Fuzzy Expert Decision Set

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***Abstract*- in 1965, L. A. Zadeh introduced the idea of fuzzy set theory as a common mathematical tool for handling with uncertainty. In this paper, we proposed the model of a Fuzzy Expert Decision Set, which will be more useful and effective. The Fuzzy Expert Decision Set where the user can know the opinion of all experts in one model and give an application of this model in decision making problem. We also define its fundamental operations, namely union, intersection, complement, AND and OR. Finally, we give an application of this model in decision making problem.**

***Keyword*- Fuzzy Set, Fuzzy Soft Set, Fuzzy Expert Decision Set**

I. Introduction

Many scientists desire to discover appropriate solutions to several mathematical problems that cannot be solved by conventional techniques. These problems lie in the fact that conventional techniques cannot solve the problems of uncertainty in Control Systems, economy, engineering, medicine and the decision-making problems. One of these solutions is fuzzy sets [1] —the title of Zadeh's first article about his novel mathematical theory, which was published in a scientific journal in 1965. Since Zadeh [1] published his paper almost fifty years ago, fuzzy set theory has received more and more from researchers in a wide range of scientific areas, particularly in the past few years. The difference between a binary set and a fuzzy set is that in a "normal" set every element is either a member or a non-member of the set. Here, we see that it either has to be A or not A. In a fuzzy set, an element can be a member of a set to some degree and at the same time a non-member to some degree of the same set.

In traditional set theory, the membership of elements in a set is assessed in binary expressions according to a bivalent condition; an element either belongs or does not belong to the set. By contrast, fuzzy set theory permits the gradual assessment of the membership of elements in a set; this is described with the aid of a membership function valued in the closed unit interval [0, 1]. Fuzzy sets generalize traditional sets, since the indicator functions of standard sets are particular cases of the membership functions of fuzzy sets, if the latter only take values 0 or 1. Therefore, a fuzzy set A in a universe of discourse X is a function $A:X \rightarrow [0,1]$, usually this function is referred to as the membership function and denoted by $\mu_A(x)$. Some mathematicians use the notation A(x) to denote the membership function instead of $\mu_A(x)$.

Molodtsov [2] initiated the idea of soft set theory as a mathematical tool for dealing with uncertainties. After Molodtsov's work, some operations and application of soft sets were studied by Chen et al. [3], Maji et al. [4] and Maji et al. [5]. Also Maji et al. [6] have introduced the concept of fuzzy soft set, a more general concept, which is a combination of fuzzy set and soft set and studied its properties and also Roy and Maji [6] used this idea to solve some decision making problems. Alkhazaleh [8 -10] et al. introduced the idea of soft multi-sets as a generalization of soft set. They also defined the concepts of fuzzy parameterized interval-valued fuzzy soft set and possibility fuzzy soft set and gave their applications in decision making and medical diagnosis.

Alkhazaleh et al. [11] introduced the idea of a soft expert set, where the user can know the opinion of all experts in one model without any operations. Even after any operation the user can know the opinion of all experts. So in this paper, we introduce the idea of an Expert Decision Set, which will be more effective and useful and which is a combination of fuzzy set and soft expert set. We also define its basic operations, namely complement, union, intersection, AND and OR and study their properties. Finally, we give an application of this concept in decision making problem.

II. Preliminaries

Zadeh [1] in 1965 first introduced Fuzzy set as a mathematical way of representing impreciseness or indistinctness in everyday life.

2.1. Fuzzy Set

A fuzzy set [1] is characterized by a membership function mapping elements of a domain space or universe of discourse X to the unit interval [0,1].(i,e)A = $\{(x, \mu_A(x); x \in X\}$, Here μ_A: X $\rightarrow$[0,1] is a mapping called the degree of membership function of the fuzzy set A and $\mu_A(x)$ is called the membership value of x ε X in the fuzzy set A. These membership grades are often represented by real numbers ranging from [0,1].

A fuzzy set A of the universe of discourse X is called a normal fuzzy set implying that there exist atleast one xεX such that $\mu_A(x) = 1$.

The fuzzy set A is convex if and only if, for any x_1, x_2 Є X, membership function of A satisfies the inequality $\mu_A\{\lambda x_1+(1-\lambda)x_2\} \geq \min\{\mu_A(x_1), \mu_A(x_2)\}$, $0 \leq \lambda \leq 1$.

2.2. α -Cut Of A Trapezoidal Fuzzy Number

The α-cut of a fuzzy number A(x) is defined as

$$A(\alpha) = \{ x : \mu(x) \geq \alpha, \alpha \in [0,1]\}$$

2.3. Trapezoidal fuzzy number

For a trapezoidal number A(x), it can be represented by A(a,b,c,d;1) with membership function μ(x) is given as,

$$\mu(x) = \begin{cases} \frac{x-a}{b-a}, a \leq x \leq b \\ 1, b \leq x \leq c \\ \frac{d-x}{d-c}, c \leq x \leq d \\ 0, \text{otherwise} \end{cases}$$

2.4. Function principle

Function principle is proposed to be as the fuzzy arithmetical operations by trapezoidal fuzzy numbers. We describe some fuzzy arithmetical operations under Function Principle as follows

Suppose $\tilde{A} = (a_1, b_1, c_1, d_1)$ and $\tilde{B} = (a_2, b_2, c_2, d_2)$ are two trapezoidal fuzzy numbers. Then

Addition of two fuzzy numbers $\tilde{A}$ and $\tilde{B}$ is defined as

$$\tilde{A} \oplus \tilde{B} = (a_1 + a_2, b_1 + b_2, c_1 + c_2, d_1 + d_2)$$

Where, $a_1, b_1, c_1, d_1, a_2, b_2, c_2, d_2$ are any real numbers?

(ii) Multiplication of two fuzzy numbers $\tilde{A}$ and $\tilde{B}$ is defined as

$$\tilde{A} \otimes \tilde{B} = (a_3, b_3, c_3, d_3)$$

$$\text{Where } X = (a_1a_2, a_1d_2, d_1a_2, d_1d_2)$$

$$Y = (b_1b_2, b_1c_2, c_1b_2, c_1c_2)$$

$$a_3 = \min X, b_3 = \min Y, c_3 = \max Y, d_3 = \max X$$

where $a_1, b_1, c_1, d_1, a_2, b_2, c_2, d_2$ are any positive real numbers.

(iii)Division of two fuzzy numbers $\tilde{A}$ and $\tilde{B}$ is defined as

$$\tilde{A} / \tilde{B} = \left(\frac{a_1}{d_2}, \frac{b_1}{c_2}, \frac{c_1}{b_2}, \frac{d_1}{a_2}\right)$$

where $a_1, b_1, c_1, d_1, a_2, b_2, c_2, d_2$ are any positive real numbers.

(iv) Scalar Multiplication

Take α be any real number. Then for $\alpha \geq 0$, $\alpha\tilde{A} = (\alpha a_1, \alpha b_1, \alpha c_1, \alpha d_1)$

$\alpha < 0$, $\alpha\tilde{A} = (\alpha d_1, \alpha c_1, \alpha\, b_1, \alpha a_1)$

(v) The inverse of a fuzzy number $\tilde{A} = (a_1, b_1, c_1, d_1)$ is defined as $\tilde{A}^{-1} = \left(\frac{1}{d_1}, \frac{1}{c_1}, \frac{1}{b_1}, \frac{1}{a_1}\right)$

where a_1, b_1, c_1, d_1 are any positive real numbers.

2.5. Fuzzy Logical Operations

(i) Intersection: Let A and B are fuzzy subsets of a nonempty set x.

The intersection of A and B is defined as

$$(A \cap B)(t) = \min\{A(t), B(t)\}$$

for all $t \in X$

(ii) Union: Let A and B are fuzzy subsets of a nonempty set x.

The union of A and B is defined as

$$(A \cup B)(t) = max\{A(t), B(t)\}$$

(iii) Complement: Let A and B are fuzzy subsets of a nonempty set x.

The complement of a fuzzy set A is defined as

$$(\urcorner A)(t) = 1 - A(t)$$

III. Fuzzy Expert Decision Set

In this section we introduce the concept of fuzzy expert decision set and give definitions of its basic operations namely complement, union, intersection, AND, OR. We give examples for these concepts . Basic properties of operations are also given.

Let U be a universe, E a set of parameters, and X a set of experts. Let O= {0 = disagree, 1 = agree} be a set of opinions, $Z = E\ x\ X\ x\ O$

Definition 1: A set Z is called a fuzzy expert decision set over U where F is a mapping given by $F: Z \to P(U)$, where $P(u)$ denotes the power set of U.

Example 1: Suppose that a company produced new types of its products and wishes to take the opinion of some experts about concerning these products. Let $U = \{u_1, u_2, u_3, u_4\}$ be a set of products, $E = \{e_1, e_2, e_3\}$ a set of decision parameters where e_i $(i = 1,2,3)$ *denotes the decision* "easy to use", "quality " *and* " cheap", respectively, and let $X = \{p, q, r\}$ be a set of experts.

Suppose that the company has distributed a questionnaire to three experts to make decisions on the company's products, and we get the following,

$F(e_1, p, 1) = \{u_1/0.3, u_2/0.5, u_3/0.7, u_4/0.1\}$, $F(e_1, q, 1) = \{u_1/0.5, u_2/0.2, u_3/0.3, 1/u_4\}$, $F(e_1, r, 1) =$ $\{u_1/0.4, u_2/0.8\ u_3/0.3, u_4/0.4\}$, $F(e_2, p, 1) = \{u_1/0.3, u_2/0.2, u_3/0.5, u_4/0.6\}$,
$F(e_2, q, 1) = \{u_1/0.6, u_2/0.4, u_3/0.3, u_4/0.7\}$, $F(e_2, r, 1) = \{u_1/0.1, u_2/03, u_3/0.7, u_4/0.4\}$,
$F(e_3, p, 1) = \{u_1/0.6, u_2/0.2, u_3/0.4, u_4/0.3\}$, $F(e_3, q, 1) = \{u_1/0.5, u_2/0.3, u_3/0.5, u_4/0.7\}$
$F(e_3, r, 1) = \{u_1/0.3, u_2/0.4, u_3/0.3, u_4/0.4\}$, $F(e_1, p, 0) = \{u_1/0.6, u_2/0.4, u_3/0.4, u_4/0.6\}$
$F(e_1, q, 0) = \{u_1/0.3, u_2/0.6, u_3/0.4, 0/u_4\}$, $F(e_1, r, 0) = \{u_1/0.5, u_2/0.1, u_3/0.7, u_4/0.5\}$
$F(e_2, p, 0) = \{u_1/0.5, u_2/0.6, u_3/0.4, u_4/0.2\}$, $F(e_2, q, 0) = \{u_1/0.2, u_2/0.4, u_3/0.5, u_4/0.1\}$
$F(e_2, r, 0) = \{u_1/0.7, u_2/0.5, u_3/02, u_4/0.5\}$, $F(e_3, p, 0) = \{u_1/0.3, u_2/0.5, u_3/0.5, u_4/0.6\}$
$F(e_3, q, 0) = \{u_1/0.3, u_2/0.5, u_3/0.4, u_4/0.2\}$, $F(e_3, r, 0) = \{u_1/0.5, u_2/0.4, u_3/0.6, u_4/0.5\}$

Then we can view the fuzzy expert decision set Z as consisting of the following collection of approximations.

$$Z = \begin{matrix} \{\{u_1/0.3, u_2/0.5, u_3/0.7, u_4/0.1\}, \{u_1/0.5, u_2/0.2, u_3/0.3, 1/u_4\} \\ \{u_1/0.4, u_2/0.8\ u_3/0.3, u_4/0.4\}, \{u_1/0.3, u_2/0.2, u_3/0.5, u_4/0.6\} \\ \{u_1/0.6, u_2/0.4, u_3/0.3, u_4/0.7\}, \{u_1/0.1, u_2/03, u_3/0.7, u_4/0.4\} \\ \{u_1/0.6, u_2/0.2, u_3/0.4, u_4/0.3\}, \{u_1/0.5, u_2/0.3, u_3/0.5, u_4/0.7\} \\ \{u_1/0.3, u_2/0.4, u_3/0.3, u_4/0.4\}, \{u_1/0.6, u_2/0.4, u_3/0.4, u_4/0.6\} \\ \{u_1/0.3, u_2/0.6, u_3/0.4, 0/u_4\}, \{u_1/0.5, u_2/0.1, u_3/0.7, u_4/0.5\} \\ \{u_1/0.5, u_2/0.6, u_3/0.4, u_4/0.2\}, \{u_1/0.2, u_2/0.4, u_3/0.5, u_4/0.1\} \\ \{u_1/0.7, u_2/0.5, u_3/02, u_4/0.5\}, \{u_1/0.3, u_2/0.5, u_3/0.5, u_4/0.6\} \\ \{u_1/0.3, u_2/0.5, u_3/0.4, u_4/0.2\}, \{u_1/0.5, u_2/0.4, u_3/0.6, u_4/0.5\}\} \end{matrix}$$

Definition 2: For two fuzzy expert decision set A and B over U, A is called a fuzzy expert decision subset of B if

1. $B \subseteq A$,
2. $\forall \varepsilon\ \epsilon A,\ A(\varepsilon) is\ fuzzy\ subset\ of\ B(\varepsilon)$.

This relationship is denoted by $A \,\tilde{\subseteq}\,$ B. In this case B is called fuzzy expert decision superset of A

Definition 3: Two fuzzy expert decision sets A and B over U are said to be equal if A is a fuzzy expert decision subset of B and B is a fuzzy expert decision subset of A.

Example 2: Consider example 1. Suppose that the company takes the opinion of the experts once again after a month using the products. Let

A= $\{\{u_1/0.3, u_2/0.5, u_3/0.7, u_4/0.1\}, \{u_1/0.3, u_2/0.2, u_3/0.5, u_4/0.6\},$
$\{u_1/0.4, u_2/0.8\ u_3/0.3, u_4/0.4\}, u_1/0.5, u_2/0.4, u_3/0.6, u_4/0.5\}$
$\{u_1/0.3, u_2/0.4, u_3/0.3, u_4/0.4\}, \{u_1/0.6, u_2/0.4, u_3/0.4, u_4/0.6\}$
$\{u_1/0.7, u_2/0.5, u_3/02, u_4/0.5\}, \{u_1/0.3, u_2/0.5, u_3/0.5, u_4/0.6\}\}$

and

B = $\{\{u_1/0.3, u_2/0.5, u_3/0.7, u_4/0.1\}, u_1/0.5, u_2/0.4, u_3/0.6, u_4/0.5\}$
$\{u_1/0.7, u_2/0.5, u_3/02, u_4/0.5\}, \{u_1/0.6, u_2/0.4, u_3/0.4, u_4/0.6\}\}$

Therefore $B \,\widetilde{\subseteq}\, A$.

Definition 4: Consider example 1. An agree - fuzzy expert decision set Z_1 over U is a fuzzy expert decision subset of A defined as follows $Z_1 = \{F_1(\alpha): \alpha \epsilon E\ x\ X\ x\ \{1\}\}$

Definition 5: Consider example 1. A disagree fuzzy decision expert set Z_0 over U is a fuzzy expert decision subset of A defined as follows $Z_0 = \{F_0(\alpha): \alpha \epsilon E\ x\ X\ x\ \{0\}\}\ is$

Example 3: Then the agree fuzzy expert decision set Z_1 over U is

$Z_1 = \{u_1/0.3, u_2/0.5, u_3/0.7, u_4/0.1\}, \{u_1/0.5, u_2/0.2, u_3/0.3, 1/u_4\}$
$\{u_1/0.4, u_2/0.8\ u_3/0.3, u_4/0.4\}, \{u_1/0.3, u_2/0.2, u_3/0.5, u_4/0.6\}$
$\{u_1/0.6, u_2/0.4, u_3/0.3, u_4/0.7\}, \{u_1/0.1, u_2/03, u_3/0.7, u_4/0.4\}$
$\{u_1/0.6, u_2/0.2, u_3/0.4, u_4/0.3\}, \{u_1/0.5, u_2/0.3, u_3/0.5, u_4/0.7\}$
$\{u_1/0.3, u_2/0.4, u_3/0.3, u_4/0.4\}\}$

and the disagree fuzzy expert decision set Z_0 over U is

$Z_0 = \{\{u_1/0.3, u_2/0.6, u_3/0.4, 0/u_4\}, \{u_1/0.5, u_2/0.1, u_3/0.7, u_4/0.5\}$
$\{u_1/0.5, u_2/0.6, u_3/0.4, u_4/0.2\}, \{u_1/0.2, u_2/0.4, u_3/0.5, u_4/0.1\}$
$\{u_1/0.7, u_2/0.5, u_3/02, u_4/0.5\}, \{u_1/0.3, u_2/0.5, u_3/0.5, u_4/0.6\}$
$\{u_1/0.3, u_2/0.5, u_3/0.4, u_4/0.2\}, \{u_1/0.5, u_2/0.4, u_3/0.6, u_4/0.5\}$
$\{u_1/0.6, u_2/0.4, u_3/0.4, u_4/0.6\}\}$

IV. Operations of Fuzzy Expert Decision Set

In this section, we introduce the definitions of union, intersection and complement of fuzzy expert decision sets, derive their properties, and give some examples.

Definition 6: The complement of a fuzzy expert decision set A is denoted by A^c and is defined by , is the set of all elements a in U such that a is not in A.

Thus $A^c = \{a \epsilon U: a \notin A\}$

Example 4: Consider example 1

By using the basic fuzzy complement, we have

$$Z^c = \begin{array}{l} \{\{u_1/0.7, u_2/0.5, u_3/0.3, u_4/0.9\}, \{u_1/0.5, u_2/0.8, u_3/0.7, 0/u_4\} \\ \{u_1/0.6, u_2/0.2\ u_3/0.7, u_4/0.6\}, \{u_1/0.7, u_2/0.8, u_3/0.5, u_4/0.4\} \\ \{u_1/0.4, u_2/0.6, u_3/0.7, u_4/0.3\}, \{u_1/0.9, u_2/0.7, u_3/0.3, u_4/0.6\} \\ \{u_1/0.4, u_2/0.8, u_3/0.6, u_4/0.7\}, \{u_1/0.5, u_2/0.7, u_3/0.5, u_4/0.3\} \\ \{u_1/0.7, u_2/0.6, u_3/0.7, u_4/0.6\}, \{u_1/0.4, u_2/0.6, u_3/0.6, u_4/0.4\} \\ \{u_1/0.6, u_2/0.4, u_3/0.6, 1/u_4\}, \{u_1/0.5, u_2/0.2, u_3/0.3, u_4/0.5\} \\ \{u_1/0.5, u_2/0.4, u_3/0.6, u_4/0.8\}, \{u_1/0.8, u_2/0.6, u_3/0.5, u_4/0.9\} \\ \{u_1/0.3, u_2/0.5, u_3/0.8, u_4/0.5\}, \{u_1/0.7, u_2/0.5, u_3/0.5, u_4/0.4\} \\ \{u_1/0.7, u_2/0.5, u_3/0.6, u_4/0.8\}, \{u_1/0.5, u_2/0.6, u_3/0.4, u_4/0.5\}\} \end{array}$$

Proposition 1: If Z is a fuzzy expert decision set over U, then $(Z^C)^c = Z$

Definition 7: The union of two fuzzy expert decision sets A and B over U, denoted by $A \,\breve{\cup}\, B$, is set of all elements a in U such that a is A or a is in B.

Thus, $A \cup B = \{a\epsilon U: a\epsilon A\ or\ a\epsilon B\}$.

Example 5: Consider example 1.

A= $\{\{u_1/0.3, u_2/0.5, u_3/0.7, u_4/0.1\}, \{u_1/0.3, u_2/0.2, u_3/0.5, u_4/0.6\},$
$\{u_1/0.4, u_2/0.8\ u_3/0.3, u_4/0.4\}, \{u_1/0.5, u_2/0.4, u_3/0.6, u_4/0.5\}$
$\{u_1/0.3, u_2/0.4, u_3/0.3, u_4/0.4\}, \{u_1/0.6, u_2/0.4, u_3/0.4, u_4/0.6\}\}$

and

B = $\{\{u_1/0.3, u_2/0.5, u_3/0.7, u_4/0.1\}, \{u_1/0.5, u_2/0.4, u_3/0.6, u_4/0.5\}$
$\{u_1/0.7, u_2/0.5, u_3/02, u_4/0.5\}, \{u_1/0.6, u_2/0.4, u_3/0.4, u_4/0.6\}$
$\{u_1/0.3, u_2/0.5, u_3/0.5, u_4/0.6\}\}$

$A \cup B = \{\{u_1/0.3, u_2/0.5, u_3/0.7, u_4/0.1\}, \{u_1/0.5, u_2/0.4, u_3/0.6, u_4/0.5\}$
$\{u_1/0.3, u_2/0.4, u_3/0.3, u_4/0.4\}, \{u_1/0.6, u_2/0.4, u_3/0.4, u_4/0.6\}$
$\{u_1/0.7, u_2/0.5, u_3/02, u_4/0.5\}, \{u_1/0.3, u_2/0.5, u_3/0.5, u_4/0.6\}\}$

Definition 8: The intersection of two fuzzy expert decision sets A and B over U, denoted by $A \,\widetilde{\cap}\, B$, is set of all elements a in U such that a is A and a is in B.

Thus, $A \cap B = \{a\epsilon U: a\epsilon A\ \ and\ \ a\epsilon B\}$.

Example 6:

A= $\{\{u_1/0.3\,,\ u_2/0.5,\ u_3/0.7,\ u_4/0.1\}, \{u_1/0.3\,,\ u_2/0.2,\ u_3/0.5,\ u_4/0.6\},$
$\{u_1/0.4\,,\ u_2/0.8\ u_3/0.3,\ u_4/0.4\},\{\ u_1/0.5\,,\ u_2/0.4,\ u_3/0.6,\ u_4/0.5\}$
$\{u_1/0.3\,,\ u_2/0.4,\ u_3/0.3,\ u_4/0.4\}, \{u_1/0.6\,,\ u_2/0.4,\ u_3/0.4,\ u_4/0.6\}\ \}\}$

and

B = $\{\{u_1/0.3\,,\ u_2/0.5,\ u_3/0.7,\ u_4/0.1\}, \{\ u_1/0.5\,,\ u_2/0.4,\ u_3/0.6,\ u_4/0.5\}$
$\{u_1/0.7\,,\ u_2/0.5,\ u_3/02,\ u_4/0.5\}, \{u_1/0.6\,,\ u_2/0.4,\ u_3/0.4,\ u_4/0.6\}$
$\{u_1/0.3\,,\ u_2/0.5,\ u_3/0.5,\ u_4/0.6\}\}$

A $\cap$ B = $\{\{u_1/0.3\,,\ u_2/0.5,\ u_3/0.7,\ u_4/0.1\},\{\ u_1/0.5\,,\ u_2/0.4,\ u_3/0.6,\ u_4/0.5\}$
$\{u_1/0.6\,,\ u_2/0.4,\ u_3/0.4,\ u_4/0.6\}\ \}$

Definition 9: Two fuzzy expert decision sets A and B are called disjoint if and only in they have no element in common.

Definition 10: If A and B are two fuzzy expert decision set over U the " A and B " denoted by A $\wedge$ B is defined by $A \wedge B = (H, AxB)$

such that $H(\alpha,\beta) = t(f(\alpha), G(\beta)),\ \forall(\alpha,\beta) \in A\ X\ B$ where t is a t-norm.

Definition 11: If A and B are two fuzzy expert decision set over U the " A or B " denoted by A $\vee$B is defined by $A \vee B = (H, AxB)$

such that $H(\alpha,\beta) = s(f(\alpha), G(\beta)),\ \forall(\alpha,\beta) \in A\ X\ B$ where s is a s-norm.

V. An Application of Fuzzy Expert Decision Set in Decision Making

In this section, we present an application of Fuzzy Expert Decision Set theory in a decision making problem. Assume that a company wants to fill a position. There are four candidates who form the universe u = $\{u_1, u_2, u_3, u_4\}$, the hiring committee considers a set of parameters, E= $\{e_1, e_2, e_3\}$, the parameters e_i = {i= 1, 2, 3}, stand for “experience”, “computer knowledge” and “good speaking” respectively. Let $X = \{p,q,r\}$ be a set of experts (Committee members). After a serious discussion the committee constructs the following Fuzzy Expert Decision Set. Consider example 1,

$$Z = \begin{array}{l} \{\{u_1/0.3\,,\ u_2/0.5,\ u_3/0.7,\ u_4/0.1\}, \{u_1/0.5\,,\ u_2/0.2,\ u_3/0.3, 1/\ u_4\} \\ \{u_1/0.4\,,\ u_2/0.8\ u_3/0.3,\ u_4/0.4\}, \{u_1/0.3\,,\ u_2/0.2,\ u_3/0.5,\ u_4/0.6\} \\ \{u_1/0.6\,,\ u_2/0.4,\ u_3/0.3,\ u_4/0.7\}, \{u_1/0.1\,,\ u_2/03,\ u_3/0.7,\ u_4/0.4\} \\ \{u_1/0.6\,,\ u_2/0.2,\ u_3/0.4,\ u_4/0.3\}, \{u_1/0.5\,,\ u_2/0.3,\ u_3/0.5,\ u_4/0.7\} \\ \{u_1/0.3\,,\ u_2/0.4,\ u_3/0.3,\ u_4/0.4\}, \{u_1/0.6\,,\ u_2/0.4,\ u_3/0.4,\ u_4/0.6\} \\ \{u_1/0.3\,,\ u_2/0.6,\ u_3/0.4, 0/\ u_4\}\,, \{u_1/0.5\,,\ u_2/0.1,\ u_3/0.7,\ u_4/0.5\} \\ \{u_1/0.5\,,\ u_2/0.6,\ u_3/0.4,\ u_4/0.2\}, \{u_1/0.2\,,\ u_2/0.4,\ u_3/0.5,\ u_4/0.1\} \\ \{u_1/0.7\,,\ u_2/0.5,\ u_3/02,\ u_4/0.5\}\,, \{u_1/0.3\,,\ u_2/0.5,\ u_3/0.5,\ u_4/0.6\} \\ \{u_1/0.3\,,\ u_2/0.5,\ u_3/0.4,\ u_4/0.2\}, \{u_1/0.5\,,\ u_2/0.4,\ u_3/0.6,\ u_4/0.5\}\} \end{array}$$

In **Table 1** and **Table 2** we present the agree Fuzzy Expert Decision Set and disagree Fuzzy Expert Decision Set respectively.

The following algorithm may be followed by the company to fill the position.

1. Input the Fuzzy Expert Decision Set (*Z*).
2. Find an Agree- Fuzzy Expert Decision Set and a Disagree- Fuzzy Expert Decision Set.
3. Find $x_i = \sum_i u_i$ for agree Fuzzy Expert Decision Set.
4. Find $y_j = \sum_i u_j$ for disagree Fuzzy Expert Decision Set.
5. Find Max (x_i) and Max (y_i).

   If u_i and u_j has more than one value,

   Then any one of them could be chosen by the company using its option.
6. Find S, which

   S= Max (Max (x_i), Max (y_j))

   If Max (x_i) = Max (y_j),

   Then S= Max (x_i) or Max (y_j).

Table 1. Agree Fuzzy Expert Decision Set.

U	**u_1**	**u_2**	**u_3**	**u_4**
e_1, p	0.3	0.5	0.7	0.1
e_2, p	0.3	0.2	0.5	0.6
e_3, p	0.6	0.2	0.4	0.3
e_1, q	0.5	0.2	0.3	1
e_2, q	0.6	0.4	0.3	0.7
e_3, q	0.5	0.3	0.5	0.7
e_1, r	0.4	0.8	0.3	0.4
e_2, r	0.1	0.3	0.7	0.4
e_3, r	0.3	0.4	0.3	0.4
x_i	3.6	3.3	4	**4.6**

Table 2. Disagree Fuzzy Expert Decision Set.

U	**u_1**	**u_2**	**u_3**	**u_4**
e_1, p	0.6	0.4	0.4	0.6
e_2, p	0.5	0.6	0.4	0.2
e_3, p	0.3	0.5	0.5	0.6
e_1, q	0.3	0.6	0.4	0
e_2, q	0.2	0.4	0.5	0.1
e_3, q	0.3	0.5	0.4	0.2
e_1, r	0.5	0.1	0.7	0.5
e_2, r	0.7	0.5	0.2	0.5
e_3, r	0.5	0.4	0.6	0.5
y_i	3.9	4.0	**4.1**	3.2

Find Max (x_i) and Max (y_j) from this algorithm,

Max (x_i) = 4.6 (u_4) and Max (y_j) = 4.1 (u_3)

Then, S= Max (Max (x_i) = 4.6 (u_4), Max (y_j) = 4.1 (u_3))

Therefore, S= 4.6 ($u_{4,}$)

So the committee will decide candidate 4 for the job.

VI. Conclusion

In this paper, we have introduced the concept of Fuzzy Expert Decision Set which is more useful and effective and studied several of its properties. Also the fundamental operations on Fuzzy Expert Decision Set namely complement, union, intersection, AND and OR have been defined. An application of this theory has been given to solve a decision making problem.

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