International Journal of Pure and Applied Mathematics
Volume 77 No. 3 2012, 391-401
ISSN: 1311-8080 (printed version)
url: http://www.ijpam.eu

ijpam.eu

GENERALIZED VAGUE SOFT SET AND ITS APPLICATIONS

Khaleed Alhazaymeh[1], Nasruddin Hassan[2 §]
[1,2]School of Mathematical Sciences
University Kebangsaan Malaysia
43600, UKM, Bangi Selangor, MALAYSIA

Abstract: In this paper we recall the concept of generalized intuitionistic fuzzy soft set and its operations. We introduce the concept of generalized vague soft set and its operation which are equal, subset, union and intersection. An application of generalized vague soft sets in decision making with respect to degree of preference is illustrated.

AMS Subject Classification: 03E72
Key Words: fuzzy soft set, generalized intuitionistic fuzzy soft, soft set, vague set, vague soft set

1. Introduction

Most of the existing mathematical tools for formal modeling, reasoning and computing are crisp, deterministic and precise in character. Most of these problems were solved by fuzzy set provided by Zadeh [1]. In 1999, Molodtsov [2] introduced the concept of soft set theory, which was completely a new approach for modeling vagueness and uncertainties. Soft set theory has a rich potential for application in solving practical problems in economics, engineering, environment, social science, medical science and business management. Later on, Maji et al. [3, 4, 5] studied the theory of fuzzy soft set and intuitionistic fuzzy soft set. Majumdar and Samanta [6] later generalized the concept of fuzzy soft set

Received: March 1, 2012

[§]Correspondence author

introduced by Maji et al.[3]. Vague set theory is actually an extension of fuzzy set theory and vague sets are regarded as a special case of context-dependent fuzzy sets. The basic concepts of vague set theory and its extensions defined by [7, 8]. A vague set over U is characterized by a truth-membership function t_v and a false-membership function f_v, $t_v : U \to [0,1]$ and $f_v : U \to [0,1]$ respectively where $t_v(u_i)$ is a lower bound on the grade of membership of u_i which is derived from the evidence for u_i, $f_v(u_i)$ is a lower bound on the negation of u_i derived from the evidence against u_i and $t_v(u_i) + f_v(u_i) \leq 1$. The grade of the vague value $[t_v(u_i), 1 - f_v(u_i)]$ indicates that the exact grade of membership $\mu_v(u_i)$ of u_i maybe unknown, but it is bounded by $t_v(u_i) \leq \mu_v(u_i) \leq f_v(u_i)$ where $t_v(u_i) + f_v(u_i) \leq 1$. Alkhazaleh et al. [9] introduced the concept of fuzzy parameterized interval-valued fuzzy soft set and gave its application in decision making. Alkhazaleh et al. [10] also introduced soft multisets as a generalization of Molodtsov's soft set. Alkhazaleh et al. [11] introduced the concept of possibility fuzzy soft set as extensions of soft set [12, 13]. They [14] also introduced the multiparameterized soft set, while Alhazaymeh et al. [15] introduced the concept of the soft intuitionistic fuzzy sets.

In this paper we introduce the concept of generalized vague soft set and its operations, namely equal, subset, union and intersection. We also present some applications of generalized vague soft set in decision making.

2. Preliminaries

In this section we recall some definitions of operations on generalized intuitionistic fuzzy soft set.

Definition 2.1. (see [2]) Let U be an initial set and E a set of parameters. Let $P(U)$ denotes the power set of U, and let $A \subseteq E$. A pair (F, A) is called a soft set over U, where F is a mapping given by $F : A \to P(U)$.

Definition 2.2. (see [13]) Consider U and E as a universe set and a set of parameters respectively. Let $IFS(U)$ denotes the intuitionistic fuzzy power set of U. Let $A \subseteq E$. A pair (F, A) is an intuitionistic fuzzy soft set over U where the mapping F is given by $F : A \to IFS(U)$.

Definition 2.3. (see [6]) Let $U = \{x_1, x_2, ...x_n\}$ be the universal set of elements and $E = \{e_1, e_2, ...e_m\}$ be the universal set of parameters. The pair (U,E) will be called a soft universe. Let $F : U \longrightarrow I^U$ and μ be a fuzzy subset of E, i.e $\mu : E \longrightarrow I = [0,1]$, where I^U is the collection of all fuzzy subset of U. Let F_μ be a mapping given by $F_\mu : E \longrightarrow I \times I^U$ defined as follows:

$F_\mu(e) = (F(e), \mu(e))$, where$F(e) \in I^U$. Then F_μ is called generalized fuzzy soft set over the soft universe (U, E).

Here for each parameter e_i, $F_\mu(e_i)$ indicates not only the degree of belongingness of the elements of U in $F(e_i)$ but also the degree of possibility of such belongingness which is represented by $\mu(e_i)$.

Definition 2.4. (see [16]) Let U be the universal set and E be the universal set of parameters. Let $A \subseteq E$ and $F : A \longrightarrow IF^U$ and α be a fuzzy subset of A, i.e $\alpha : A \longrightarrow [0, 1]$, where IF^U is the collection of all intuitionistic fuzzy subset of U. Let $F_\alpha : A \longrightarrow IF^U \times [0, 1]$ be a function defined as

$$F_\alpha(a) \quad = \quad (F(a) = \{x, \mu_F(x), \nu_F(x)\}, \alpha(a)),$$

where μ and ν denote the degree of membership and degree of non-membership respectively. Then F_α is called generalized intuitionistic fuzzy soft set over (U, E).

Here, for each parameter e_i, $F_\alpha(e_i)$ indicates not only the degree of belongingness of the elements of U in $F(a)$ but also the degree of preference of such belongingness which is represented by $\alpha(e_i)$.

Definition 2.5. (see [16]) Let F_α and G_β be two generalised intuitionistic fuzzy soft sets over universe (U, E). Now F_α is called generalized intuitionistic fuzzy soft subset of G_β if:

(i) α is a fuzzy subset of β,

(ii) $A \subseteq B$,

(iii) $\forall \alpha \in A$, $F(a)$ is an intuitionistic fuzzy subset of $G(b)$,
i.e. $\mu_F(a)(x) \leq \mu_G(b)(x)$ and $\nu_F(a)(x) \geq \nu_G(b)(x)$ where $\forall x \in U$ and $a \in A$. We write $F_\alpha \subseteq G_\beta$.

Definition 2.6. (see [16]) Two generalized intuitionistic fuzzy soft sets F_α and G_β over a universe U are said to be generalized intuitionistic fuzzy soft subset if F_α is a generalized intuitionistic fuzzy soft subset of G_β and G_β is a generalized intuitionistic fuzzy soft subset of F_α.

Definition 2.7. (see [16]) The intersection of two generalized intuitionistic fuzzy soft sets F_α and G_β is denoted by $F_\alpha \tilde{\cap} G_\beta$ and defined by a generalized intuitionistic fuzzy soft set $H_\delta : A \cap B \longrightarrow IF^{(U)} \times [0, 1]$ such that for each $e \in A \cap B$ and $x \in U$,

$$H_\delta(e) \quad = \quad (x, \mu_{H(e)}(x), \nu_{H(e)}(x), \delta(e)),$$

where $\mu_{H(e)}(x)=\mu_{F(e)}(x)*\mu_{G(e)}(x)$, $\nu_{H(e)}(x)=\nu_{F(e)}(x)\diamond\nu_{G(e)}(x)$, and $\delta(e)=\alpha(e)*\beta(e)$.

Definition 2.8. (see [16]) The union of two generalized intuitionistic fuzzy soft sets F_α and G_β is denoted by $F_\alpha\tilde{\cup}G_\beta$ and defined by a generalized intuitionistic fuzzy soft set $H_\delta : A\cup B \longrightarrow IF^{(U)}\times[0,1]$ such that for each $e\in A\cup B$ and $x\in U$,

$$H_\delta(\varepsilon)=\begin{cases}(x,\mu_{F(e)}(x),\nu_{F(e)}(x)), & \text{if } e\in A-B,\\ (x,\mu_{G(e)}(x),\nu_{G(e)}(x)), & \text{if } e\in B-A,\\ (x,\mu_{H(e)}(x),\nu_{H(e)}(x)), & \text{if } e\in A\cap B,\end{cases}$$

where $\mu_{H(e)}(x)=\mu_{F(e)}(x)\diamond\mu_{G(e)}(x)$, $\nu_{H(e)}(x)=\nu_{F(e)}(x)*\nu_{G(e)}(x)$, and $\delta(e)=\alpha(e)\diamond\beta(e)$.

Definition 2.9. (see [12]) Let F_α and G_β be two generalized intuitionistic soft sets over (U,E). Then generalized intuitionistic fuzzy soft relation $\Re$ from F_α to G_β is the function $\Re : A\times B \longrightarrow IF^U\times[0,1]$ defined by

$$\Re(a,b)\tilde{\subseteq}F_\alpha(a)\tilde{\cap}G_\beta(b), \forall(a,b)\in A\times B.$$

3. Generalized Vague Soft Set

In this section we introduce the state of a generalized vague soft set and its operations. These operations are equality, union, intersection and subset. An application on generalized vague soft set in decision making is then presented.

3.1. Generalized Vague Soft Set

Definition 3.1.1. Let U the universal set and E be the set of parameters. Let $A\subseteq E$ and $F : A\longrightarrow V^U$ and α be a vague subset of A i.e. $\alpha : A\longrightarrow[0,1]$, where V^U the collection of all vague subset of U. Let $\tilde{F}_\alpha : A\longrightarrow V^U\times[0,1]$ be a function defined as follow

$$\tilde{F}_\alpha(a) \quad = \quad (\tilde{F}(a)=\{x,t_{F(a)},1-f_{F(a)}\},\alpha(a)),$$

Then $\tilde{F}_\alpha$ is called the generalized vague soft set over (U,E).

Here for each parameter e_i, $\tilde{F}_\alpha(e_i)$ indicates not only the degree of belongingness of the elements of U in $\tilde{F}(a)$ but also the degree of preference of such belongingingness which is represented by $\alpha(e_i)$.

Example 3.1.1. Consider a generalized vague soft set $(\tilde{F}, E)$, where $U = \{s_1, s_2, s_3\}$ is the set of students to be nominated as valedictorian and E is a parameters set. Let $A \subseteq E$ and $A = \{$r="result", $c =$"conduct", $g =$"games and sports performances"$\}$. Let $\alpha : A \longrightarrow [0,1]$ be given such that $\alpha(r) = 0.5, \alpha(c) = 0.6, \alpha(g) = 0.7$. We define $\tilde{F}_\alpha$ as follows:

$$\begin{aligned}\tilde{F}_\alpha(r) =& \{\langle[s_1, 0.8, 0.8], [s_2, 0.5, 0.7], [s_3, 0.4, 0.5]\rangle, 0.5\},\\ \tilde{F}_\alpha(c) =& \{\langle[s_1, 0.6, 0.7], [s_2, 0.7, 0.8], [s_3, 0.9, 0.9]\rangle, 0.6\},\\ \tilde{F}_\alpha(g) =& \{\langle[s_1, 0.7, 0.8], [s_2, 0.1, 0.6], [s_3, 0.2, 0.5]\rangle, 0.7\}.\end{aligned}$$

Then $\tilde{F}_\alpha$ is a generalized vague soft set.

Definition 3.1.2. Let $\tilde{F}_\alpha$ and $\tilde{G}_\beta$ be two generalized vague soft sets over universe (U, E). Now $\tilde{F}_\alpha$ is called a generalized vague soft subset of $\tilde{G}_\beta$ if:

(i) α is a vague subset of β,

(ii) $A \subseteq B$,

(iii) $\forall \alpha \in A$, $F(a)$ is a vague subset of $G(b)$.

i.e. $u_i \in U$, $t_{\tilde{F}(a)}(u_i) \leq t_{\tilde{G}(b)}(u_i)$ and $1 - f_{\tilde{F}(a)}(u_i) \geq 1 - f_{\tilde{G}(b)}(u_i)$ where $o \leq i \leq n$.

We write $\tilde{F}_\alpha(a) \subseteq \tilde{G}_\beta(b)$.

Example 3.1.2. Let $\tilde{G}_\beta$ be a generalized vague soft set defined as follows:

$$\begin{aligned}\tilde{G}_\alpha(r) =& \{\langle[s_1, 0.7, 0.7], [s_2, 0.4, 0.6], [s_3, 0.3, 0.4]\rangle, 0.4\},\\ \tilde{G}_\alpha(c) =& \{\langle[s_1, 0.5, 0.6], [s_2, 0.6, 0.7], [s_3, 0.8, 0.8]\rangle, 0.5\},\\ \tilde{G}_\alpha(g) =& \{\langle[s_1, 0.6, 0.7], [s_2, 0, 0.5], [s_3, 0.1, 0.4]\rangle, 0.6\},\end{aligned}$$

and consider a generalized vague soft set $\tilde{F}_\alpha$ given in example 3.1.1.

Then $\tilde{G}_\beta$ is a generalized vague soft subset of $\tilde{F}_\alpha$.

Definition 3.1.3. Two generalized vague soft sets $\tilde{F}_\alpha$ and $\tilde{G}_\beta$ over a universe U are said to be generalized vague soft subset if $\tilde{F}_\alpha$ is a generalized vague soft subset of $\tilde{G}_\beta$ and $\tilde{G}_\beta$ is a generalized vague soft subset of $\tilde{F}_\alpha$.

Definition 3.1.4. The intersection of two generalized vague soft sets $\tilde{F}_\alpha$ and $\tilde{G}_\beta$ is denoted by $\tilde{F}_\alpha \tilde{\cap} \tilde{G}_\beta$ defined by a generalized vague soft set $\tilde{H}_\delta$: $A \cap B \longrightarrow V^{(U)} \times [0,1]$, such that for each $e \in A \cap B$ and $u \in U$

$$H_\delta(e)(\{u, t_{H(e)}(u), 1 - f_{H(e)}(u), u\}, \delta(e))$$

where $t_{\tilde{H}(e)}(u) = t_{\tilde{F}(e)}(u) * t_{\tilde{G}(e)}(u)$, $1 - f_{\tilde{H}(e)}(u) = 1 - f_{\tilde{F}(e)}(u) \diamond 1 - f_{\tilde{G}(e)}(u)$, and $\delta(e) = \alpha(e) * \beta(e)$.

Definition 3.1.5 The union of two generalized vague soft sets F_α and G_β is denoted by $\tilde{F}_\alpha \tilde{\cup} \tilde{G}_\beta$ and defined by a generalized vague soft set $\tilde{H}_\delta : A \cup B \longrightarrow V^{(U)} \times [0,1]$ such that for each $e \in A \cup B$ and $x \in U$,

$$\tilde{H}_\delta(e) = \begin{cases} (x, t_{\tilde{F}(e)}(x), 1 - f_{\tilde{F}(e)}(x), \alpha(e)), & \text{if } e \in A - B, \\ (x, t_{\tilde{G}(e)}(x), 1 - f_{\tilde{G}(e)}(x), \beta(e)), & \text{if } e \in B - A, \\ (x, t_{\tilde{H}(e)}(x), 1 - f_{\tilde{H}(e)}(x), \delta(e)) & if e \in A \cap B, \end{cases}$$

where $t_{\tilde{H}(e)}(x) {=} t_{\tilde{F}(e)}(x) \diamond t_{\tilde{G}(e)}(x)$, $1 - f_{\tilde{H}(e)}(x) {=} 1 - f_{\tilde{F}(e)}(x) * 1 - f_{\tilde{G}(e)}(x)$, and $\alpha(e) {=} \alpha(e) \diamond \beta(e)$.

Definition 3.1.6. Let $\tilde{F}_\alpha$ and $\tilde{G}_\beta$ be two generalized vague soft sets over (U, E). Then the generalized vague soft relation $\Re$ from $\tilde{F}_\alpha$ to $\tilde{G}_\beta$ is the function $\Re : A \times B \longrightarrow V^{(U)} \times [0,1]$ defined by $\Re(a,b) \tilde{\subseteq} F_\alpha(a) \tilde{\cap} \tilde{G}_\beta(b)$, $\forall (a,b) \in A \times B$.

3.2. An Application on Generalized Vague Soft Set

We present an application of generalized vague soft set in a decision making problem. Suppose there are four T-shirts in the universe U as $U = \{b_1, b_2, b_3, b_4\}$ and the parameter set $E = \{e_1, e_2, e_3, e_4, e_5, e_6\}$, where each $1 \leq i \leq n$ is a specific criterion for T-shirts:

e_1 stands for "bright",
e_2 stands for "cheap",
e_3 stands for "colorful",
e_4 stands for "cotton",
e_5 stands for "polystyrene",
e_6 stands for "long sleeve".

Suppose we aim to find out the most appropriate T-shirt for a person to buy on the basis of his wish as defined above.

Suppose also that $A \subseteq E$ where $A = \{e_1, e_2, e_4, e_6\}$.

Let $\alpha : A \longrightarrow [0,1]$ be a vague subset of A, defined as follows: $\alpha(e_1) = 0.2, \alpha(e_2) = 0.5, \alpha(e_4) = 0.3$ and $\alpha(e_6) = 0.7$.

Consider the generalized vague soft set $\tilde{F}_\alpha$ as a collection of vague approximation as below:

$$\tilde{F}_\alpha(e_1) = (\{(b_1, 0.6, 0.7)(b_2, 0.5, 0.5)(b_3, 0.8, 0.9)(b_4, 0.7, 0.7)\}, 0.2),$$
$$\tilde{F}_\alpha(e_2) = (\{(b_1, 0.5, 0.8)(b_2, 0.6, 0.6)(b_3, 0.3, 0.7)(b_4, 0.4, 0.7)\}, 0.5),$$

$$\tilde{F}_\alpha(e_4) = (\{(b_1, 0.7, 0.9)(b_2, 0.3, 0.3)(b_3, 0.5, 0.6)(b_4, 0.1, 0.9)\}, 0.3),$$
$$\tilde{F}_\alpha(e_6) = (\{(b_1, 0.9, 0.9)(b_2, 0, 0.3)(b_3, 0.3, 0.7)(b_4, 0.2, 0.8)\}, 0.7).$$

Now we introduce the following operations of:

(i) the truth-membership function $\acute{t}_{b_r} = a_i + b_i - a_i b_i$, where $a_i = t_{b_r}(e_i)$ and $b_i = \alpha(e_i)$, and

(ii) the false-membership function $1 - \acute{f}_{b_r}(e_i) = c_i d_i$, where $1 - f_i = 1 - f_{b_r}(e_i)$ and $d_i = \alpha(e_i)$.

Now, we use $\acute{t}_{br}(e_i)$ to determine the high truth-membership value and $1 - \acute{f}_{br}(e_i)$ to determine the low false-membership value of $\tilde{F}_\alpha(e_i)$ on the basis of the degree of preference of the said person. The generalized vague soft set $\tilde{F}_\alpha(e_i)$ reduced to a generalized vague soft set $\acute{\tilde{F}}_\alpha(e_i)$ is given as below:

$$\acute{\tilde{F}}_\alpha(e_1) = \{(b_1, 0.68, 0.14)(b_2, 0.6, 0.1)(b_3, 0.84, 0.18)(b_4, 0.76, 0.14)\},$$
$$\acute{\tilde{F}}_\alpha(e_2) = \{(b_1, 0.75, 0.4)(b_2, 0.8, 0.3)(b_3, 0.65, 0.35)(b_4, 0.7, 0.35)\},$$
$$\acute{\tilde{F}}_\alpha(e_4) = \{(b_1, 0.79, 0.27)(b_2, 0.5, 0.09)(b_3, 0.65, 0.18)(b_4, 0.37, 0.27)\},$$
$$\acute{\tilde{F}}_\alpha(e_6) = \{(b_1, 0.97, 0.63)(b_2, 0.7, 0.21)(b_3, 0.79, 0.49)(b_4, 0.76, 0.56)\}.$$

Definition 3.2.1. A comparison table is a square table in which the number of rows and number of columns are equal and both are labeled by the object name of the universe such as $b_1, b_2, ..., b_n$. The entries are c_{ij}, where c_{ij} is the number of parameters for which the value of b_i exceeds or equal to the value of b_j. The algorithm will be as follows:

(i) Input the set $A \subseteq E$ of choice of parameters of the person.

(ii) Consider the reduced vague soft set in tabular form as in Table 1 and 4.

(iii)Compute the comparison tables as in Tables 2 and 5 for the truth-membership function and false-membership function respectively.

(iv) Compute the truth-membership score and false-membership score as in Tables 3 and 6 respectively.

(v) Compute the final score by subtracting the false-membership score from the truth-membership score as in Table 7.

Find the maximum score. The $i-th$ row item with the maximum score is recommended to be bought.

.	e_1	e_2	e_4	e_6
b_1	0.68	0.75	0.79	0.97
b_2	0.6	0.8	0.5	0.7
b_3	0.84	0.65	0.65	0.79
b_4	0.76	0.7	0.37	0.67

Table 1: Tabular representation of the truth-membership function

.	b_1	b_2	b_3	b_4
b_1	4	3	3	3
b_2	1	4	1	3
b_3	1	3	4	3
b_4	1	1	1	4

Table 2: Comparison table of the truth-membership function

.	Row sum (a)	Column sum (b)	Membership score $(a-b)$
b_1	13	7	6
b_2	9	11	-2
b_3	11	9	2
b_4	7	13	-6

Table 3: Truth-membership score table

.	e_1	e_2	e_4	e_6
b_1	0.14	0.4	0.27	0.63
b_2	0.1	0.3	0.09	0.21
b_3	0.18	0.35	0.18	0.49
b_4	0.14	0.35	0.27	0.56

Table 4: Tabular representation of the false -membership function

Clearly the maximum score is the score 10 shown in Table 7 for the T-shirt b_2.

Hence the best decision is to buy b_2 followed by b_3.

.	b_1	b_2	b_3	b_4
b_1	4	4	3	2
b_2	0	4	0	0
b_3	1	4	4	1
b_4	2	4	2	4

Table 5: Comparison table of the false-membership function

.	Row sum (c)	Column sum (d)	Membership score ($c-d$)
b_1	13	7	6
b_2	4	16	-12
b_3	10	9	1
b_4	12	7	5

Table 6: False-membership score table

.	Truth-Membership score	False-Membership score	Final score
b_1	6	6	0
b_2	-2	-12	10
b_3	2	1	1
b_4	-6	5	-11

Table 7: Final score table

4. Conclusions

In this paper we introduced the concept of a generalized vague soft set and its operations, which are equality, union, intersection and subset. Also, we gave an application in decision making and it is expected that the approach will be useful to handle other realistic uncertain problems.

Acknowledgments

We are indebted to Universiti Kebangsaan Malaysia for funding this research under the grant UKM-GUP-2011-159.

References

[1] A. Zadeh, Fuzzy sets, *Inform. Control*, **8**(1965), 338-353.

[2] D. Molodtsov, Soft set theory first result, *An International Journal of Computers and Mathematics with Applications*, **37**(1999), 19-31.

[3] P.K. Maji, R. Biswas, A. R.Roy, Fuzzy soft sets, *The Journal of Fuzzy Mathematics*, **9(3)** (2001), 589-602.

[4] P. K. Maji, R. Biswas, A. R. Roy, Intuitionistic fuzzy soft sets, *The Journal of Fuzzy Mathematics*, **9**(3) (2001), 677-692.

[5] P.K.Maji, A.R.Roy, R.Biswas, On intuitionistic fuzzy soft sets, *The Journal of Fuzzy Mathematics*, **12**(3) (2004), 669-683.

[6] P.Majumder, S.K.Samanta, Generalised fuzzy soft sets, *Comput. Math. Appl.*, **59**(4) (2010), 1425-1432.

[7] H. Bustince, P. Burillo, Vague sets are intuitionistic fuzzy sets, *Fuzzy Sets and Systems*, **79** (1996), 403-405.

[8] W.L. Gau, D.J. Buehrer, Vague sets, *IEEE Trans, Systems Man and Cybernet*, **23** (2) (1993), 610-614.

[9] S. Alkhazaleh. A. R. Salleh, N. Hassan, Fuzzy parameterized interval-valued fuzzy soft set, *Appl. Math. Sci.*, **67** (2011), 3335-3346.

[10] S. Alkhazaleh. A. R. Salleh, N. Hassan, Soft multisets theory, *Appl. Math. Sci.*, **72** (2011), 3561 - 3573.

[11] S. Alkhazaleh. A. R. Salleh, N. Hassan, Possibility fuzzy soft set, *Advances in Decision Sciences*, Vol. (2011), Article ID 479756, **18** pages.doi:10.1155/2011/479756

[12] Y. Xu, Y. Sun, D. Li, Intuitionistic fuzzy soft set, *Science and Research Department Dalian Naval Academy Dalian*, China (2010).

[13] B. Yao, L. Jin-liang, Y. Rui-xia, Fuzzy soft set and soft fuzzy set, *Fourth International Conference on Natural Computation*, **4** (2008), 252-255.

[14] A. R. Salleh, S. Alkhazaleh, N. Hassan and A.G. Ahmad, Multiparameterized soft set, *Journal of Mathematics and Statistics*, **8** (2012), 92-97.

[15] Kh. Alhazaymeh, Sh. Abdul Halim, A. R. Salleh, and N. Hassan, Soft intuitionistic fuzzy sets. *Appl. Math. Sci.*, **6**(54)(2012), 2669 2680.

[16] B. Dinda, T. Bera, T.K. Samanta, Generalized intuitionistic fuzzy soft sets and its application in decision making, (2010), arXiv:1010.2468v1 [math.GM]