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Fuzzy Parameterized Generalised Fuzzy Soft Expert Set

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ABSTRACT
In this paper, we introduce the model of fuzzy parameterized generalised fuzzy soft expert set as a generalization of fuzzy soft expert set by giving a membership value for each parameter in a set of parameters with generalised membership value. Finally, We define its basic operations, complement, intersection, union, ”AND” and ”OR” and study their properties.

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INTRODUCTION

A large amount of the problems in economics, engineering, environment and medical science etc, have different uncertainties. Lotfi A. Zadeh (1965) introduce the concept of fuzzy set theory is a form of multi valued logic tool for dealing with such uncertainties. Molodtsov (1999) initiated the theory of the soft set as a mathematical tool for dealing with such uncertainties. After Molodtsov’s work, Maji (2001) have introduced the theory of fuzzy soft set, as a more universal concept, and as a grouping of fuzzy set and soft set where they studied its properties. Also Roy and Maji (2007) used this theory to resolve some real time decision making problems.

Further, C¸aˇgman, (2010) introduced the concept of fuzzy parameterized fuzzy soft set and their operations. As well as fuzzy parameterized fuzzy soft set aggregation operator to form fuzzy parameterized fuzzy soft set decision making method which allows constructing more efficient decision processes. Alkhazaleh and Salleh (2011) introduced the concept of soft expert set and fuzzy soft expert set, where the user can know the opinion of all experts in one model without any operations. Majumdar & Samanta (11) has introduced the notion of generalised fuzzy soft sets and have applied this set in decision making. Hazaymeh (2012) introduced the theory of Fuzzy Parameterized Fuzzy Soft Expert Set, It is a combination of fuzzy soft expert set and fuzzy parameterized fuzzy soft expert.

In this paper, we shall introduce the concept of fuzzy parameterized generalised fuzzy soft expert set, which is more effective and useful as we shall see. It is a combination of fuzzy soft expert set, generalised fuzzy soft expert and fuzzy parameterized fuzzy soft expert. Finally, we shall also define its basic operations, namely complement, union, intersection, and study their properties.

1. *Preliminaries:*

Let U be a universe, E a set of parameters and X be a set of experts. Let O be a set of opinions, $Z = E \, x \, X \, x \, O$ and $A \subseteq Z$.

2.1. Definition:

A Pair (F, A) is called a soft expert set over U, where F is a mapping $F: A \to P(U)$ and P(U) denotes the power set of U.

2.2. Definition:

A Pair (F, A) is called a fuzzy soft expert set over U, where F is a mapping $F: A \to I^U$ and I^U denotes all fuzzy subsets of U.

2.3. Definition:

The complement of a fuzzy soft expert set (F, A) is denoted by $(F, A)^C$ and is defined by $(F, A) = (F^c, ⅂A)$ where $F^c : ⅂A \to I^U$ is a mapping given by $F^c(\alpha) = c\,(F(⅂\alpha))$, $\forall \alpha \epsilon ⅂A$, Where c is a fuzzy complement .

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2.4. Definition:

The union of two fuzzy soft expert sets (F,A) and (G,B) over U denoted by $(F,A)\tilde{U}(G,B)$ is a fuzzy soft expert set (H,C) such that $C = A \cup B$ and $\forall \varepsilon \in C$

$$H(\varepsilon) = \begin{cases} F(\varepsilon)\ if\ \varepsilon \in A - B \\ G(\varepsilon)\ if\ \varepsilon \in B - A \\ s(F(\varepsilon), G(\varepsilon))\ if\ \varepsilon \in A \cap B \end{cases}$$

Where s is an s-norm.

2.5. Definition:

The intersection of two fuzzy soft expert sets (F,A) and (G,B) over U denoted by $(F,A)\tilde{\cap}(G,B)$ is a fuzzy soft expert set (H,C) such that $C = AUB$ and $\forall \varepsilon \in C$

$$H(\varepsilon) = \begin{cases} F(\varepsilon)\ if\ \varepsilon \in A - B \\ G(\varepsilon)\ if\ \varepsilon \in B - A \\ t(F(\varepsilon), G(\varepsilon))\ if\ \varepsilon \in A \cap B \end{cases}$$

where t is a t-norm.

2.6. Definition:

If (F,A) and (G,B) are two fuzzy soft expert sets, then $(F,A)AND(G,B)$, denoted by $(F,A)\wedge(G,B)$ is defined by

$(F,A)\wedge(G,B) = (H, A \times B)$

Where $H(\alpha,\beta)=F(\propto)\tilde{\cap}G(\beta)$, for all $(\propto,\beta) \in A\times B$.

2.7. Definition:

If (F,A) and (G,B) are two fuzzy soft expert sets, then $(F,A)OR(G,B)$, denoted by $(F,A)\vee(G,B)$ is defined by

$(F,A)\wedge(G,B) = (H, A \times B)$

Where $H(\alpha,\beta)=F(\propto)\tilde{\cup}G(\beta)$, for all $(\propto,\beta) \in A\times B$.

2. ***Fuzzy Parameterised generalized fuzzy soft expert set (FPGFSES):***

Let U be a universe, E be a set of parameters, I^E denotes all fuzzy subsets of E and X be a set of experts. Let O={0 = disagree, 1 = agree} be a set of opinions, $Z = \Psi\ x\ X\ x\ O$ and $A \subseteq Z$, Where $\Psi \subset I^E$, $\mu: Z \to I = [0,1]$

3.1. Definition:

A Pair (F_ψ, A) is called a Fuzzy Parameterized Generalized Fuzzy Soft Expert Set (FPGFSES in short) over U, where F_ψ is a mapping given by $F_\psi: A \to I^U\ x\ I$, where I^U denotes the collection of all fuzzy subset of U.

Here for each parameter indicates not only the degree of belongingness of the elements but also the degree of possibility of such belongingness.

Example 1: Let $U = \{u_1, u_2, u_3, u_4\}$ be a set of universe and let $E = \{e_1, e_2, e_3\}$ a set of parameters. Let $\Psi = \left\{\frac{e_1}{0.5}, \frac{e_2}{0.7}, \frac{e_3}{0.9}\right\}$ be a fuzzy subset of I^E and $X = \{m, n, r\}$ be a set of experts. Let $Z = \Psi\ x\ X\ x\ O$ and $A \subseteq Z$, Where $\Psi \subset I^E$, $\mu: Z \to I = [0,1]$

Define a function, $F_\psi: A \to I^U\ x\ I$ as follows

$$F_\psi\left(\frac{e_1}{0.5}, \mathrm{m}, 1\right) = \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.3}, \frac{u_3}{0.2}, \frac{u_4}{0.4}\right\}, 0.2\right)\ F_\psi\left(\frac{e_1}{0.5}, \mathrm{n}, 1\right) = \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.4}, \frac{u_3}{0.1}, \frac{u_4}{0.3}\right\}, 0.1\right)$$
$$F_\psi\left(\frac{e_1}{0.5}, \mathrm{r}, 1\right) = \left(\left\{\frac{u_1}{0.1}, \frac{u_2}{0.3}, \frac{u_3}{0.8}, \frac{u_4}{0.7}\right\}, 0.2\right)\ F_\psi\left(\frac{e_2}{0.7}, \mathrm{m}, 1\right) = \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.3}, \frac{u_3}{0.2}, \frac{u_4}{0.7}\right\}, 0.4\right)$$
$$F_\psi\left(\frac{e_2}{0.7}, \mathrm{n}, 1\right) = \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.8}, \frac{u_3}{0.6}, \frac{u_4}{0.4}\right\}, 0.2\right)\ F_\psi\left(\frac{e_2}{0.7}, \mathrm{r}, 1\right) = \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.7}\right\}, 0.3\right)$$
$$F_\psi\left(\frac{e_3}{0.9}, \mathrm{m}, 1\right) = \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.6}, \frac{u_3}{0.8}, \frac{u_4}{0.9}\right\}, 0.6\right)\ F_\psi\left(\frac{e_3}{0.9}, \mathrm{n}, 1\right) = \left(\left\{\frac{u_1}{0.2}, \frac{u_2}{0.3}, \frac{u_3}{0.7}, \frac{u_4}{0.6}\right\}, 0.5\right)$$
$$F_\psi\left(\frac{e_3}{0.9}, \mathrm{r}, 1\right) = \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.4}, \frac{u_3}{0.6}, \frac{u_4}{0.3}\right\}, 0.8\right)\ F_\psi\left(\frac{e_1}{0.5}, \mathrm{m}, 0\right) = \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.6}, \frac{u_3}{0.7}, \frac{u_4}{0.6}\right\}, 0.7\right)$$
$$F_\psi\left(\frac{e_1}{0.5}, \mathrm{n}, 0\right) = \left(\left\{\frac{u_1}{0.2}, \frac{u_2}{0.7}, \frac{u_3}{0.8}, \frac{u_4}{0.7}\right\}, 0.9\right)\ F_\psi\left(\frac{e_1}{0.5}, \mathrm{r}, 0\right) = \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.8}, \frac{u_3}{0.4}, \frac{u_4}{0.5}\right\}, 0.6\right)$$
$$F_\psi\left(\frac{e_2}{0.7}, \mathrm{m}, 0\right) = \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.6}, \frac{u_3}{0.8}, \frac{u_4}{0.3}\right\}, 0.6\right)\ F_\psi\left(\frac{e_2}{0.7}, \mathrm{n}, 0\right) = \left(\left\{\frac{u_1}{0.2}, \frac{u_2}{0.4}, \frac{u_3}{0.5}, \frac{u_4}{0.7}\right\}, 0.7\right)$$
$$F_\psi\left(\frac{e_2}{0.7}, \mathrm{r}, 0\right) = \left(\left\{\frac{u_1}{0.4}, \frac{u_2}{0.6}, \frac{u_3}{0.5}, \frac{u_4}{0.3}\right\}, 0.4\right)\ F_\psi\left(\frac{e_3}{0.9}, \mathrm{m}, 0\right) = \left(\left\{\frac{u_1}{0.8}, \frac{u_2}{0.4}, \frac{u_3}{0.3}, \frac{u_4}{0.1}\right\}, 0.3\right)$$
$$F_\psi\left(\frac{e_3}{0.9}, \mathrm{n}, 0\right) = \left(\left\{\frac{u_1}{0.9}, \frac{u_2}{0.6}, \frac{u_3}{0.8}, \frac{u_4}{0.3}\right\}, 0.6\right)\ F_\psi\left(\frac{e_3}{0.9}, \mathrm{r}, 0\right) = \left(\left\{\frac{u_1}{0.8}, \frac{u_2}{0.5}, \frac{u_3}{0.4}, \frac{u_4}{0.6}\right\}, 0.5\right)$$

Then we can find the Fuzzy parameterized generalized fuzzy soft expert sets (F_ψ, Z) as consisting of the following collections of approximations

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$$(F_\psi, Z) = \left\{\begin{array}{c}
\left(\left(\frac{e_1}{0.5}, m, 1\right), \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.3}, \frac{u_3}{0.2}, \frac{u_4}{0.4}\right\}, 0.2\right)\right), \left(\left(\frac{e_1}{0.5}, n, 1\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.4}, \frac{u_3}{0.1}, \frac{u_4}{0.3}\right\}, 0.1\right)\right) \\
\left(\left(\frac{e_1}{0.5}, r, 1\right), \left(\left\{\frac{u_1}{0.1}, \frac{u_2}{0.3}, \frac{u_3}{0.8}, \frac{u_4}{0.7}\right\}, 0.2\right)\right), \left(\left(\frac{e_2}{0.7}, m, 1\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.3}, \frac{u_3}{0.2}, \frac{u_4}{0.7}\right\}, 0.4\right)\right) \\
\left(\left(\frac{e_2}{0.7}, n, 1\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.8}, \frac{u_3}{0.6}, \frac{u_4}{0.4}\right\}, 0.2\right)\right), \left(\left(\frac{e_2}{0.7}, r, 1\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.7}\right\}, 0.3\right)\right) \\
\left(\left(\frac{e_3}{0.9}, m, 1\right), \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.6}, \frac{u_3}{0.8}, \frac{u_4}{0.9}\right\}, 0.6\right)\right), \left(\left(\frac{e_3}{0.9}, n, 1\right), \left(\left\{\frac{u_1}{0.2}, \frac{u_2}{0.3}, \frac{u_3}{0.7}, \frac{u_4}{0.6}\right\}, 0.5\right)\right) \\
\left(\left(\frac{e_3}{0.9}, r, 1\right), \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.4}, \frac{u_3}{0.6}, \frac{u_4}{0.3}\right\}, 0.8\right)\right), \left(\left(\frac{e_1}{0.5}, m, 0\right), \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.6}, \frac{u_3}{0.7}, \frac{u_4}{0.6}\right\}, 0.7\right)\right) \\
\left(\left(\frac{e_1}{0.5}, n, 0\right), \left(\left\{\frac{u_1}{0.2}, \frac{u_2}{0.7}, \frac{u_3}{0.8}, \frac{u_4}{0.7}\right\}, 0.9\right)\right), \left(\left(\frac{e_1}{0.5}, r, 0\right), \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.8}, \frac{u_3}{0.4}, \frac{u_4}{0.5}\right\}, 0.6\right)\right) \\
\left(\left(\frac{e_2}{0.7}, m, 0\right), \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.6}, \frac{u_3}{0.8}, \frac{u_4}{0.3}\right\}, 0.6\right)\right), \left(\left(\frac{e_2}{0.7}, n, 0\right), \left(\left\{\frac{u_1}{0.2}, \frac{u_2}{0.4}, \frac{u_3}{0.5}, \frac{u_4}{0.7}\right\}, 0.7\right)\right) \\
\left(\left(\frac{e_2}{0.7}, r, 0\right), \left(\left\{\frac{u_1}{0.4}, \frac{u_2}{0.6}, \frac{u_3}{0.5}, \frac{u_4}{0.3}\right\}, 0.4\right)\right), \left(\left(\frac{e_3}{0.9}, m, 0\right), \left(\left\{\frac{u_1}{0.8}, \frac{u_2}{0.4}, \frac{u_3}{0.3}, \frac{u_4}{0.1}\right\}, 0.3\right)\right) \\
\left(\left(\frac{e_3}{0.9}, n, 0\right), \left(\left\{\frac{u_1}{0.9}, \frac{u_2}{0.6}, \frac{u_3}{0.8}, \frac{u_4}{0.3}\right\}, 0.6\right)\right), \left(\left(\frac{e_3}{0.9}, r, 0\right), \left(\left\{\frac{u_1}{0.8}, \frac{u_2}{0.5}, \frac{u_3}{0.4}, \frac{u_4}{0.6}\right\}, 0.5\right)\right)
\end{array}\right\}$$

3.2. Definition: For two FPGFSESs (F_ψ, A) and (G_δ, B) over U, (F_ψ, A) is called a fuzzy parameterised generalized fuzzy soft expert subset of (G_δ, B) if

(1) $A \subseteq B$

(2) For all $\varepsilon \epsilon A$, $F_\psi(\varepsilon)$ is fuzzy parameterised generalized fuzzy subset of $G_\delta(\varepsilon)$

Example 2: Consider Example 1. Let $\Psi = \left\{\frac{e_1}{0.5}, \frac{e_2}{0.3}, \frac{e_3}{0.6}\right\}$ be a fuzzy subset over E and $\gamma = \left\{\frac{e_1}{0.6}, \frac{e_2}{0.3}, \frac{e_3}{0.8}\right\}$ be a another fuzzy subset over E then A

$$A = \left\{\begin{array}{c}
\left(\frac{e_1}{0.5}, m, 1\right), \left(\frac{e_3}{0.6}, m, 1\right), \left(\frac{e_3}{0.6}, m, 0\right), \left(\frac{e_1}{0.5}, n, 1\right), \left(\frac{e_2}{0.3}, n, 1\right), \left(\frac{e_2}{0.3}, r, 0\right), \left(\frac{e_3}{0.6}, n, 0\right) \\
\left(\frac{e_2}{0.3}, r, 1\right), \left(\frac{e_3}{0.6}, r, 1\right), \left(\frac{e_3}{0.6}, r, 0\right)
\end{array}\right\}$$

$$B = \left\{\left(\frac{e_1}{0.6}, m, 1\right), \left(\frac{e_3}{0.8}, m, 0\right), \left(\frac{e_1}{0.6}, n, 1\right), \left(\frac{e_2}{0.3}, n, 1\right), \left(\frac{e_2}{0.3}, r, 0\right), \left(\frac{e_3}{0.8}, r, 1\right), \left(\frac{e_3}{0.8}, r, 0\right)\right\}$$

Since γ is fuzzy subset of Ψ,clearly $B_\gamma \subset A_\psi$ .Let (F_ψ,A) and (G_δ, B) be defined as follows:

$$(F_\psi, A) = \left\{\begin{array}{c}
\left(\left(\frac{e_1}{0.5}, m, 1\right), \left(\left\{\frac{u_1}{0.4}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.2}\right\}, 0.2\right)\right), \left(\left(\frac{e_1}{0.5}, n, 1\right), \left(\left\{\frac{u_1}{0.4}, \frac{u_2}{0.3}, \frac{u_3}{0.4}, \frac{u_4}{0.7}\right\}, 0.1\right)\right) \\
\left(\left(\frac{e_2}{0.3}, n, 1\right), \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.4}, \frac{u_3}{0.4}, \frac{u_4}{0.2}\right\}, 0.2\right)\right), \left(\left(\frac{e_2}{0.3}, r, 0\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.4}, \frac{u_3}{0.6}, \frac{u_4}{0.4}\right\}, 0.3\right)\right) \\
\left(\left(\frac{e_2}{0.3}, r, 1\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.6}, \frac{u_3}{0.3}, \frac{u_4}{0.2}\right\}, 0.0\right)\right), \left(\left(\frac{e_3}{0.6}, m, 1\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.3}, \frac{u_3}{0.4}, \frac{u_4}{0.5}\right\}, 0.6\right)\right) \\
\left(\left(\frac{e_3}{0.6}, m, 0\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.4}, \frac{u_3}{0.7}, \frac{u_4}{0.5}\right\}, 0.3\right)\right), \left(\left(\frac{e_3}{0.6}, n, 0\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.6}, \frac{u_3}{0.3}, \frac{u_4}{0.2}\right\}, 0.3\right)\right) \\
\left(\left(\frac{e_3}{0.6}, r, 1\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.4}, \frac{u_3}{0.6}, \frac{u_4}{0.3}\right\}, 0.6\right)\right), \left(\left(\frac{e_3}{0.6}, r, 0\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.4}, \frac{u_3}{0.6}, \frac{u_4}{0.3}\right\}, 0.5\right)\right)
\end{array}\right\}$$

$$(G_\delta, B) = \left\{\begin{array}{c}
\left(\left(\frac{e_1}{0.6}, m, 1\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.6}, \frac{u_3}{0.6}, \frac{u_4}{0.4}\right\}, 0.1\right)\right), \left(\left(\frac{e_1}{0.6}, n, 1\right), \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.4}, \frac{u_3}{0.6}, \frac{u_4}{0.8}\right\}, 0.1\right)\right) \\
\left(\left(\frac{e_2}{0.3}, n, 1\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.4}\right\}, 0.1\right)\right), \left(\left(\frac{e_3}{0.8}, m, 0\right), \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.5}\right\}, 0.7\right)\right) \\
\left(\left(\frac{e_2}{0.3}, r, 0\right), \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.6}\right\}, 0.4\right)\right), \left(\left(\frac{e_3}{0.8}, r, 1\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.4}, \frac{u_3}{0.7}, \frac{u_4}{0.6}\right\}, 0.3\right)\right) \\
\left(\left(\frac{e_3}{0.8}, r, 0\right), \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.6}\right\}, 0.5\right)\right)
\end{array}\right\}$$

$\therefore (G_\delta, B) \subseteq (F_\psi, A)$.

3.3. Definition: Two FPGFSES (F_ψ,A) and (G_δ, B) over U are said to be equal if (F_ψ,A) is FPGFSE subset of (G_δ, B) and (G_δ, B) is FPGFSE subset of (F_ψ,A).

3.4. Definition: An agree FPGFSES $(F_\psi, A)_1$ over U is a FPGFSE subset of (F_ψ,A) defined as follows:

$$(F_\psi, A)_1 = \{F_\psi(\alpha): \alpha \epsilon\ \Psi \times X \times \{1\}\}$$

3.5. Definition: A disagree FPGFSES $(F_\psi, A)_0$ over U is a FPGFSE subset of (F_ψ,A) defined as follows:

$$(F_\psi, A)_0 = \{F_\psi(\alpha): \alpha\ \epsilon\ \Psi \times X \times \{0\}\}$$

Example 3: Consider Example1. The agree Fuzzy parameterised generalized fuzzy soft expert set $(F_\psi, \mathrm{Z})_1$ over U is

$$(F_\psi, \mathrm{Z})_1 = \left\{ \begin{array}{c} \left(\left(\frac{e_1}{0.5}, \mathrm{m}, 1\right), \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.3}, \frac{u_3}{0.2}, \frac{u_4}{0.4}\right\}, 0.2\right)\right), \left(\left(\frac{e_1}{0.5}, \mathrm{n}, 1\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.4}, \frac{u_3}{0.1}, \frac{u_4}{0.3}\right\}, 0.1\right)\right) \\ \left(\left(\frac{e_1}{0.5}, \mathrm{r}, 1\right), \left(\left\{\frac{u_1}{0.1}, \frac{u_2}{0.3}, \frac{u_3}{0.8}, \frac{u_4}{0.7}\right\}, 0.2\right)\right), \left(\left(\frac{e_2}{0.7}, \mathrm{m}, 1\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.3}, \frac{u_3}{0.2}, \frac{u_4}{0.7}\right\}, 0.4\right)\right) \\ \left(\left(\frac{e_2}{0.7}, \mathrm{n}, 1\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.8}, \frac{u_3}{0.6}, \frac{u_4}{0.4}\right\}, 0.2\right)\right), \left(\left(\frac{e_2}{0.7}, \mathrm{r}, 1\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.7}\right\}, 0.3\right)\right) \\ \left(\left(\frac{e_3}{0.9}, \mathrm{m}, 1\right), \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.6}, \frac{u_3}{0.8}, \frac{u_4}{0.9}\right\}, 0.6\right)\right), \left(\left(\frac{e_3}{0.9}, \mathrm{n}, 1\right), \left(\left\{\frac{u_1}{0.2}, \frac{u_2}{0.3}, \frac{u_3}{0.7}, \frac{u_4}{0.6}\right\}, 0.5\right)\right) \\ \left(\left(\frac{e_3}{0.9}, \mathrm{r}, 1\right), \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.4}, \frac{u_3}{0.6}, \frac{u_4}{0.3}\right\}, 0.8\right)\right) \end{array} \right\}$$

and the disagree fuzzy parameterized generalized fuzzy soft expert set $(F_\psi, \mathrm{Z})_0$ over U is

$$(F_\psi, \mathrm{Z})_0 = \left\{ \begin{array}{c} \left(\frac{e_1}{0.5}, \mathrm{m}, 0\right), \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.6}, \frac{u_3}{0.7}, \frac{u_4}{0.6}\right\}, 0.7\right), \left(\left(\frac{e_1}{0.5}, \mathrm{n}, 0\right), \left(\left\{\frac{u_1}{0.2}, \frac{u_2}{0.7}, \frac{u_3}{0.8}, \frac{u_4}{0.7}\right\}, 0.9\right)\right) \\ \left(\left(\frac{e_1}{0.5}, \mathrm{r}, 0\right), \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.8}, \frac{u_3}{0.4}, \frac{u_4}{0.5}\right\}, 0.6\right)\right), \left(\left(\frac{e_2}{0.7}, \mathrm{m}, 0\right), \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.6}, \frac{u_3}{0.8}, \frac{u_4}{0.3}\right\}, 0.6\right)\right) \\ \left(\left(\frac{e_2}{0.7}, \mathrm{n}, 0\right), \left(\left\{\frac{u_1}{0.2}, \frac{u_2}{0.4}, \frac{u_3}{0.5}, \frac{u_4}{0.7}\right\}, 0.7\right)\right), \left(\left(\frac{e_2}{0.7}, \mathrm{r}, 0\right), \left(\left\{\frac{u_1}{0.4}, \frac{u_2}{0.6}, \frac{u_3}{0.5}, \frac{u_4}{0.3}\right\}, 0.4\right)\right) \\ \left(\left(\frac{e_3}{0.9}, \mathrm{m}, 0\right), \left(\left\{\frac{u_1}{0.8}, \frac{u_2}{0.4}, \frac{u_3}{0.3}, \frac{u_4}{0.1}\right\}, 0.3\right)\right), \left(\left(\frac{e_3}{0.9}, \mathrm{n}, 0\right), \left(\left\{\frac{u_1}{0.9}, \frac{u_2}{0.6}, \frac{u_3}{0.8}, \frac{u_4}{0.3}\right\}, 0.6\right)\right) \\ \left(\left(\frac{e_3}{0.9}, \mathrm{r}, 0\right), \left(\left\{\frac{u_1}{0.8}, \frac{u_2}{0.5}, \frac{u_3}{0.4}, \frac{u_4}{0.6}\right\}, 0.5\right)\right) \end{array} \right\}$$

3.6. Definition: The complement of a fuzzy parameterized generalized fuzzy soft expert set $(F_\psi$,A) is denoted by $(F_\psi, \mathrm{A})^{\mathrm{c}}$ and is defined by
$(F_\psi$, A) = {$(F_\psi{}^c$, ˥A) where $F_\psi{}^c$: ˥A → I^U is a mapping given by
$F_\psi{}^c(\alpha) = c\ (F_\psi(˥\alpha))$, $\forall \alpha \epsilon$˥A,
Where c is a generalized fuzzy complement and ˥$A \subset \{\ \psi^c\ x\ X\ x\ O\ \}$.
Example 4: Consider example , by using the basic fuzzy complement, we have

$$(F_\psi, \mathrm{Z})^{\mathrm{c}} = \left\{ \begin{array}{c} \left(\left(\frac{e_1}{0.5}, \mathrm{m}, 1\right), \left(\left\{\frac{u_1}{0.4}, \frac{u_2}{0.7}, \frac{u_3}{0.8}, \frac{u_4}{0.6}\right\}, 0.8\right)\right), \left(\left(\frac{e_1}{0.5}, \mathrm{n}, 1\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.6}, \frac{u_3}{0.9}, \frac{u_4}{0.7}\right\}, 0.9\right)\right) \\ \left(\left(\frac{e_1}{0.5}, \mathrm{r}, 1\right), \left(\left\{\frac{u_1}{0.9}, \frac{u_2}{0.7}, \frac{u_3}{0.2}, \frac{u_4}{0.3}\right\}, 0.8\right)\right), \left(\left(\frac{e_2}{0.7}, \mathrm{m}, 1\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.7}, \frac{u_3}{0.8}, \frac{u_4}{0.3}\right\}, 0.6\right)\right) \\ \left(\left(\frac{e_2}{0.7}, \mathrm{n}, 1\right), \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.2}, \frac{u_3}{0.4}, \frac{u_4}{0.6}\right\}, 0.8\right)\right), \left(\left(\frac{e_2}{0.7}, \mathrm{r}, 1\right), \left(\left\{\frac{u_1}{0.3}, \frac{u_2}{0.5}, \frac{u_3}{0.4}, \frac{u_4}{0.3}\right\}, 0.7\right)\right) \\ \left(\left(\frac{e_3}{0.9}, \mathrm{m}, 1\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.4}, \frac{u_3}{0.2}, \frac{u_4}{0.1}\right\}, 0.4\right)\right), \left(\left(\frac{e_3}{0.9}, \mathrm{n}, 1\right), \left(\left\{\frac{u_1}{0.8}, \frac{u_2}{0.7}, \frac{u_3}{0.3}, \frac{u_4}{0.4}\right\}, 0.5\right)\right) \\ \left(\left(\frac{e_3}{0.9}, \mathrm{r}, 1\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.6}, \frac{u_3}{0.4}, \frac{u_4}{0.7}\right\}, 0.2\right)\right), \left(\left(\frac{e_1}{0.5}, \mathrm{m}, 0\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.4}, \frac{u_3}{0.3}, \frac{u_4}{0.4}\right\}, 0.3\right)\right) \\ \left(\left(\frac{e_1}{0.5}, \mathrm{n}, 0\right), \left(\left\{\frac{u_1}{0.8}, \frac{u_2}{0.3}, \frac{u_3}{0.2}, \frac{u_4}{0.3}\right\}, 0.1\right)\right), \left(\left(\frac{e_1}{0.5}, \mathrm{r}, 0\right), \left(\left\{\frac{u_1}{0.4}, \frac{u_2}{0.2}, \frac{u_3}{0.6}, \frac{u_4}{0.5}\right\}, 0.4\right)\right) \\ \left(\left(\frac{e_2}{0.7}, \mathrm{m}, 0\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.4}, \frac{u_3}{0.2}, \frac{u_4}{0.7}\right\}, 0.4\right)\right), \left(\left(\frac{e_2}{0.7}, \mathrm{n}, 0\right), \left(\left\{\frac{u_1}{0.8}, \frac{u_2}{0.6}, \frac{u_3}{0.5}, \frac{u_4}{0.3}\right\}, 0.3\right)\right) \\ \left(\left(\frac{e_2}{0.7}, \mathrm{r}, 0\right), \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.4}, \frac{u_3}{0.5}, \frac{u_4}{0.7}\right\}, 0.6\right)\right), \left(\left(\frac{e_3}{0.9}, \mathrm{m}, 0\right), \left(\left\{\frac{u_1}{0.2}, \frac{u_2}{0.6}, \frac{u_3}{0.7}, \frac{u_4}{0.9}\right\}, 0.7\right)\right) \\ \left(\left(\frac{e_3}{0.9}, \mathrm{n}, 0\right), \left(\left\{\frac{u_1}{0.1}, \frac{u_2}{0.4}, \frac{u_3}{0.2}, \frac{u_4}{0.7}\right\}, 0.4\right)\right), \left(\left(\frac{e_3}{0.9}, \mathrm{r}, 0\right), \left(\left\{\frac{u_1}{0.2}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.4}\right\}, 0.5\right)\right) \end{array} \right\}$$

3.7. Proposition: If (F_ψ, A) is a fuzzy parameterized generalized fuzzy soft expert set over U, then
(1)$\left(F_{\psi,}A)^c\right)^c = (F_\psi, \mathrm{A})$,
(2)$(F_\psi, \mathrm{A})_0^c = (F_\psi, \mathrm{A})_1$,
(3) $(F_\mu, A)_1^c = (F_\psi, \mathrm{A})_0$.
Proof: The proof is straight forward.

3. Union and intersection of FPGFSES:

In this section ,we introduce the definitions of union and inter section of fuzzy parameterized generalised fuzzy soft expert sets derive their properties and gives some examples.

4.1. Definition: The union of two FPGFSES 's (F_ψ, A) and (G_δ,B) over U denoted by $(F_\psi, A)\tilde{U}$(G_δ,B) is the FPGFSES (H_Ω, C)such that $C = \Omega\ x\ X\ x\ 0$ where $\Omega = \ \psi\ \cup \delta$

$$H_{\Omega}(\varepsilon)=\begin{cases} F(\varepsilon)\ if\ \varepsilon\ \epsilon\ A-B \\ G(\varepsilon)\ if\ \varepsilon\ \epsilon\ B-A \\ F(\varepsilon)\ \tilde{U}\ G(\varepsilon)\ if\ \varepsilon\ \epsilon\ A\cap B \end{cases}$$

Example 5: Consider Example 1. Let $\Psi=\left\{\frac{e_1}{0.5},\frac{e_2}{0.3},\frac{e_3}{0.6}\right\}$ be a fuzzy subset over E and $\gamma=\left\{\frac{e_1}{0.6},\frac{e_2}{0.3},\frac{e_3}{0.8}\right\}$ be a another fuzzy subset over E then A

$$A=\left\{\begin{array}{c}\left(\frac{e_1}{0.5},\mathrm{m},1\right),\left(\frac{e_3}{0.6},\mathrm{m},1\right),\left(\frac{e_3}{0.6},\mathrm{m},0\right),\left(\frac{e_1}{0.5},\mathrm{n},1\right),\left(\frac{e_2}{0.3},\mathrm{n},1\right),\left(\frac{e_2}{0.3},\mathrm{r},0\right),\left(\frac{e_3}{0.6},\mathrm{n},0\right)\\ \left(\frac{e_2}{0.3},\mathrm{r},1\right),\left(\frac{e_3}{0.6},\mathrm{r},1\right),\left(\frac{e_3}{0.6},\mathrm{r},0\right)\end{array}\right\}$$

$$B=\left\{\left(\frac{e_1}{0.6},\mathrm{m},1\right),\left(\frac{e_3}{0.8},\mathrm{m},0\right),\left(\frac{e_1}{0.6},\mathrm{n},1\right),\left(\frac{e_2}{0.3},\mathrm{n},1\right),\left(\frac{e_2}{0.3},\mathrm{r},0\right),\left(\frac{e_3}{0.8},\mathrm{r},1\right),\left(\frac{e_3}{0.8},\mathrm{r},0\right)\right\}$$

Since γ is fuzzy subset of Ψ,clearly $B_{\gamma}\subset A_{\psi}$ .Let (F_{ψ},A) and (G_{δ}, B) be defined as follows:

$$(F_{\psi},A)=\left\{\begin{array}{c}\left(\left(\frac{e_1}{0.5},\mathrm{m},1\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.2\right)\right),\left(\left(\frac{e_1}{0.5},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.3},\frac{u_3}{0.4},\frac{u_4}{0.7}\right\},0.1\right)\right)\\ \left(\left(\frac{e_2}{0.3},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.4},\frac{u_3}{0.4},\frac{u_4}{0.2}\right\},0.2\right)\right),\left(\left(\frac{e_2}{0.3},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.4}\right\},0.3\right)\right)\\ \left(\left(\frac{e_2}{0.3},\mathrm{r},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.6},\frac{u_3}{0.3},\frac{u_4}{0.2}\right\},0.0\right)\right),\left(\left(\frac{e_3}{0.6},\mathrm{m},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.3},\frac{u_3}{0.4},\frac{u_4}{0.5}\right\},0.6\right)\right)\\ \left(\left(\frac{e_3}{0.6},\mathrm{m},0\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.7},\frac{u_4}{0.5}\right\},0.3\right)\right),\left(\left(\frac{e_3}{0.6},\mathrm{n},0\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.6},\frac{u_3}{0.3},\frac{u_4}{0.2}\right\},0.3\right)\right)\\ \left(\left(\frac{e_3}{0.6},\mathrm{r},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.3}\right\},0.6\right)\right),\left(\left(\frac{e_3}{0.6},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.3}\right\},0.5\right)\right)\end{array}\right\}$$

$$(G_{\delta},B)=\left\{\begin{array}{c}\left(\left(\frac{e_1}{0.6},\mathrm{m},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.6},\frac{u_3}{0.6},\frac{u_4}{0.4}\right\},0.1\right)\right),\left(\left(\frac{e_1}{0.6},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.8}\right\},0.1\right)\right)\\ \left(\left(\frac{e_2}{0.3},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.7},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.4}\right\},0.1\right)\right),\left(\left(\frac{e_3}{0.8},\mathrm{m},0\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.5}\right\},0.7\right)\right)\\ \left(\left(\frac{e_2}{0.3},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.6}\right\},0.4\right)\right),\left(\left(\frac{e_3}{0.8},\mathrm{r},1\right),\left(\left\{\frac{u_1}{0.7},\frac{u_2}{0.4},\frac{u_3}{0.7},\frac{u_4}{0.6}\right\},0.3\right)\right)\\ \left(\left(\frac{e_3}{0.8},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.6}\right\},0.5\right)\right)\end{array}\right\}$$

$$(H_{\Omega},C)=\left\{\begin{array}{c}\left(\left(\frac{e_1}{0.6},\mathrm{m},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.6},\frac{u_3}{0.6},\frac{u_4}{0.4}\right\},0.2\right)\right),\left(\left(\frac{e_3}{0.8},\mathrm{m},0\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.5},\frac{u_3}{0.7},\frac{u_4}{0.5}\right\},0.7\right)\right)\\ \left(\left(\frac{e_1}{0.6},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.8}\right\},0.1\right)\right),\left(\left(\frac{e_2}{0.3},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.6}\right\},0.5\right)\right)\\ \left(\left(\frac{e_3}{0.8},\mathrm{r},1\right),\left(\left\{\frac{u_1}{0.7},\frac{u_2}{0.4},\frac{u_3}{0.7},\frac{u_4}{0.6}\right\},0.6\right)\right),\end{array}\right\}$$

4.2. Preposition: If (F_{ψ},A), (G_{δ}, B) and (H_{Ω},C) are three FPGFSESs over U, then
(i) $(F_{\psi},A)\ \tilde{U}\ ((G_{\delta},B)\ \tilde{U}(H_{\Omega},C))=((F_{\psi},A)\ \tilde{U}\ (G_{\delta},B))\ \tilde{U}(H_{\Omega},C)$
(ii) $(F_{\psi},A)\ \tilde{\mathrm{U}}\ (F_{\psi},A)=(F_{\psi},A$
Proof: the proof is straightforward.

4.3. Definition: The intersection of two FPGFSESs (F_{ψ},A) and (G_{δ},B) over U denoted by $(F_{\psi},A)\ \widetilde{\cap U}(G_{\delta}$,B) , is the FPGFSES (H_{Ω},C)such that $C=\Omega\ x\ X\ x\ 0$
where $\Omega=\psi\ \cup\delta$

$$H_{\Omega}(\varepsilon)=\begin{cases} F(\varepsilon)\ if\ \varepsilon\ \epsilon\ A-B \\ G(\varepsilon)\ if\ \varepsilon\ \epsilon\ B-A \\ F(\varepsilon)\ \tilde{\cap}\ G(\varepsilon)\ if\ \varepsilon\ \epsilon\ A\cup B \end{cases}$$

Example 6: Consider Example 1. Let $\Psi=\left\{\frac{e_1}{0.5},\frac{e_2}{0.3},\frac{e_3}{0.6}\right\}$ be a fuzzy subset over E and $\gamma=\left\{\frac{e_1}{0.6},\frac{e_2}{0.3},\frac{e_3}{0.8}\right\}$ be a another fuzzy subset over E then A

$$A=\left\{\begin{array}{c}\left(\frac{e_1}{0.5},\mathrm{m},1\right),\left(\frac{e_3}{0.6},\mathrm{m},1\right),\left(\frac{e_3}{0.6},\mathrm{m},0\right),\left(\frac{e_1}{0.5},\mathrm{n},1\right),\left(\frac{e_2}{0.3},\mathrm{n},1\right),\left(\frac{e_2}{0.3},\mathrm{r},0\right),\left(\frac{e_3}{0.6},\mathrm{n},0\right)\\ \left(\frac{e_2}{0.3},\mathrm{r},1\right),\left(\frac{e_3}{0.6},\mathrm{r},1\right),\left(\frac{e_3}{0.6},\mathrm{r},0\right)\end{array}\right\}$$

$$B=\left\{\left(\frac{e_1}{0.6},\mathrm{m},1\right),\left(\frac{e_3}{0.8},\mathrm{m},0\right),\left(\frac{e_1}{0.6},\mathrm{n},1\right),\left(\frac{e_2}{0.3},\mathrm{n},1\right),\left(\frac{e_2}{0.3},\mathrm{r},0\right),\left(\frac{e_3}{0.8},\mathrm{r},1\right),\left(\frac{e_3}{0.8},\mathrm{r},0\right)\right\}$$

Since γ is fuzzy subset of Ψ,clearly $B_{\gamma}\subset A_{\psi}$ .Let (F_{ψ},A) and (G_{δ}, B) be defined as follows:

$$(F_\psi,\mathrm{A})=\left\{\begin{matrix}\left(\left(\frac{e_1}{0.5},\mathrm{m},1\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.2\right)\right),\left(\left(\frac{e_1}{0.5},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.3},\frac{u_3}{0.4},\frac{u_4}{0.7}\right\},0.1\right)\right)\\ \left(\left(\frac{e_2}{0.3},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.4},\frac{u_3}{0.4},\frac{u_4}{0.2}\right\},0.2\right)\right),\left(\left(\frac{e_2}{0.3},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.4}\right\},0.3\right)\right)\\ \left(\left(\frac{e_2}{0.3},\mathrm{r},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.6},\frac{u_3}{0.3},\frac{u_4}{0.2}\right\},0.0\right)\right),\left(\left(\frac{e_3}{0.6},\mathrm{m},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.3},\frac{u_3}{0.4},\frac{u_4}{0.5}\right\},0.6\right)\right)\\ \left(\left(\frac{e_3}{0.6},\mathrm{m},0\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.7},\frac{u_4}{0.5}\right\},0.3\right)\right),\left(\left(\frac{e_3}{0.6},\mathrm{n},0\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.6},\frac{u_3}{0.3},\frac{u_4}{0.2}\right\},0.3\right)\right)\\ \left(\left(\frac{e_3}{0.6},\mathrm{r},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.3}\right\},0.6\right)\right),\left(\left(\frac{e_3}{0.6},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.3}\right\},0.5\right)\right)\end{matrix}\right\}$$

$$(G_\delta,\mathrm{B})=\left\{\begin{matrix}\left(\left(\frac{e_1}{0.6},\mathrm{m},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.6},\frac{u_3}{0.6},\frac{u_4}{0.4}\right\},0.1\right)\right),\left(\left(\frac{e_1}{0.6},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.8}\right\},0.1\right)\right)\\ \left(\left(\frac{e_2}{0.3},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.7},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.4}\right\},0.1\right)\right),\left(\left(\frac{e_3}{0.8},\mathrm{m},0\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.5}\right\},0.7\right)\right)\\ \left(\left(\frac{e_2}{0.3},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.6}\right\},0.4\right)\right),\left(\left(\frac{e_3}{0.8},\mathrm{r},1\right),\left(\left\{\frac{u_1}{0.7},\frac{u_2}{0.4},\frac{u_3}{0.7},\frac{u_4}{0.6}\right\},0.3\right)\right)\\ \left(\left(\frac{e_3}{0.8},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.6}\right\},0.5\right)\right)\end{matrix}\right\}$$

$$(H_\Omega,\mathrm{C})=\left\{\begin{matrix}\left(\left(\frac{e_1}{0.5},\mathrm{m},1\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},01\right)\right),\left(\left(\frac{e_3}{0.6},\mathrm{m},0\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.7},\frac{u_4}{0.5}\right\},0.3\right)\right)\\ \left(\left(\frac{e_1}{0.5},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.3},\frac{u_3}{0.4},\frac{u_4}{0.7}\right\},0.1\right)\right),\left(\left(\frac{e_2}{0.3},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.4}\right\},0.3\right)\right)\\ \left(\left(\frac{e_3}{0.6},\mathrm{r},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.3}\right\},0.3\right)\right),\end{matrix}\right\}$$

4.4. Preposition: If $(F_\psi$,A), $(G_\delta$, B) and $(H_\Omega$,C) are three FPGFSESs over U, then
(i) $(F_\psi,A)\tilde{\cap}((G_\delta,B)\,\tilde{\cap}(H_\Omega\,,C)) = ((F_\psi,A)\,\tilde{\cap}\,(G_\delta,B))\,\tilde{\cap}(H_\Omega\,,C)$
(ii) $(F_\psi,A)\,\tilde{\cap}\,(F_\psi,A) = (F_\psi,A$
Proof: The proof is straightforward.

4.5. Preposition: If $(F_\psi$,A), $(G_\delta$, B) and $(H_\Omega$,C) are three FPGFSESs over U, then
(i) $(F_\psi,A)\,\tilde{\cup}\,((G_\delta,B)\tilde{\cap}\,(H_\Omega\,,C)) = ((F_\psi,A)\,\tilde{\cup}\,(G_\delta,B))\,\tilde{\cap}\,((F_\psi,A)\,\tilde{\cup}\,(H_\Omega\,,C)))$
(ii) $(F_\psi,A)\tilde{\cap}\,((G_\delta,B)\,\tilde{\cup}\,(H_\Omega\,,C)) = ((F_\psi,A)\,\tilde{\cap}\,(G_\delta,B))\,\tilde{\cup}\,((F_\psi,A)\tilde{\cap}\,(H_\Omega\,,C)))$
Proof: The proof is straightforward.

4. AND and OR Operations of FPGFSES:

In this section ,we introduce the definitions of AND and OR operations for GFSESs, deriver their properties , and give some examples.

5.1. Definition: if (F_μ,A)and(G_δ,B) are two GFSESs over U, then "(F_μ,A)AND(G_δ,B)" denoted by (F_μ,A)^(G_δ,B)is defined by
(F_μ,A)^(G_δ,B) = $(H_\Omega, A\times B)$
Such that H(α,β)=F($\propto$) $G(\beta)$,for all $(\propto,\beta)$Є A×B, where is GFSESs.
Example 7:
Consider Example 1. Let $\Psi=\left\{\frac{e_1}{0.5},\frac{e_2}{0.3},\frac{e_3}{0.6}\right\}$ be a fuzzy subset over E and $\gamma=\left\{\frac{e_1}{0.6},\frac{e_2}{0.3},\frac{e_3}{0.8}\right\}$ be a another fuzzy subset over E then A A= $\left\{\left(\frac{e_1}{0.5},\mathrm{m},1\right),\left(\frac{e_3}{0.6},\mathrm{r},1\right),\left(\frac{e_3}{0.6},\mathrm{r},0\right),\left(\frac{e_1}{0.5},\mathrm{n},1\right),\right\}$
B= $\left\{\left(\frac{e_1}{0.6},\mathrm{m},1\right),\left(\frac{e_2}{0.3},\mathrm{n},1\right),\left(\frac{e_3}{0.8},\mathrm{r},0\right)\right\}$
Since γ is fuzzy subset of Ψ,clearly $B_\gamma \subset A_\psi$ .Let $(F_\psi$,A) and $(G_\delta$, B) be defined as follows:

$$(F_\psi,\mathrm{A})=\left\{\begin{matrix}\left(\left(\frac{e_1}{0.5},\mathrm{m},1\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.2\right)\right),\left(\left(\frac{e_1}{0.5},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.3},\frac{u_3}{0.4},\frac{u_4}{0.7}\right\},0.1\right)\right)\\ \left(\left(\frac{e_3}{0.6},\mathrm{r},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.3}\right\},0.6\right)\right),\left(\left(\frac{e_3}{0.6},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.3}\right\},0.5\right)\right)\end{matrix}\right\}$$

$$(G_\delta,\mathrm{B})=\left\{\begin{matrix}\left(\left(\frac{e_1}{0.6},\mathrm{m},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.6},\frac{u_3}{0.6},\frac{u_4}{0.4}\right\},0.1\right)\right),\left(\left(\frac{e_2}{0.3},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.7},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.4}\right\},0.1\right)\right)\\ \left(\left(\frac{e_3}{0.8},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.6}\right\},0.5\right)\right)\end{matrix}\right\}$$

$$(H_{\Omega}, A\times B) = \left\{\begin{matrix}
\left(\left(\left(\frac{e_1}{0.5},\mathrm{m},1\right),\left(\frac{e_1}{0.6},\mathrm{m},1\right)\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.1\right)\right)\\
\left(\left(\left(\frac{e_1}{0.5},\mathrm{m},1\right),\left(\frac{e_2}{0.3},\mathrm{n},1\right)\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.1\right)\right)\\
\left(\left(\left(\frac{e_1}{0.5},\mathrm{m},1\right),\left(\frac{e_3}{0.8},\mathrm{r},0\right)\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.2\right)\right)\\
\left(\left(\left(\frac{e_3}{0.6},\mathrm{r},1\right),\left(\frac{e_1}{0.6},\mathrm{m},1\right)\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.1\right)\right)\\
\left(\left(\left(\frac{e_3}{0.6},\mathrm{r},1\right),\left(\frac{e_2}{0.3},\mathrm{n},1\right)\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.1\right)\right)\\
\left(\left(\left(\frac{e_3}{0.6},\mathrm{r},1\right),\left(\frac{e_3}{0.8},\mathrm{r},0\right)\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.2\right)\right)\\
\left(\left(\left(\frac{e_3}{0.6},\mathrm{r},0\right),\left(\frac{e_1}{0.6},\mathrm{m},1\right)\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.1\right)\right)\\
\left(\left(\left(\frac{e_3}{0.6},\mathrm{r},0\right),\left(\frac{e_2}{0.3},\mathrm{n},1\right)\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.1\right)\right)\\
\left(\left(\left(\frac{e_3}{0.6},\mathrm{r},0\right),\left(\frac{e_3}{0.8},\mathrm{r},0\right)\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.2\right)\right)\\
\left(\left(\left(\frac{e_1}{0.5},\mathrm{n},1\right),\left(\frac{e_1}{0.6},\mathrm{m},1\right)\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.1\right)\right)\\
\left(\left(\left(\frac{e_1}{0.5},\mathrm{n},1\right),\left(\frac{e_2}{0.3},\mathrm{n},1\right)\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.1\right)\right)\\
\left(\left(\left(\frac{e_1}{0.5},\mathrm{n},1\right),\left(\frac{e_3}{0.8},\mathrm{r},0\right)\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.2\right)\right)
\end{matrix}\right\}$$

5.2. Definition: If (F_μ,A)and(G_δ,B) are two GFSESs over U, then "(F_μ,A)OR(G_δ,B)" denoted by (F_μ,A) ∨ (G_δ,B)is defined by
(F_μ,A) ∨ (G_δ,B) = (H_Ω,A×B)
Such that $H(\alpha,\beta)$=F(∝) $G(\beta)$,for all $(\propto,\beta)$∈ A×B, where is generalized fuzzy union.
Example 8:
Consider Example 1. Let $\Psi = \left\{\frac{e_1}{0.5},\frac{e_2}{0.3},\frac{e_3}{0.6}\right\}$ be a fuzzy subset over E and $\gamma = \left\{\frac{e_1}{0.6},\frac{e_2}{0.3},\frac{e_3}{0.8}\right\}$ be a another fuzzy subset over E then A= $\left\{\left(\frac{e_1}{0.5},\mathrm{m},1\right),\left(\frac{e_3}{0.6},\mathrm{r},1\right),\left(\frac{e_3}{0.6},\mathrm{r},0\right),\left(\frac{e_1}{0.5},\mathrm{n},1\right),\right\}$
B= $\left\{\left(\frac{e_1}{0.6},\mathrm{m},1\right),\left(\frac{e_2}{0.3},\mathrm{n},1\right),\left(\frac{e_3}{0.8},\mathrm{r},0\right)\right\}$
Since γ is fuzzy subset of Ψ,clearly $B_\gamma \subset A_\psi$ .Let (F_ψ,A) and (G_δ, B) be defined as follows:

$$(F_\psi,A)= \left\{\begin{matrix}\left(\left(\frac{e_1}{0.5},\mathrm{m},1\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.2}\right\},0.2\right)\right),\left(\left(\frac{e_1}{0.5},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.4},\frac{u_2}{0.3},\frac{u_3}{0.4},\frac{u_4}{0.7}\right\},0.1\right)\right)\\
\left(\left(\frac{e_3}{0.6},\mathrm{r},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.3}\right\},0.6\right)\right),\left(\left(\frac{e_3}{0.6},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.4},\frac{u_3}{0.6},\frac{u_4}{0.3}\right\},0.5\right)\right)\end{matrix}\right\}$$

$$(G_\delta, B)= \left\{\begin{matrix}\left(\left(\frac{e_1}{0.6},\mathrm{m},1\right),\left(\left\{\frac{u_1}{0.5},\frac{u_2}{0.6},\frac{u_3}{0.6},\frac{u_4}{0.4}\right\},0.1\right)\right),\left(\left(\frac{e_2}{0.3},\mathrm{n},1\right),\left(\left\{\frac{u_1}{0.7},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.4}\right\},0.1\right)\right)\\
\left(\left(\frac{e_3}{0.8},\mathrm{r},0\right),\left(\left\{\frac{u_1}{0.6},\frac{u_2}{0.5},\frac{u_3}{0.6},\frac{u_4}{0.6}\right\},0.5\right)\right)\end{matrix}\right\}$$

$$(H_{\Omega}, A\times B) = \left\{\begin{array}{l}
\left(\left(\left(\frac{e_1}{0.5}, \mathrm{m}, 1\right), \left(\frac{e_1}{0.6}, \mathrm{m}, 1\right)\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.4}\right\}, 0.1\right)\right) \\
\left(\left(\left(\frac{e_1}{0.5}, \mathrm{m}, 1\right), \left(\frac{e_2}{0.3}, \mathrm{n}, 1\right)\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.4}\right\}, 0.2\right)\right) \\
\left(\left(\left(\frac{e_1}{0.5}, \mathrm{m}, 1\right), \left(\frac{e_3}{0.8}, \mathrm{r}, 0\right)\right), \left(\left\{\frac{u_1}{0.4}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.6}\right\}, 0.5\right)\right) \\
\left(\left(\left(\frac{e_3}{0.6}, \mathrm{r}, 1\right), \left(\frac{e_1}{0.6}, \mathrm{m}, 1\right)\right), \left(\left\{\frac{u_1}{0.4}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.2}\right\}, 0.6\right)\right) \\
\left(\left(\left(\frac{e_3}{0.6}, \mathrm{r}, 1\right), \left(\frac{e_2}{0.3}, \mathrm{n}, 1\right)\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.4}\right\}, 0.6\right)\right) \\
\left(\left(\left(\frac{e_3}{0.6}, \mathrm{r}, 1\right), \left(\frac{e_3}{0.8}, \mathrm{r}, 0\right)\right), \left(\left\{\frac{u_1}{0.4}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.2}\right\}, 0.6\right)\right) \\
\left(\left(\left(\frac{e_3}{0.6}, \mathrm{r}, 0\right), \left(\frac{e_1}{0.6}, \mathrm{m}, 1\right)\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.6}, \frac{u_3}{0.6}, \frac{u_4}{0.4}\right\}, 0.5\right)\right) \\
\left(\left(\left(\frac{e_3}{0.6}, \mathrm{r}, 0\right), \left(\frac{e_2}{0.3}, \mathrm{n}, 1\right)\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.4}\right\}, 0.5\right)\right) \\
\left(\left(\left(\frac{e_3}{0.6}, \mathrm{r}, 0\right), \left(\frac{e_3}{0.8}, \mathrm{r}, 0\right)\right), \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.6}\right\}, 0.5\right)\right) \\
\left(\left(\left(\frac{e_1}{0.5}, \mathrm{n}, 1\right), \left(\frac{e_1}{0.6}, \mathrm{m}, 1\right)\right), \left(\left\{\frac{u_1}{0.5}, \frac{u_2}{0.6}, \frac{u_3}{0.6}, \frac{u_4}{0.7}\right\}, 0.1\right)\right) \\
\left(\left(\left(\frac{e_1}{0.5}, \mathrm{n}, 1\right), \left(\frac{e_2}{0.3}, \mathrm{n}, 1\right)\right), \left(\left\{\frac{u_1}{0.7}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.7}\right\}, 0.1\right)\right) \\
\left(\left(\left(\frac{e_1}{0.5}, \mathrm{n}, 1\right), \left(\frac{e_3}{0.8}, \mathrm{r}, 0\right)\right), \left(\left\{\frac{u_1}{0.6}, \frac{u_2}{0.5}, \frac{u_3}{0.6}, \frac{u_4}{0.6}\right\}, 0.5\right)\right)
\end{array}\right\}$$

Conclusions:

In this work we have introduced the concept of fuzzy parameterized generalised fuzzy soft expert set and studied some of its properties. Finally, the complement, intersection and union operations have been defined on the fuzzy parameterized generalised fuzzy soft expert set.

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