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EQUALITY OF THREE TRIANGULAR FUZZY SETS

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Abstract: Ranking fuzzy number is an important aspect of decision making in fuzzy environment. In this paper, we compare three triangular fuzzy sets and discuss their equalities.

Keyword: Fuzzy numbers, triangular fuzzy number, ranking fuzzy numbers

1. Introduction

1.1 Fuzzy Logic

Fuzzy logic is a form in which it deals with an unclear situation. In general it is not connected with fixed or exact value but it deals with approximate value. In real life all the real numbers are compared using inequalities i.e., greater than or equal to and less than or equal to. In case of fuzzy numbers these inequalities are not possible because it deals with possibilities. Ranking fuzzy numbers plays a major role in ordering fuzzy numbers. This ordering of fuzzy numbers is done using ranking function $\mathbf{R}$: F(R) → R, where F(R) is the set of fuzzy numbers on the real line.

1.2 Fuzzy Numbers

A fuzzy set A defined on the set of real numbers R is said to fuzzy number if its membership function μ_A:R→ [0,1] has the following characteristics

i) A is normal i.e., there exist an x ∈R such that $\mu_A(x) = 1$

ii) A is convex i.e., for every $x_1, x_2 \in R$, $\mu_A(\lambda x_1 + (1-\lambda) x_2) \geq \min\{ \mu_A(x_1), \mu_A(x_2)\}$, $\lambda \in [0,1]$

iii) μ_A is upper semi-continuous.

iv) Supp (A) is bounded in R

2. Triangular Fuzzy Number

A fuzzy number A in R is said to be triangular if its membership function has the following characteristics

$$\mu_A = \begin{cases} \frac{x - a_1}{a_2 - a_1}, & a_1 \leq x \leq a_2 \\ 1, & x = a_2 \\ \frac{a_3 - x}{a_3 - a_2}, & a_2 \leq x \leq a_3 \\ 0, & \text{otherwise} \end{cases}$$

2.1. Ranking of Triangular Fuzzy Number

There are so many ideas regarding ranking of fuzzy numbers in the literature. An effective result for comparing the fuzzy numbers is by using ranking function based on their grade means. That is, for every A= (a,b,c) ∈ F(R),the ranking function $\mathbf{R}$:F(R)→R by graded mean is defined as

$$\mathbf{R}(A) = \frac{a + 4b + c}{6}$$

Remark

If A = (a, b, c) is a triangular fuzzy numbers then

i) $\mathbf{R}(A) = \frac{a + 4b + c}{6}$

ii) mod (A) = b

iii) div (A) = c-a

Preposition :

Let A= (a_1, b_1, c_1), B = (a_2, b_2, c_2) and C=(a_3,b_3,c_3) be three triangular fuzzy numbers such that $\mathbf{R}(A) = \mathbf{R}(B) = \mathbf{R}(C)$, mod(A)=mod(B)=mod(C) and div (A)=div(B)=div(C) then A=B=C

ie., $a_1 = a_2 = a_3$, $b_1 = b_2 = b_3$, $c_1 = c_2 = c_3$

Proof

i) $\mathbf{R}$ (A) = $\mathbf{R}$ (B) = $\mathbf{R}$ (C)

i.e., $\frac{a_1 + 4b_1 + c_1}{6} = \frac{a_2 + 4b_2 + c_2}{6} = \frac{a_3 + 4b_3 + c_3}{6}$ (1)

i.e., $a_1 + 4b_1 + c_1 = a_2 + 4b_2 + c_2 = a_3 + 4b_3 + c_3$

ii) mod(A) = mod(B) = mod(C)

i.e., $b_1 = b_2 = b_3$ (2)

iii) div(A) = div(B) = div(C)

i.e., $c_1 - a_1 = c_2 - a_2 = c_3 - a_3$ (3)

Solving (1), (2) and (3) , we get

$a_1 = a_2 = a_3$, $b_1 = b2 = b3$, $c_1 = c_2 = c_3$

Hence, A=B=C

3. Dominated Index

The Dominated index of proposition A = (α, β, γ) is dominated over B = $(\alpha_1, \beta_1, \gamma_1)$ is given by DI(A<B) = $\frac{\beta_1 - \beta}{\gamma + \alpha_1}$. Using dominated index the following ranking order is defined.

(i). If DI(A<B) ≥ 1, then A is said to be totally dominating over B in the sense of minimization and B is said to be totally dominating over A in the sense of maximization, it is also denoted by A < B.

(ii). If 0 < DI(A<B) < 1, then A is said to be partially dominating over B in the sense of minimization and B is said to be partially dominating over A in the sense of maximization, it is also denoted by A < B.

4. Numerical example

Let us consider the two sets A = (7,3,11), B = (1,5,4) .

DI (A < B) = $\frac{5-3}{11+1} = \frac{2}{12} = 0.17$.

Here A is said to be partially dominating over B in the sense of minimization and B is said to be partially dominating over A in the sense of maximization.

5. Conclusion

The three triangular fuzzy numbers are compared and their equalities are discussed. Also, the numerical example is given.

6. References

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