.5, 0.2, 0.1, 0.2)], [(\chi_1, 0.1, 0.3, 0.4, 0.3, 0.4), (\chi_2, 0.2, 0.3, 0.2, 0.3, 0.3)]\}$ over a fixed set $B = \{\chi_1, \chi_2\}$. Then, $(\bar{\theta}(M), \underline{\theta}(M)) \cup (\bar{\theta}(N), \underline{\theta}(N)) = \{[(\chi_1, 0.4, 0.4, 0.1, 0.4, 0.2), (\chi_2, 0.7, 0.6, 0.2, 0.1, 0.2)], [(\chi_1, 0.1, 0.3, 0.4, 0.1, 0.4), (\chi_2, 0.2, 0.3, 0.2, 0.3, 0.1)\}$.

Definition 4.6. *Let* $(\bar{\theta}(M), \underline{\theta}(M))$ *&* $(\bar{\theta}(N), \underline{\theta}(N))$ *be two PFN-SRS over B. Then the complement of M,* $M^C = (\bar{\theta}(M^C), \underline{\theta}(M^C)) = \{[\psi_{\bar{\theta}(M)}(\chi), \nu_{\bar{\theta}(M)}(\chi), 1 - \eta_{\bar{\theta}(M)}(\chi), \zeta_{\bar{\theta}(M)}(\chi), \phi_{\bar{\theta}(M)}(\chi)], [\psi_{\underline{\theta}(M)}(\chi), \nu_{\underline{\theta}(A)}(\chi), 1 - \eta_{\underline{\theta}(M)}(\chi), \zeta_{\underline{\theta}(M)}(\chi), \phi_{\underline{\theta}(M)}(\chi)]\chi \in B\}$.

Example 4.5. Consider two PFN-SRS $(\bar{\theta}(M), \underline{\theta}(M)) = \{[(\chi_1, 0.2, 0.2, 0.5, 0.6, 0.3), (\chi_2, 0.2, 0.6, 0.3, 0.8, 0.4)], [(\chi_1, 0.1, 0.3, 0.5, 0.1, 0.6), (\chi_2, 0.2, 0.2, 0.2, 0.4, 0.1)]\}$ and $(\bar{\theta}N), \underline{\theta}(N)) = \{[\chi_1, 0.4, 0.4, 0.1, 0.4, 0.2), (\chi_2, 0.7, 0.5, 0.2, 0.1, 0.2)], [(\chi_1, 0.1, 0.3, 0.4, 0.3, 0.4), (\chi_2, 0.2, 0.3, 0.2, 0.3, 0.3)]\}$ over a fixed set $B = \{\chi_1, \chi_2\}$. Then $(\bar{\theta}(M), \underline{\theta}(M)) \cup (\bar{\theta}(N), \underline{\theta}(N)) = \{[(\chi_1, 0.4, 0.4, 0.1, 0.4, 0.2), (\chi_2, 0.7, 0.6, 0.2, 0.1, 0.2)], [(\chi_1, 0.1, 0.3, 0.4, 0.1, 0.4), (\chi_2, 0.2, 0.3, 0.2, 0.3, 0.1)]\}$.

5. An Application of PFN-SRS Using ANMABA Method in Decision Making

In this part, we introduce a new method namely ANMABA method for Pentapartitioned fermatean neutrosophic soft-rough set which is useful in decision-making problems.

Definition 5.1. *Score function for* $PFN-SRS$ = {*Upper Single valued PFN-SRS + Lower Single valued PFN-SRS*} /2
where, Upper Single valued $PFN-SRS = \phi_{\bar{\theta}(A)}(\chi) + \nu_{\bar{\theta}(A)}(\chi) + (1 - \eta_{\bar{\theta}(A)}(\chi)) + \zeta_{\bar{\theta}(A)}(\chi) + \psi_{\bar{\theta}(A)}(\chi)$
Lower Single valued PFN-SRS $= \phi_{\underline{\theta}(A)}(\chi) + \nu_{\underline{\theta}(A)}(\chi) + (1 - \eta_{\underline{\theta}(A)}(\chi)) + \zeta_{\underline{\theta}(A)}(\chi) + \psi_{\underline{\theta}(A)}(\chi)$.

ANMABA Algorithm:
Using PFN-SRS:
Step-1 : Define relevant attributes for each factor.
Step-2 : Assign membership grades to each attribute based on the defined factors.
Step-3 : Calculate the PFN-SRS values based on the membership grades of the attributes.
Step-4 : Using score function for PFN-SRS, find PFN-SRS value.
Step-5 : Take decision based on PFN-SRS value.

Example 5.1. We consider a scenario in which a university admissions committee is tasked with selecting the most suitable candidates from a pool of applicants. They consider various factors such as academic performance, extracurricular activities, letters of recommendation and entrance exam scores. We define relevant attributes for each factor to identify the suitable candidate such as:

Factor	**Attribute-1**	**Attribute-2**
Academic performance (σ_1)	CGPA	Scores on standardized test
Non scholastic activity (σ_2)	Position of leadership	Community work
Entrance exam scores(σ_3)	Numerical Eligibility	Logical Reasoning

The committee assigns membership grades to each attribute based on the eligibility factor and calculates the PFN-SRS values for each applicant based on the membership grades of the attributes. The applicants are ranked based on their PFN-SRS values, with the highest-ranked applicants being considered for admission.

Applicant	σ_1	σ_2	σ_3
Λ_1	(0.2,0.2,0.4,0.6,0.5)	(0.2,0.1,0.5,0.5,0.4)	(0.3,0.2,0.3,0.6,0.2)
Λ_2	(0.3,0.1,0.3,0.4,0.3)	(0.3,0.2,0.3,0.3,0.6)	(0.4,0.2,0.5,0.5,0.6)
Λ_3	(0.2,0.1,0.4,0.3,0.4)	(0.4,0.1,0.3,0.3,0.4)	(0.4,0.1,0.6,0.3,0.4)
Λ_4	(0.2,0.3,0.4,0.6,0.5)	(0.2,0.2,0.5,0.5,0.4)	(0.3,0.1,0.3,0.6,0.2)

Let $X = \{(\sigma_1, 0.4, 0.4, 0.2, 0.7, 0.4), (\sigma_2, 0.3, 0.4, 0.4, 0.7, 0.2), (\sigma_3, 0.3, 0.4, 0.3, 0.7, 0.3)\}$ Then $\bar{\theta}(X) = \{(\Lambda_1, 0.3, 0.3, 0.3, 0.7, 0.3), (\Lambda_2, 0.3, 0.2, 0.3, 0.7, 0.4), (\Lambda_3, 0.3, 0.1, 0.4, 0.3, 0.4), (\Lambda_4, 0.4, 0.2, 0.3, 0.3, 0.4)\}$, $\underline{\theta}(X) = \{(\Lambda_1, 0.3, 0.4, 0.4, 0.5, 0.3), (\Lambda_2, 0.4, 0.4, 0.3, 0.7, 0.3), (\Lambda_3, 0.4, 0.4, 0.3, 0.7, 0.3), (\Lambda_4, 0.4, 0.4, 0.3, 0.7, 0.4)\}$. We find the PFN-SRS value by using definition 4.1.

Applicant	Λ_1	Λ_2	Λ_3	Λ_4
PFN-SRS value	0.4	0.3	0.4	0.5

Based on the PFN-SRS values, Applicant Λ_4 is considered the most suitable candidate for admission, followed by Applicant Λ_1 & Λ_3 and then Applicant Λ_2.

Advantages of using PFN-SRS in this scenario:

1. PFN-SRS can handle uncertainty and imprecision in the evaluation process, such as when applicants have conflicting strengths and weaknesses.

2. PFN-SRS can consider multiple factors simultaneously, providing a more comprehensive assessment of each applicant.

3. PFN-SRS can provide a quantitative ranking of applicants, making it easier to compare candidates and make selection decisions.

By incorporating PFN-SRS into the admissions process, universities can make more informed and objective decisions.

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