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S-Norm Normal Fuzzy Soft Additive Near-Ring

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Abstract: In this paper, we study (m,n) – S- fuzzy soft subgroup structure under suitable norm . By using a s-norm S, we characterize some basic properties of relational aspect has been investigated. Also, we define relational concept of normal (m,n) – S- fuzzy soft subgroup structure with suitable example.

Keywords: S-norm, fuzzy subset, relation, (m,n) - S-fuzzy subgroups, max norm, normal, near-ring , union, intersection,

I. INTRODUCTION

Molodtsov [7] introduced the concept of soft set theory and started to develop the basics of the corresponding theory as a new approach for modeling uncertainties. A soft set can be considered as an approximate description of an object. Soft set theory has a rich potential for applications in several directions.

At present, works on soft set theory and its applications are progressing rapidly. Rosenfeld [9] introduced the idea of fuzzy groups on 1971. Maji et al.[6] presented some new definitions on soft sets. Pei et al.[8] discussed the relationship between soft sets and information systems. In 2001, Maji et al.[5] combined the fuzzy set and soft set models and introduced the concept of fuzzy soft set. To continue the investigation on fuzzy soft sets, Ahmad and Khara [2] presented some more properties of them. Fuzzy set theory was first proposed by [10]. In this paper, we study (m,n) – S- fuzzy soft subgroup structure under suitable norm . By using a s-norm S, we characterize some basic properties of relational aspect has been investigated. Also, we define relational concept of normal (m,n) – S- fuzzy soft subgroup structure with suitable example.

II. BASIC DEFINITIONS AND PRELIMINARIES

In this section, we will analyze the elementary concepts and its basic properties.

Let R_1, R_2 be two arbitrary near-rings with addition operators. A fuzzy subset of $R_1 \times R_2$, we mean s function from $R_1 \times R_2$ into $[0,1]$. The set of all fuzzy subsets of $R_1 \times R_2$ is called the $[0,1]^m$ – power set of $R_1 \times R_2$ and is denoted by $[0,1]^{R_1 \times R_2}$.

A. Definition 2.1

By an s-norm S, we mean a function $S: [0,1] \times [0,1] \rightarrow [0,1]$ satisfying the following axioms

(S1) $S(x, 0) = x$

(S2) $S(x,y) \leq S(y,z)$ if $y \leq z$

(S3) $S(x,y) = S(y,x)$

(S4) $S(x, S(y,z)) = S(S(x,y), z)$, for all $x,y,z \in [0,1]$. Suppose s-norm S is idempotent if $S(x,x) = x$, for all $x \in [0,1]$.

B. Proposition 2.2

For an s-norm, then the following statement holds $S(x,y) \geq \max\{x,y\}$, for all $x,y \in [0,1]$.

C. Definition 2.3

Let A be a fuzzy soft set of a group $R_1 \times R_2$. Then A is (m,n) - S- norm fuzzy soft subring if for all $(a,b), (c,d) \in R_1 \times R_2$,

1) $A((a,b)^m + (c,d)^n) \leq \max\{A(a,b)^m, A(c,d)^n\}$

2) $A((a,b)^{-m}) = A(a,b)^m$.

Usually the set of all (m,n) –S- fuzzy soft sub rings of $R_1 \times R$ is denoted by MNSFR.

D. Example 2.4

Let $Z_2 = \{0,1\}$, $Z_3 = \{0,1,2\}$ be two additive rings. Then

$Z_2 \times Z_3 = \{(0,0), (0,1), (0,2), (1,0), (1,1), (1,2)\}$. Define a fuzzy soft set A in $Z_2 \times Z_3$ by

$A(0,0)^m$	0.2
$A(1,0)^m$	0.7
$A(0,2)^m = A(0,1)^m$	0.3
$A(1,1)^m = A(1,2)^m$	0.6

If $S(x, y) = \min \{ 0, x + y - 1 \}$, for all $(x, y) \in Z_2 \times Z_3$, then $A \in \text{MNSFR} (Z_2 \times Z_3)$.

E. Definition 2.5

Let $A_1, A_2 \in \text{MNSFR} (Z_2 \times Z_3)$ and $(a,b) \in R_1 \times R_2$. We define

- (i) $A_1 \subseteq A_2$ if and only if $A_1(a, b) \geq A_2(a,b)$
- (ii) $A_1 = A_2$ if and only if $A_1(a,b) = A_2(a,b)$.
- (iii) $(A_1 \cup A_2)(a, b) = S \{ A_1(a,b), A_2(a,b) \}$.

Also we have $A_1 \cup A_2 = A_2 \cup A_1$ and associative laws are holds by using (S3) and (S4) of definition 2.1.

F. Lemma 2.6

Let S be a s-norm. Then $S(S(a,b), S(w,c)) = S(S(a,w), S(b,c))$, for all $a,b,w,c \in [0,1]$.

G. Proposition 2.7

Let $A_1, A_2 \in \text{MNSFR} (R_1 \times R_2)$. Then $A_1 \cup A_2 \in \text{MNSFR} (R_1 \times R_2)$.

Proof: Let $(a,b), (c,d) \in R_1 \times R_2$.

$$\begin{aligned} (A_1 \cup A_2)((a,b)^m + (c,d)^n) &= S(A_1((a,b)^m + (c,d)^n), A_2((a,b)^m + (c,d)^n)) \\ &\leq S(S(A_1((a,b)^m), A_1((c,d)^n)), S(A_2((a,b)^m), A_2((c,d)^n))) \\ &= S(S(A_1((a,b)^m), A_2((a,b)^m)), S(A_1((c,d)^n), A_2((c,d)^n))) \\ &= S((A_1 \cup A_2)(a,b), (A_1 \cup A_2)(c,d)). \end{aligned}$$

Also

$$\begin{aligned} (A_1 \cup A_2)(a, b)^{-m} &= S(A_1(a, b)^{-m}, A_2(a,b)^{-m}) \\ &\leq S(A_1(a, b), A_2(a,b)) \\ &= (A_1 \cup A_2)(a,b). \end{aligned}$$

Therefore union of MNSFR is also MNSFR.

H. Corollary 2.8

Let $J_n = \{ 1,2,3 \dots \dots n \}$. If $\{ A_i / i \in J_n \} \subseteq \text{MNSFR} (R_1 \times R_2)$. Then

$$A = \bigcup_{i \in J_n} A_i \in \text{MNSFR} (R_1 \times R_2).$$

I. Example 2.9

$Z_3 = \{ 0,1,2 \}$ be two additive rings. Then

$Z_3 \times Z_3 = \{ (0,0), (0,1), (0,2), (1,0), (1,1), (1,2), (2,0), (2,1), (2,2) \}$. Define a fuzzy soft set A_1, A_2 in $Z_3 \times Z_3$ by

$A(0,0)^m = 0.1$	$A(0,0)^n = 0.9$
$A(1,0)^m = 0.5$	$A(1,0)^n = 0.8$
$A(0,2)^m = 0.7$	$A(0,2)^n = 0.2$
$A(1,0)^m = 0.4$	$A(1,0)^n = 0.6$
$A(2,0)^m = 0.9$	$A(2,0)^n = 0.4$
$A(1,1)^m = 0.4$	$A(1,1)^n = 0.6$
$A(2,2)^m = 0.7$	$A(2,2)^n = 0.2$
$A(2,1)^m = 0.5$	$A(2,1)^n = 0.6$
$A(1,2)^m = 0.6$	$A(1,2)^n = 0.5$

respectively. If $S(a,b) = \min \{ 0, a + b - 1 \}$, for all $(a,b) \in Z_3 \times Z_3$, then $A_1, A_2, A_1 \cup A_2 \in \text{MNSFR} (R_1 \times R_2)$.

III. NORMAL (M,N) –S-FUZZY SUBNEAR-RINGS.

- 1) *Definition 3.1:* Let $A \in \text{MNSFR}(R_1 \times R_2)$. Then A is called (m,n) - S -fuzzy soft normal subgroup of $R_1 \times R_2$ if for all $(a,b), (c,d) \in R_1 \times R_2, A((a,b)^m (c,d)^n (a,b)^{-m}) = A(c,d)^n$.
- 2) *Note 3.2:* The set of all (m,n) - S -fuzzy soft normal subgroup of $R_1 \times R_2$ is represented as $\text{NMNSFR}(R_1 \times R_2)$.
- 3) *Proposition 3.3:* Let $A \in \text{NMNSFR}(R_1 \times R_2)$ and $H_1 \times H_2$ be a near-ring. Suppose that ϕ is an epimorphism of $R_1 \times R_2$ onto $H_1 \times H_2$. Then $\phi(A) \in \text{NMNSFR}(R_1 \times R_2)$.
- 4) *Proposition 3.4:* Let $H_1 \times H_2$ be a near-ring and $\alpha \in \text{NMNSFR}(R_1 \times R_2)$. Suppose that ϕ is a homomorphism of $R_1 \times R_2$ into $H_1 \times H_2$. Then $\phi^{-1}(\alpha) \in \text{NMNSFR}(R_1 \times R_2)$.
- 5) *Proposition 3.5:* Let $A_1, A_2 \in \text{NMNSFR}(R_1 \times R_2)$. Then $A_1 \cup A_2 \in \text{NMNSFR}(R_1 \times R_2)$.
- 6) *Corollary 3.6:* Let $J_n = \{1, 2, 3, \dots, n\}$. If $\{A_i / i \in J_n\} \subseteq \text{NMNSFR}(R_1 \times R_2)$. Then $A = \bigcup_{i \in J_n} A_i \in \text{NMNSFR}(R_1 \times R_2)$.
- 7) *Example 3.7:* Let $Z_2 = \{0, 1\}, Z_3 = \{0, 1, 2\}$ be two additive rings. Then $Z_2 \times Z_3 = \{(0,0), (0,1), (0,2), (1,0), (1,1), (1,2)\}$. Define a fuzzy soft set A in $Z_2 \times Z_3$ by

A_1	$A_1(0,0)^m = A_1(0,1)^m = A_1(0,2)^m = A_1(1,0)^m = A_1(1,1)^m = A_1(1,2)^m = 0.723$
A_2	$A_2(0,0)^m = A_2(0,1)^m = A_2(0,2)^m = A_2(1,0)^m = A_2(1,1)^m = A_2(1,2)^m = 0.5$

IV. CONCLUSION

we study (m,n) – S - fuzzy soft subgroup structure under suitable norm . By using a s -norm S , we characterize some basic properties of relational aspect has been investigated. Also, we define relational concept of normal (m,n) – S - fuzzy soft subgroup structure with suitable example. One can obtain the similar results using soft G -modules and Neutrosophic soft near-rings.

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