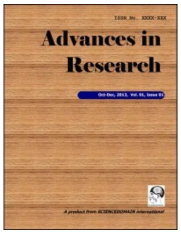

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A Note on "Soft Set Theory and *Uni-int* Decision Making"

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Author's contribution

This whole work was carried out by the author ZZ.

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ABSTRACT

Aims: The aim of this paper is to propose a note on "Soft set theory and *uni-int* decision making".
Study Design: In this note, we point out by an example that Çagman and Enginoglu's method is very likely to get an empty decision set.
Place and Duration of Study: In a recent paper [Çaðman, N., Enginoðlu, S., 2010. Soft set theory and *uni-int* decision making. European Journal of Operational Research 207, 848-855], Çaðman and Enginoðlu constructed an *uni-int* decision making method which selected a set of optimum elements from the alternatives.
Methodology: Furthermore, we present a new approach to soft set based decision making
Results: We give some illustrative examples.
Conclusion: Two numerical examples illustrate the practicality and effectiveness of the developed approach.

Keywords: Distributed decision making; soft sets; choice value; uni-int decision function; uni-int decision making.

1. INTRODUCTION

Soft set theory, firstly proposed by [1], is a general mathematical tool for dealing with uncertainty. Compared with some traditional tools for dealing with uncertainties, such as the

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theory of probability, the theory of fuzzy sets [2] and the theory of rough sets [3], the advantage of soft set theroy is that it is free from the inadequacy of the parametrization tools of those theories. According to Molodtsov [1], the soft set theory has been successfully applied in many fields such as functions smoothness, game theory, riemann-integration, theory of measurement and so on. In recent years, soft set theory has received much attention. Maji and Roy [4] first introduced the soft set into the decision making problems. Çaðman and Enginoðlu [5] redefined the operations of Molodtsov's soft sets, and proposed products of soft sets and *uni-int* decision function. By using these new definitions they constructed an *uni-int* decision making method which selected a set of optimum elements from the alternatives. It should be noted that the Çaðman and Enginoðlu's method has its inherent limitation. There exist some soft set based decision problems in which Çaðman and Enginoðlu's method is very likely to get an empty decision set. The aim of this note is to show the limitation of Çaðman and Enginoðlu's method by an example. Moreover, to overcome this limitation, we present a new approach to soft set based decision making problems and give some illustrative examples.

2. PRELIMINARIES

In the current section, we will briefly recall the notions of soft sets. Throughout this paper, let U be an initial universe of objects and E the set of parameters in relation to objects in U. Parameters are often attributes, characteristics, or properties of objects. Let $P(U)$ denote the power set of U and $A \subseteq E$.

Definition 2.1 [5]. A soft set F_A on the universe U is defined by the set of ordered pairs

$$F_A = \{(x, f_A(x)) : x \in E, f_A(x) \in P(U)\},$$

where $f_A : E \to P(U)$ such that $f_A(x) = \emptyset$ if $x \notin A$.

The set of all soft sets over U is denoted by $S(U)$.

Definition 2.2 [5]. If $F_A, F_B \in S(U)$, then $\wedge$-product of two soft sets F_A and F_B, denoted by $F_A \wedge F_B$, is a soft set defined by the approximate function

$$f_{A\wedge B} : E \times E \to P(U),\ f_{A\wedge B}(x, y) = f_A(x) \cap f_B(y), \text{ for all } x, y \in E.$$

Assume that $\wedge(U)$ is a set of all $\wedge$-products of the soft sets over U.

Definition 2.3 [5]. Let $F_A \wedge F_B \in \wedge(U)$. Then *uni-int* operators for the $\wedge$-products, denoted by $uni_x int_y$ and $uni_y int_x$, are defined, respectively, as

$$uni_x int_y : \wedge(U) \to P(U),\ uni_x int_y (F_A \wedge F_B) = \bigcup_{x\in A} \left(\bigcap_{y\in B} \left(f_{A\wedge B}(x, y)\right)\right),$$

$$uni_y int_x : \wedge(U) \to P(U),\ uni_y int_x (F_A \wedge F_B) = \bigcup_{y\in B} \left(\bigcap_{x\in A} \left(f_{A\wedge B}(x, y)\right)\right).$$

Definition 2.4 [5]. Let $F_A \wedge F_B \in \wedge(U)$. Then $uni\text{-}int$ decision function for the $\wedge$-products, denoted by $uni\text{-}int$, is defined by,

$$uni\text{-}int : \wedge(U) \to P(U),$$
$$uni\text{-}int(F_A \wedge F_B) = uni_x int_y (F_A \wedge F_B) \cup uni_y int_x (F_A \wedge F_B)$$

that reduces the size of the universe U. Hence, the values $uni\text{-}int(F_A \wedge F_B)$ is a subset of U called $uni\text{-}int$ decision set of $F_A \wedge F_B$.

3. ÇAĐMAN AND ENGINOĐLU'S METHOD AND ITS LIMITATION

In [5], Çaðman and Enginoðlu constructed an *uni-int* decision making method which selected a set of optimum elements from the alternatives. This method was organized as in the following algorithm: Assume that a set of alternatives and a set of parameters are given.

Algorithm 3.1 [5].

Step 1: Choose feasible subsets of the set of parameters,
Step 2: Construct the soft sets for each set of parameters,
Step 3: Find the $\wedge$-product of the soft sets,
Step 4: Compute the *uni-int* decision set of the product.

It should be noted that the Çaðman and Enginoðlu's method has the inherent limitation. There exist some soft set based decision problems in which the algorithm 3.1 is very likely to get an empty decision set. To illustrate this limitation, let us consider the following example.

Example 3.1. Let $U = \{u_1, u_2, \cdots, u_{48}\}$ be the set of objects. The parameter sets $E = \{x_1, x_2, \cdots, x_7\}$, $A = \{x_1, x_2, x_4, x_7\}$, and $B = \{x_1, x_2, x_5\}$. The soft sets F_A and F_B are shown as follows, respectively.

$$F_A = \left\{ \begin{array}{l} \left(x_1, \{u_7, u_{13}, u_{21}, u_{28}, u_{31}, u_{32}, u_{36}, u_{39}, u_{41}, u_{43}, u_{44}, u_{48}\}\right), \\ \left(x_2, \{u_1, u_3, u_{13}, u_{18}, u_{19}, u_{21}, u_{22}, u_{24}, u_{28}, u_{32}, u_{36}, u_{42}, u_{44}, u_{46}\}\right), \\ \left(x_4, \{u_2, u_3, u_{15}, u_{18}, u_{23}, u_{25}, u_{28}, u_{30}, u_{33}, u_{36}, u_{38}, u_{42}, u_{43}\}\right), \\ \left(x_7, \{u_1, u_5, u_{12}, u_{13}, u_{17}, u_{20}, u_{24}, u_{29}, u_{34}, u_{41}, u_{45}, u_{47}\}\right) \end{array} \right\},$$

$$F_B = \left\{ \begin{array}{l} \left(x_1, \{u_3, u_4, u_5, u_8, u_{14}, u_{21}, u_{22}, u_{26}, u_{27}, u_{34}, u_{35}, u_{37}, u_{40}, u_{46}\}\right), \\ \left(x_2, \{u_1, u_4, u_7, u_{10}, u_{11}, u_{13}, u_{15}, u_{29}, u_{30}, u_{32}, u_{36}, u_{42}, u_{43}, u_{45}\}\right), \\ \left(x_5, \{u_2, u_4, u_8, u_9, u_{12}, u_{13}, u_{14}, u_{16}, u_{17}, u_{23}, u_{28}, u_{36}, u_{44}\}\right) \end{array} \right\}.$$

According to Definition 2.2, $F_A \wedge F_B$ is computed as follows:

$$F_A \wedge F_B = \left\{ \begin{array}{l} \left((x_1,x_1),\{u_{21}\}\right),\left((x_1,x_2),\{u_7,u_{13},u_{32},u_{36},u_{43}\}\right), \\ \left((x_1,x_5),\{u_{13},u_{28},u_{36},u_{44}\}\right),\left((x_2,x_1),\{u_3,u_{21},u_{22},u_{46}\}\right), \\ \left((x_2,x_2),\{u_1,u_{13},u_{32},u_{36},u_{42}\}\right),\left((x_2,x_5),\{u_{13},u_{28},u_{36},u_{44}\}\right), \\ \left((x_4,x_1),\{u_3\}\right),\left((x_4,x_2),\{u_{15},u_{30},u_{36},u_{42},u_{43}\}\right), \\ \left((x_4,x_5),\{u_2,u_{23},u_{28},u_{36}\}\right),\left((x_7,x_1),\{u_5,u_{34}\}\right), \\ \left((x_7,x_2),\{u_1,u_{13},u_{29},u_{45}\}\right),\left((x_7,x_5),\{u_{12},u_{13},u_{17}\}\right) \end{array} \right\}.$$

By the algorithm 3.1, we can arrive at a decision set $uni\text{-}int\left(F_A \wedge F_B\right)$ as follows:

$$\begin{aligned} uni_x int_y\left(F_A \wedge F_B\right) &= \bigcup_{x\in A}\left(\bigcap_{y\in B}\left(f_{A\wedge B}(x,y)\right)\right) \\ &= \bigcup \left\{ \begin{array}{l} \bigcap\left\{\{u_{21}\},\{u_7,u_{13},u_{32},u_{36},u_{43}\},\{u_{13},u_{28},u_{36},u_{44}\}\right\}, \\ \bigcap\left\{\{u_3,u_{21},u_{22},u_{46}\},\{u_1,u_{13},u_{32},u_{36},u_{42}\},\{u_{13},u_{28},u_{36},u_{44}\}\right\}, \\ \bigcap\left\{\{u_3\},\{u_{15},u_{30},u_{36},u_{42},u_{43}\},\{u_2,u_{23},u_{28},u_{36}\}\right\}, \\ \bigcap\left\{\{u_5,u_{34}\},\{u_1,u_{13},u_{29},u_{45}\},\{u_{12},u_{13},u_{17}\}\right\} \end{array} \right\}, \\ &= \varnothing \cup \varnothing \cup \varnothing \cup \varnothing = \varnothing \end{aligned}$$

$$\begin{aligned} uni_y int_x\left(F_A \wedge F_B\right) &= \bigcup_{y\in B}\left(\bigcap_{x\in A}\left(f_{A\wedge B}(x,y)\right)\right) \\ &= \bigcup \left\{ \begin{array}{l} \bigcap\left\{\{u_{21}\},\{u_3,u_{21},u_{22},u_{46}\},\{u_3\},\{u_5,u_{34}\}\right\}, \\ \bigcap\left\{\{u_7,u_{13},u_{32},u_{36},u_{43}\},\{u_1,u_{13},u_{32},u_{36},u_{42}\},\{u_{15},u_{30},u_{36},u_{42},u_{43}\},\{u_1,u_{13},u_{29},u_{45}\}\right\}, \\ \bigcap\left\{\{u_{13},u_{28},u_{36},u_{44}\},\{u_{13},u_{28},u_{36},u_{44}\},\{u_2,u_{23},u_{28},u_{36}\},\{u_{12},u_{13},u_{17}\}\right\}, \end{array} \right\} \\ &= \varnothing \cup \varnothing \cup \varnothing = \varnothing \end{aligned}$$

$$uni\text{-}int\left(F_A \wedge F_B\right) = uni_x int_y\left(F_A \wedge F_B\right) \cup uni_y int_x\left(F_A \wedge F_B\right) = \varnothing \cup \varnothing = \varnothing .$$

Hence by using the Çaðman and Enginoðlu's method the final optimal decision set is empty.

Following let us analyze the algorithm 3.1. Suppose that $U = \{u_1, u_2, \cdots, u_m\}$ is a set of m objects. $A = \{x_1, x_2, \cdots, x_k\}$ and $B = \{y_1, y_2, \cdots, y_l\}$ are two sets of parameters. Then we have

$$
\begin{aligned}
uni_x int_y\left(F_A \wedge F_B\right) &= \bigcup_{x\in A}\left(\bigcap_{y\in B}\left(f_{A\wedge B}(x,y)\right)\right) \\
&= \left(f_{A\wedge B}(x_1,y_1)\cap f_{A\wedge B}(x_1,y_2)\cap\cdots\cap f_{A\wedge B}(x_1,y_l)\right) \\
&\quad \cup\left(f_{A\wedge B}(x_2,y_1)\cap f_{A\wedge B}(x_2,y_2)\cap\cdots\cap f_{A\wedge B}(x_2,y_l)\right) \\
&\quad \cup\cdots\cup\left(f_{A\wedge B}(x_k,y_1)\cap f_{A\wedge B}(x_k,y_2)\cap\cdots\cap f_{A\wedge B}(x_k,y_l)\right) \\
&= \left(f_A(x_1)\cap f_B(y_1)\cap f_B(y_2)\cap\cdots\cap f_B(y_l)\right) \\
&\quad \cup\left(f_A(x_2)\cap f_B(y_1)\cap f_B(y_2)\cap\cdots\cap f_B(y_l)\right) \\
&\quad \cup\cdots\cup\left(f_A(x_k)\cap f_B(y_1)\cap f_B(y_2)\cap\cdots\cap f_B(y_l)\right),
\end{aligned}
$$

$$
\begin{aligned}
uni_y int_x\left(F_A \wedge F_B\right) &= \bigcup_{y\in B}\left(\bigcap_{x\in A}\left(f_{A\wedge B}(x,y)\right)\right) \\
&= \left(f_{A\wedge B}(x_1,y_1)\cap f_{A\wedge B}(x_2,y_1)\cap\cdots\cap f_{A\wedge B}(x_k,y_1)\right) \\
&\quad \cup\left(f_{A\wedge B}(x_1,y_2)\cap f_{A\wedge B}(x_2,y_2)\cap\cdots\cap f_{A\wedge B}(x_k,y_2)\right) \\
&\quad \cup\cdots\cup\left(f_{A\wedge B}(x_1,y_l)\cap f_{A\wedge B}(x_2,y_l)\cap\cdots\cap f_{A\wedge B}(x_k,y_l)\right) \\
&= \left(f_B(y_1)\cap f_A(x_1)\cap f_A(x_2)\cap\cdots\cap f_A(x_k)\right) \\
&\quad \cup\left(f_B(y_2)\cap f_A(x_1)\cap f_A(x_2)\cap\cdots\cap f_A(x_k)\right) \\
&\quad \cup\cdots\cup\left(f_B(y_l)\cap f_A(x_1)\cap f_A(x_2)\cap\cdots\cap f_A(x_k)\right),
\end{aligned}
$$

$$
\begin{aligned}
uni\text{-}int\left(F_A \wedge F_B\right) &= uni_x int_y\left(F_A \wedge F_B\right)\cup uni_y int_x\left(F_A \wedge F_B\right) \\
&= \left\{ u_i \;\middle|\; \begin{array}{l}
u_i\in U, u_i \text{ simultaneously possesses attributes } x_1, y_1, y_2, \cdots, y_l, \text{or,} \\
u_i \text{ simultaneously possesses attributes } x_2, y_1, y_2, \cdots, y_l, \text{or,} \\
\cdots, \text{or,} \\
u_i \text{ simultaneously possesses attributes } x_k, y_1, y_2, \cdots, y_l, \text{or,} \\
u_i \text{ simultaneously possesses attributes } y_1, x_1, x_2, \cdots, x_k, \text{or,} \\
u_i \text{ simultaneously possesses attributes } y_2, x_1, x_2, \cdots, x_k, \text{or,} \\
\cdots, \text{or,} \\
u_i \text{ simultaneously possesses attributes } y_l, x_1, x_2, \cdots, x_k.
\end{array} \right\}
\end{aligned}
$$

Hence, we can obtain that $uni\text{-}int\left(F_A \wedge F_B\right)$ is a nonempty decision set if and only if there exists an object $u_i \in U$ which possesses all attributes in A and some attribute in B, or there exists an object $u_j \in U$ which possesses all attributes in B and some attribute in A. It is easy to see that the condition, under which $uni\text{-}int\left(F_A \wedge F_B\right)$ is a nonempty set, is so restrictive that it may limit the application of algorithm 3.1 in some practical problems. In other words, Çagman and Enginoglu's method is very likely to get an empty decision set in some decision making problems.

4. A NEW APPROACH TO SOFT SET BASED DECISION MAKING

To overcome the limitation of the algorithm 3.1, in this section we shall present a new approach to soft set based decision making problems. This approach is based on the following concept called the union of soft sets.

Definition 4.1. Suppose that $A_1, A_2, \cdots, A_n$ are n sets of parameters and $F_{A_1}, F_{A_2}, \cdots, F_{A_n} \in S(U)$. Then union of F_{A_1}, F_{A_2}, $\cdots$, F_{A_n}, denoted by $\tilde{\bigcup}_{i=1}^{n} F_{A_i}$, is a soft set defined by the approximate function

$$f_{\bigcup_{i=1}^{n} A_i}(x) = \bigcup_{i=1}^{n} f_{A_i}(x), \text{ for all } x \in E.$$

Roy and Maji [6] pointed out that the object recognition problem may be viewed as a multiobserver decision making problem, where the final identification of the object is based on the set of inputs from different observers who provide the overall object characterisation in terms of diverse sets of parameters. Let $U = \{u_1, u_2, \cdots, u_m\}$ be a set of m objects, which may be characterised by n sets of parameters $A_1, A_2, \cdots, A_n$. The elements of A_i represents a specific property set. Here we assume that these property sets may be viewed as crisp sets. In view of above we may now define a soft set F_{A_i} which characterises a set of objects having the parameter set A_i.

Algorithm 4.1.

Step 1: Input the (resultant) soft sets F_{A_1}, F_{A_2}, $\cdots$, F_{A_n}.

Step 2: Compute the union $\tilde{\bigcup}_{i=1}^{n} F_{A_i}$ of F_{A_1}, F_{A_2}, $\cdots$, F_{A_n}.

Step 3: Present $\tilde{\bigcup}_{i=1}^{n} F_{A_i}$ in tabular form and compute the choice value $c_i = \sum_{x \in E} f_{\bigcup_{i=1}^{n} A_i}(x)(u_i)$, $i = 1, 2, \cdots, m$.

Step 4: The optimal decision is to select u_k if $c_k = \max_{1 \le i \le m} c_i$.

Step 5: If k has more than one value, then the u_k with the smallest subscript may be chosen.

To illustrate this idea, let us reconsider the example 3.1.

Example 4.1. Let $U = \{u_1, u_2, \cdots, u_{48}\}$ be the set of objects. The parameter sets $E = \{x_1, x_2, \cdots, x_7\}$, $A = \{x_1, x_2, x_4, x_7\}$, and $B = \{x_1, x_2, x_5\}$. Two soft sets F_A and F_B are shown as the example 3.1. The union of F_A and F_B are given as follows.

$$F_A \tilde{\cup} F_B = \left\{ \begin{array}{l} (x_1, \{u_3, u_4, u_5, u_7, u_8, u_{13}, u_{14}, u_{21}, u_{22}, u_{26}, u_{27}, u_{28}, u_{31}, u_{32}, u_{34}, u_{35}, u_{36}, u_{37}, u_{39}, u_{40}, u_{41}, u_{43}, u_{44}, u_{46}, u_{48}\}), \\ (x_2, \{u_1, u_3, u_4, u_7, u_{10}, u_{11}, u_{13}, u_{15}, u_{18}, u_{19}, u_{21}, u_{22}, u_{24}, u_{28}, u_{29}, u_{30}, u_{32}, u_{36}, u_{42}, u_{43}, u_{44}, u_{45}, u_{46}\}), \\ (x_4, \{u_2, u_3, u_{15}, u_{18}, u_{23}, u_{25}, u_{28}, u_{30}, u_{33}, u_{36}, u_{38}, u_{42}, u_{43}\}), \\ (x_5, \{u_2, u_4, u_8, u_9, u_{12}, u_{13}, u_{14}, u_{16}, u_{17}, u_{23}, u_{28}, u_{36}, u_{44}\}) \\ (x_7, \{u_1, u_5, u_{12}, u_{13}, u_{17}, u_{20}, u_{24}, u_{29}, u_{34}, u_{41}, u_{45}, u_{47}\}) \end{array} \right\}$$

Following we compute the choice value c_i as follows:

Table 1. Choice values

U	**Choice value**
u_9 , u_{10} , u_{11} , u_{16} , u_{19} , u_{20} , u_{25} , u_{26} , u_{27} , u_{31} , u_{33} , u_{35} , u_{37} , u_{38} , u_{39} , u_{40} , u_{47} , u_{48}	1
u_1 , u_2 , u_5 , u_7 , u_8 , u_{12} , u_{14} , u_{15} , u_{17} , u_{18} , u_{21} , u_{22} , u_{23} , u_{24} , u_{29} , u_{30} , u_{32} , u_{34} , u_{41} , u_{42} , u_{45} , u_{46}	2
u_3 , u_4 , u_{43} , u_{44}	3
u_{13} , u_{28} , u_{36}	4

From the above table, it is clear that the maximum choice value is $\max\limits_{1 \le i \le 48} \{c_i\} = \{c_{13}, c_{28}, c_{36}\}$. Therefore, according to the algorithm 4.1, u_{13} could be also selected as the optimal alternatives.

To further illustrate our idea, let's consider the following example which is adopted from [5] with some modifications.

Example 4.2. Assume that a company wants to fill a position. There are 48 candidates who fill in a form in order to apply formally for the position. There are three decision makers; one of them is from the department of human resources, one of them is from the board of directors, and one of them is from the department of public relations. They want to interview the candidates. Assume that the set of candidates $U = \{u_1, u_2, \cdots, u_{48}\}$ which may be characterized by a set of parameters $E = \{x_1, x_2, \cdots, x_8\}$. For $i = 1, 2, \cdots, 8$, the parameters x_i stand for "experience", "computer knowledge", "training", "young age", "higher education", "marriage status", "good health" and "skilled foreign languages", respectively. The decision makers considers set of parameters, $A = \{x_1, x_2, x_4, x_7\}$, $B = \{x_1, x_2, x_5\}$ and $C = \{x_1, x_3, x_8\}$, respectively, to evaluate the candidates. Then the decision makers constructs the following three soft sets over U according to their parameters, respectively,

$$F_A = \left\{ \begin{array}{l} (x_1, \{u_4, u_7, u_{13}, u_{21}, u_{28}, u_{31}, u_{32}, u_{36}, u_{39}, u_{41}, u_{43}, u_{44}, u_{48}\}), \\ (x_2, \{u_1, u_3, u_{13}, u_{18}, u_{19}, u_{21}, u_{22}, u_{24}, u_{28}, u_{32}, u_{36}, u_{42}, u_{44}, u_{46}\}), \\ (x_4, \{u_2, u_3, u_{13}, u_{15}, u_{18}, u_{23}, u_{25}, u_{28}, u_{30}, u_{33}, u_{36}, u_{38}, u_{42}, u_{43}\}), \\ (x_7, \{u_1, u_5, u_{12}, u_{13}, u_{17}, u_{20}, u_{24}, u_{28}, u_{29}, u_{34}, u_{36}, u_{41}, u_{45}, u_{47}\}). \end{array} \right\}$$

$$F_B = \left\{ \begin{array}{l} \left(x_1, \{u_3, u_4, u_5, u_8, u_{14}, u_{21}, u_{22}, u_{26}, u_{27}, u_{34}, u_{35}, u_{37}, u_{40}, u_{42}, u_{46}\}\right), \\ \left(x_2, \{u_1, u_4, u_7, u_{10}, u_{11}, u_{13}, u_{15}, u_{21}, u_{29}, u_{30}, u_{32}, u_{36}, u_{42}, u_{43}, u_{45}\}\right), \\ \left(x_5, \{u_2, u_4, u_8, u_9, u_{12}, u_{13}, u_{14}, u_{16}, u_{17}, u_{21}, u_{23}, u_{28}, u_{36}, u_{42}, u_{44}\}\right). \end{array} \right\}$$

$$F_C = \left\{ \begin{array}{l} \left(x_1, \{u_2, u_4, u_6, u_9, u_{14}, u_{21}, u_{22}, u_{23}, u_{27}, u_{33}, u_{35}, u_{36}, u_{40}, u_{42}, u_{45}\}\right), \\ \left(x_3, \{u_1, u_3, u_8, u_{10}, u_{11}, u_{14}, u_{15}, u_{20}, u_{29}, u_{30}, u_{32}, u_{37}, u_{42}, u_{43}\}\right), \\ \left(x_8, \{u_2, u_4, u_7, u_9, u_{11}, u_{13}, u_{14}, u_{15}, u_{19}, u_{21}, u_{25}, u_{28}, u_{36}, u_{38}\}\right). \end{array} \right\}$$

The union of F_A , F_B and F_C are given as follows.

$$F_A \tilde{\bigcup} F_B \tilde{\bigcup} F_C = \left\{ \begin{array}{l} \left(x_1, \left\{ \begin{array}{l} u_2, u_3, u_4, u_5, u_6, u_7, u_8, u_9, u_{13}, u_{14}, u_{21}, u_{22}, u_{23}, u_{26}, u_{27}, u_{28}, u_{31}, u_{32}, u_{33}, u_{34}, u_{35}, u_{36}, u_{37}, u_{39}, u_{40}, \\ u_{41}, u_{42}, u_{43}, u_{44}, u_{45}, u_{46}, u_{48} \end{array} \right\}\right), \\ \left(x_2, \{u_1, u_3, u_4, u_7, u_{10}, u_{11}, u_{13}, u_{15}, u_{18}, u_{19}, u_{21}, u_{22}, u_{24}, u_{28}, u_{29}, u_{30}, u_{32}, u_{36}, u_{42}, u_{43}, u_{44}, u_{45}, u_{46}\}\right), \\ \left(x_3, \{u_1, u_3, u_8, u_{10}, u_{11}, u_{14}, u_{15}, u_{20}, u_{29}, u_{30}, u_{32}, u_{37}, u_{42}, u_{43}\}\right), \\ \left(x_4, \{u_2, u_3, u_{13}, u_{15}, u_{18}, u_{23}, u_{25}, u_{28}, u_{30}, u_{33}, u_{36}, u_{38}, u_{42}, u_{43}\}\right), \\ \left(x_5, \{u_2, u_4, u_8, u_9, u_{12}, u_{13}, u_{14}, u_{16}, u_{17}, u_{21}, u_{23}, u_{28}, u_{36}, u_{42}, u_{44}\}\right), \\ \left(x_7, \{u_1, u_5, u_{12}, u_{13}, u_{17}, u_{20}, u_{24}, u_{28}, u_{29}, u_{34}, u_{36}, u_{41}, u_{45}, u_{47}\}\right), \\ \left(x_8, \{u_2, u_4, u_7, u_9, u_{11}, u_{13}, u_{14}, u_{15}, u_{19}, u_{21}, u_{25}, u_{28}, u_{36}, u_{38}\}\right). \end{array} \right\}$$

Following we can compute the choice value c_i as follows:

Table 2. Choice values

U	**Choice value**
u_6 , u_{16} , u_{26} , u_{27} , u_{31} , u_{35} , u_{39} , u_{40} , u_{47} , u_{48}	1
u_5 , u_{10} , u_{12} , u_{17} , u_{18} , u_{19} , u_{20} , u_{22} , u_{24} , u_{25} , u_{32} , u_{33} , u_{34} , u_{37} , u_{38} , u_{41} , u_{46}	2
u_1 , u_7 , u_8 , u_9 , u_{11} , u_{23} , u_{29} , u_{30} , u_{44} , u_{45}	3
u_2 , u_3 , u_4 , u_{14} , u_{15} , u_{21} , u_{43}	4
u_{42}	5
u_{13} , u_{28} , u_{36}	6

From Table 2, it follows that the maximum choice value is $c_{13} = c_{28} = c_{36} = 6$ and so the optimal decision is to select u_{13} on the basis of Algorithm 4.1.

5. CONCLUSION

In a recent paper [5], Çağman and Enginoğlu constructed an *uni-int* decision making method which selected a set of optimum elements from the alternatives. In this paper, we point out by an example that Çagman and Enginoglu's method is very likely to get an empty decision set. Moreover, we propose a new approach to soft set based decision making and give several illustrative examples.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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