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INVENTION OF BEST TECHNOLOGY IN AGRICULTURE USING INTUITIONSTIC FUZZY SOFT GRAPHS

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ABSTRACT

An intuitionistic fuzzy soft graph is a generalization of the notion of a fuzzy soft graph. Intuitionistic fuzzy models give more precision, flexibility and compatibility to the system as compared to the fuzzy models. In this paper, we define IFSG and different types of IFSG with example. Finally we extend our approach in application of these graphs in (agriculture) decision making problems.

Key Words: *Union of IFSG Complement of IFSG, Fuzzy soft set, soft graph, fuzzy soft graph, intuitionistic fuzzy soft graph.*

I. INTRODUCTION

Molodtsov [13] introduced the concept of soft set that can be seen as a new mathematical theory for dealing with uncertainties. Molodtsov applied this theory to several directions [13, 14, 15] and then formulated the notions of soft number, soft derivative, soft integral etc., in [16]. The soft set theory has been applied to many different fields with greatness maji [11] worked on theoretical study of soft sets in detail, the algebraic structure of soft set theory dealing with uncertainties has also been studied in more detail. Aktas and cagman [2] introduced definition of soft groups and derived their basic properties. The most appreciate theory to deal with of fuzzu sets, developed by zadeh [23] in 1965. But it has an inherent difficulty to set the membership function in each particular cases. The generalization at Zadeh's fuzzy set called intuitionsitic fuzzy set was inrouduced by Abanassov [4] which is characterized by a membership function and a non-membership functions. In Zadeh's fuzzy set, the sum of membership degree and non-membership degree is equal to one. In Abanassov's intuitionistic fuzzy set the sum of membership degree and non-membership degree does not exced one.

Maji *et al.* [9] presented the concept of fuzzy soft sets by embedding ideas of fuzzy set in [23]. In fact the notion of fuzzy soft set is more generalized than that of fuzzy set and soft set. There after many papers devoted to fuzzify the concept of soft set theory which leads to a series of mathematical models such as fuzzy soft set [1, 9, 17], generalized fuzzy soft set [13, 22], possibility fuzzy soft set [3] and so on. There after maji and his coauthor [10] introduced the notion of intuitionistic fuzzy soft set which is based on a combination of intuitionistic fuzzy sets and soft set models and they studied the properties of intuitionistic fuzzy soft set.

In 1736, Euler first introduced the concept of graph theory, the theory of graph is extremely useful tool for solving combinational problems in different areas such as geometry, algebra, number theory, topology, operation research, optimization and computer science, etc., The first definition of fuzzy graphs was proposed by kaffman [8] in 1973, form Zadeh's fuzzy relations [23]. But Rosenfeld [20] introduced another elaborated definition including fuzzy vertex and fuzzy edges and several fuzzy analogs at graph theoretic concepts. The first definition of intuitionistic fuzzy graph was introduced by Aztanasov [5] in 1999, Karunambigai and Parvathy [7] introduced intuitionistic fuzzy graph as a special case of Atanassov's intuitionistic fuzzy graph. Soft graph was introduced by Thumbakara and george [19]. In 2015 Mohinta and Samanta [21] introduced the concept of fuzzy soft graph. In this paper, we investigate some definition of intuitionistic fuzzy soft graphs, we have used standard definitions and terminologies in this paper.

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II. PRELIMINARIES

In this section, we recall some basic notion of fuzzy soft set theory and soft graphs.

Definition 2.1: Let U be an initial universe set and E be a set of parameters. Let P(U) denotes the power set of U. Let A≤E. A pair (F_A, E) is called a soft set over U, where F_A is a mapping given by F_A: E → P(U) such that $F_A(e) = \emptyset$ if e ∉ A. Here F_A is called approximate function of the soft set (F_A, E). The set F_A (e) is called e-approximate value set which consists of related objects of the parameter e ∈ E. In other words, a soft set over U is a parameterized family of subsets of the universe U.

Example 2.1: Let U = {u_1, u_2, u_3, u_4} be a set of Australian birds and E = {White with green, (e_1), blue with yellow (e_2), orange with brown (e_3)} be a set of parameter. If A = {e_1, e_2, e_3}≤ E.

Let $F_A(e_1)$ = {u_1, u_3, u_4} and F_A (e_2) = {u_1, u_2, u_4}, $F_A(e_3)$ ={u_2, u_3, u_4} then we write the soft set (F_A, E) = {(e_1, {u_1, u_3, u_4}), (e_2, {u_1, u_2, u_4}), (e_3, {u_2, u_3, u_4})} over U which describe the "Colour of the birds" which children is going to buy. We may represent the soft set in the following form:

U	White with green	Blue with yellow	Orange with Brown
u_1	1	1	0
u_2	0	1	1
u_3	1	0	1
u_4	1	1	1

Table-2.1

Definition 2.2: Let U be an initial universe set and E be a set of parameters. Let P(U) denotes the set of all fuzzy sets of U. Let A≤E.
A pair (F_A, E) is called a fuzzy soft set (FSS) over U, where F_A is a mapping given by F_A: E →P(U) such that $F_A(e) = \emptyset$ if e∉A, where $\emptyset$ is a null fuzzy set.

Example 2.2: Consider the example 2.1, here we cannot express with only two real numbers 0 and 1. We can characterized it by a membership function instead of crisp number 0 and 1, which associate with each element a real number in the interval [0, 1].
Then (F_A, E) = {$F_A(e_1)$ = {(U_1, 0.2), (U_3, 0.8), (U_4, 0.2)}, $F_A(e_2)$ = {(U_1, 0.3), (U_2, 0.4), (U_4, 0.7)}, $F_A(e_3)$ = {(U_2, 0.2), (U_3, 0.2), (U_4, 0.1)}} is the fuzzy soft set representing the "Colour of the Birds" which children is going to buy. We may represent the fuzzy soft set in the following form:

U	White with green	Blue with yellow	Orange with Brown
U1	0.2	0.3	0.0
U2	0.0	0.4	0.2
U3	0.8	0.0	0.2
U4	0.2	0.7	0.1

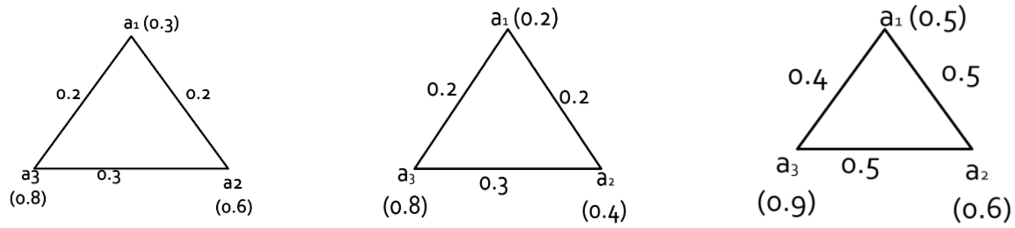
Table-2.2

Definition 2.3: A fuzzy soft graph
$\tilde{G}$ = (G*, $\tilde{F}$, $\tilde{K}$, A) is a 4 – tuple such that
(a) G* = (V, E) is a simple graph,
(b) A is a non empty set of parameters,
(c) ($\tilde{F}$, A) is a fuzzy soft set over V,
(d) ($\tilde{K}$, A) is a fuzzy soft set over E,
(e) ($\tilde{F}$(a), $\tilde{K}$(a)) is a fuzzy (sub) graph of G* for all a ∈ A. That is
$\tilde{K}$ (a) (xy) ≤ min {$\tilde{F}$ (a) (x), $\tilde{F}$ (a) (y)} for all a ∈ A and x, y ∈ V. The fuzzy graph ($\tilde{F}$(a), $\tilde{K}$(a)) is denoted by $\tilde{H}$ (a) for convenience.
On the other hand, a fuzzy soft graph is a parameterized family of fuzzy graphs.

The class of all soft graphs of G* as denoted by F(G*).

Example 2.3: Consider a simple graph G* = (V, E) such that V = {a_1, a_2, a_3} and E = {a_1a_2, a_2a_3, a_3a_1}. Let A = {e_1, e_2, e_3} be a parameter set and ($\tilde{F}$, A) be a fuzzy soft set over V with its fuzzy approximate function $\tilde{F}$: A → P (V) defined by
$\tilde{F}$ (e_1) = {a_1/0.3, a_2/0.6, a_3/0.8}
$\tilde{F}$ (e_2) = {a_1/0.2, a_2/0.4, a_3/0.8}
$\tilde{F}$ (e_3) = {a_1/0.5, a_2/0.6, a_3/0.9}

Let ($\widetilde{K}$, A) be a fuzzy soft set over E with its fuzzy approximate function $\widetilde{K}$: A → P (E) defined by
$\widetilde{K}$ (e_1) = {a_1a_2/0.2, a_2a_3/0.3, a_3a_1/0.2}
$\widetilde{K}$ (e_2) = { a_1a_2/0.2, a_2a_3/0.3, a_3a_1/0.2}
$\widetilde{K}$ (e_3) = { a_1a_2/0.5, a_2a_3/0.5, a_3a_1/0.4}
Thus,
$\widetilde{H}$ (e_1) = ($\tilde{F}$(e_1), $\widetilde{K}$(e_1)),
$\widetilde{H}$ (e_2) = ($\tilde{F}$(e_2), $\widetilde{K}$(e_2)), and
$\widetilde{H}$ (e_3) = ($\tilde{F}$(e_3), $\widetilde{K}$(e_3)) are fuzzy sub graphs of G* as shown in Figure 1.
Fuzzy Subgraphs. It is easy to verify that$\tilde{G}$ = (G*, $\tilde{F}$, $\widetilde{K}$, A) is a fuzzy soft graph.



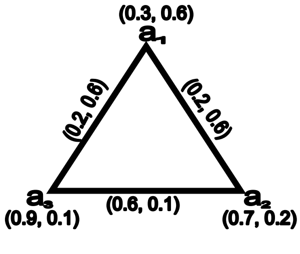
III. An Intuitionistic fuzzy soft graph:
$\tilde{G}$ = (G*, $\tilde{F}\ \mu,\gamma$, $\widetilde{K}\ \rho,\tau$, A) is such that

(i) G* = (V, E) is a simple graph.
(ii) A is a nonempty set of parameters
(iii) ($\tilde{F}_{\mu,\gamma}$, A) is a intuitionistic fuzzy soft set over V.
(iv) ($\widetilde{K}_{\rho,\tau}$, A) is a intuitionistic fuzzy soft set over E.
(v) ($\tilde{F}_{\mu,\gamma}$, $\widetilde{K}_{\rho,\tau}$) is a intuitionistic fuzzy soft graph of G* for all a ∈ A is

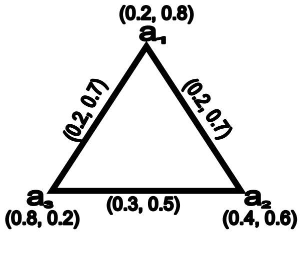
$\widetilde{K}_{\rho}$ (a) (xy) ≤ min {$\tilde{F}_{\mu,}$ (a) (x), $\tilde{F}_{\mu}$ (a) (y)} and $\widetilde{K}\tau$ (a) (xy) ≤ max {$\tilde{F}\gamma$ (a) (x), $\tilde{F}_{\gamma}$ (a) (y)} for all a∈A, x, y ∈ V. The intuitionistic fuzzy soft graph ($\tilde{F}_{\mu,\gamma}$ (a), $\widetilde{K}_{\rho,\tau}$ (a)) is denoted by $\widetilde{H}_{\beta,\delta}$ (a).

Example 3.1: Consider a simple graph G* = (V, E) such that V = {a_1, a_2, a_3} and E = {a_1a_2, a_2a_3, a_1a_3} Let A = {e_1, e_2, e_3} be a parameter set and ($\tilde{F}_{\mu,\gamma}$, A) be a intuitionistic fuzzy soft set over V with intuitionistic fuzzy approximate function $\tilde{F}_{\mu,\gamma}$: A → IF^V
Consider,
$\tilde{F}_{\mu,\gamma}$ (e_1) = {a_1/(0.3, 0.6), a_2/(0.7, 0.2), a_3/(0.9, 0.1)}
$\tilde{F}_{\mu,\gamma}$ (e_2) = {a_1/(0.2, 0.8), a_2/(0.4, 0.6), a_3/(0.8, 0.2)}
$\tilde{F}_{\mu,\gamma}$ (e_3) = {a_1/(0.5, 0.4), a_2/(0.6, 0.3), a_3/(0.9, 0.1)}

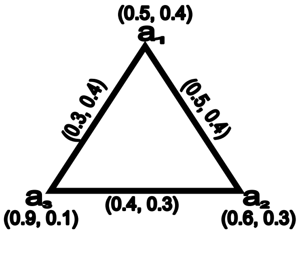
Let ($\widetilde{K}_{\rho,\tau}$, A) be a intuitionistic fuzzy soft set over E with
$\widetilde{K}_{\rho,\tau}$ (e_1) = {a_1a_2/(0.2, 0.6), a_2a_3/(0.6, 0.1), a_1a_3/(0.2, 0.6)}
$\widetilde{K}_{\rho,\tau}$ (e_2) = {a_1a_2/(0.2, 0.7), a_2a_3/(0.3, 0.5), a_1a_3/(0.2, 0.7)}
$\widetilde{K}_{\rho,\tau}$ (e_3) = {a_1a_2/(0.5, 0.4), a_2a_3/(0.4, 0.3), a_1a_3/(0.3, 0.4)}
Thus $\widetilde{H}_{\beta,\delta}$($e_1$) = ($\tilde{F}_{\mu,\gamma}$ (e_1), $\widetilde{K}_{\rho,\tau}$ (e_1)) (Figure 2)
$\widetilde{H}_{\beta,\delta}$($e_2$) = ($\tilde{F}_{\mu,\gamma}$ (e_2), $\widetilde{K}_{\rho,\tau}$($e_2$)) (Figure 3)
$\widetilde{H}_{\beta,\delta}$($e_3$) = ($\tilde{F}_{\mu,\gamma}$ (e_3), $\widetilde{K}_{\rho,\tau}$ (e_3)) is an (Figure 4)
intuitionistic fuzzy soft subgraph and
$\tilde{G}$ = (G*, $\tilde{F}_{\mu,\gamma}$, $\widetilde{K}_{\rho,\tau}$, A) is a intuitionistic fuzzy soft graph.



IFSG corresponding
to the Parameter e_1
Figure (2)



IFSG Corresponding
to the parameter e_2
Figure (3)



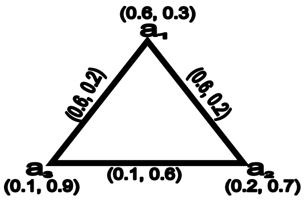
IFSG Corresponding
to the parameter e_3
Figure (4)

Definition 3.2: Complement of intuitionistic fuzzy soft graph is defined as follows
$\tilde{G}^c = (\tilde{F}^c{}_{\mu,\gamma}$ (e), $\tilde{K}^c{}_{\rho,\tau}$ (e))

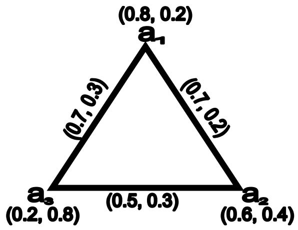
Example: 3.2

Consider the above example
$\tilde{F}^c{}_{\mu,\gamma}$ (e_1) = {a_1/(0.6, 0.3), a_2/(0.2, 0.7), a_3/(0.1, 0.9)}
$\tilde{F}^c{}_{\mu,\gamma}$ (e_2) = {a_1/(0.8, 0.2), a_2/(0.6, 0.4), a_3/(0.2, 0.8)}
$\tilde{F}^c{}_{\mu,\gamma}$ (e_3) = {a_1/(0.4, 0.5), a_2/(0.6, 0.3), a_3/(0.1, 0.9)}

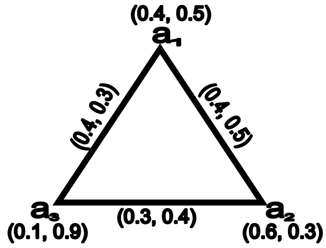
Let ($\tilde{K}^c{}_{\rho,\tau}$, A) be a intuitionistic fuzzy soft set over E with
$\tilde{K}^c{}_{\rho,\tau}$ (e_1) = {a_1a_2/(0.6, 0.2), a_2a_3/(0.1, 0.6), a_1a_3/(0.6, 0.2)}
$\tilde{K}^c{}_{\rho,\tau}$ (e_2) = {a_1a_2/(0.7, 0.2), a_2a_3/(0.5, 0.3), a_1a_3/(0.7, 0.2)}
$\tilde{K}^c{}_{\rho,\tau}$ (e_3) = {a_1a_2/(0.4, 0.5), a_2a_3/(0.3, 0.4), a_1a_3/(0.4, 0.3)}
Thus $\tilde{H}^c{}_{\beta,\delta}$ (e) = ($\tilde{F}^c{}_{\mu,\gamma}$ (e), $\tilde{K}^c{}_{\rho,\tau}$ (e)) are complement of intuitionistic fuzzy soft subgraph of $\tilde{G}^c$.



CIFSG corresponding
to the Parameter e_1
Figure (5)



CIFSG Corresponding
to the parameter e_2
Figure (6)



CIFSG Corresponding
to the parameter e_3
Figure (7)

Definition 3.3: Let V_1, $V_2 \subset V$, E_1, $E_2 \subset E$ and A, B are the subsets of the parameter set. Then **the union of two intuitionistic fuzzy soft graphis** defined as follows
$\tilde{G}_{c,V_3}$ = ($\tilde{F}^3{}_{\mu,\gamma}$ (e_i), $\tilde{K}^3{}_{\rho,\tau}$ (e_i)) Where
$e_i \in C = A \cup B$, $V_3 = V_1 \cup V_2$
$\tilde{G}^1{}_{A,V_1}$= ($\tilde{F}^1{}_{\mu,\gamma}$ (e_i), $\tilde{K}^1{}_{\rho,\tau}$ (e_i)) and
$\tilde{G}^2{}_{B,V_2}$= ($\tilde{F}^2{}_{\mu,\gamma}$ (e_i), $\tilde{K}^2$ (e_i)).

Definition 3.4: Let V_1, V_2 C V, E_1, E_2 C E and A, B are the subsets of the parameter set. Then the **intersection of two intuitionistic fuzzy soft** graph is defined as follows.
$\tilde{G}^3{}_{C,V_3}$ = ($\tilde{F}^3{}_{\mu,\gamma}$ (e_i), $\tilde{K}^3{}_{\rho,\tau}$ (e_i)) Where
$e_i \in C = A \cap B$, V3 = $V_1 \cap V_2$
$\tilde{G}^1{}_{A,V_1}$ = ($\tilde{F}^1{}_{\mu,\gamma}$ (e_i), $\tilde{K}^1{}_{\rho,\tau}$ (e_i)) and
$\tilde{G}^2{}_{B,V_2}$ = ($\tilde{F}^2{}_{\mu,\gamma}$ (e_i), $\tilde{K}^2{}_{\rho,\tau}$ (e_i))

Intuitionistic Fuzzy set graph theory Apply in Agriculture

Definition 3.5: Let $\tilde{G}_{A,V}$ = (G*, $\tilde{F}_{\mu,\gamma}$, $\tilde{K}_{\rho,\tau}$, A) ∈ IFSG.
Then **value of intuitionistic fuzzy soft graph** denoted by V ($\tilde{G}_{A,V}$) and is defined as
V ($\tilde{G}_{A,V}$) = {(Membership function – Non Membership Function)}

Definition 3.6
If $\tilde{G}^1_{A,V_1}$ = ($\tilde{F}^1{}_{\mu,\gamma}$ (e_i), $\tilde{K}^1{}_{\rho,\tau}$ (e_i)) and $\tilde{G}^1_{A,V_1}$
$\tilde{G}^2{}_{B,V_2}$ = ($\tilde{F}^2{}_{\mu,\gamma}$ (e_i), $\tilde{K}^2{}_{\rho,\tau}$ (e_i))
Then $\tilde{G}^1{}_{A,V_1}$ and $\tilde{G}^2{}_{B,V_2}$is said to be **intuitionistic fuzzy soft score graph** denoted by $S_{(A, B)}$ and is defined as
$S_{(A, B)}$= ($\tilde{G}^1{}_{A,V_1}$) – ($\tilde{G}^2{}_{B,V_2}$)

Definition 3.7
If $\tilde{G}^1{}_{A,V_1}$ = ($\tilde{F}^1{}_{\mu,\gamma}$ (e_i), $\tilde{K}^1{}_{\rho,\tau}$ (e_i)) and
$\tilde{G}^2{}_{B,V_2}$ = ($\tilde{F}^2{}_{\mu,\gamma}$ (e_i), $\tilde{K}^2{}_{\rho,\tau}$ (e_i))
Then the **total score** for each U_i in U is
S_i $= \sum_{j=1}^{n}$ V ($\tilde{G}^1{}_{A,V_1}$) – V ($\tilde{G}^2{}_{B,V_2}$)

METHODOLOGY:

Suppose U is a set of farmers producing quality of paddy to be selected as the best farmer for the healthier yields produced to the human existence without affecting their health. This will be scientifically selected and tested by the experts in agriculture according to the chemical fertilizers, natural manures, Hybrid seeds, pesticides used by the farmers. Let A is a set of parameters related to the yield cultivated by the fermers from the fields for good health. We construct IFSG $\tilde{G}^1{}_{A,V_1}$ over U represent the selection of farmers by the scientist, expert in Agriculture X. We further construct another IFSG $\tilde{G}^2{}_{B,V_2}$over U represent the selection of farmers by the expert in agricultural field Y. We compute the complements $\tilde{G}^1{}_{A,V_1}$ and $\tilde{G}^2{}_{B,V_2}$. Then compute $\tilde{G}^1{}_{A,V_1} \cup \tilde{G}^2{}_{B,V_2}$ which is the maximum membership of farmers who will be selected by the scientist As judges. Further compute $\tilde{G}^1{}_{A,V_1} \cup \tilde{G}^2{}_{B,V_2}$ which is the maximum membership of non selection of farmers by the scientist as judges. Using definition (3.5), compute V ($\tilde{G}^1_{A,V_1}$U $\tilde{G}^2_{B,V_2}$), V ($\tilde{G}^{1^c}_{A,V_1}$U $\tilde{G}^{2^C}_{B,V_2}$) and S (($\tilde{G}^1_{A,V_1}$U $\tilde{G}^2_{B,V_2}$), ($\tilde{G}^{1^c}_{A,V_1}$U $\tilde{G}^{2^C}_{B,V_2}$)) and the total score secured S_i for each former in U. Finally S_k = max (S_i), then we conclude that the farmer U_k has been selected by the judges. If S_k has more than one value occurs and by investigating this process repeatedly by reassessing the parameters.

Algorithm 4.1:

Step-1: Obtain the intuitionistic fuzzy soft graphs $\tilde{G}^1_{A,V_1}$ and $\tilde{G}^2_{B,V_2}$.

Step-2: Obtain the complement of intuitionistic fuzzy soft graphs $\tilde{G}^{1^c}_{A,V_1}$ and $\tilde{G}^{2^C}_{B,V_2}$.

Step-3: Compute $\tilde{G}^1_{A,V_1}$ U $\tilde{G}^2_{B,V_2}$, $\tilde{G}^{1^c}_{A,V_1}$ U $\tilde{G}^{2^C}_{B,V_2}$, V ($\tilde{G}^1_{A,V_1}$ U $\tilde{G}^2_{B,V_2}$), V ($\tilde{G}^{1^c}_{A,V_1}$ U $\tilde{G}^{2^C}_{B,V_2}$) and S (($\tilde{G}^1_{A,V_1}$ U $\tilde{G}^2_{B,V_2}$), ($\tilde{G}^{1^c}_{A,V_1}$ U $\tilde{G}^{2^C}_{B,V_2}$))

Step-4: Compute the total score S_i for each u_i in u

Step 5: Find s_k = max (s_i), then we conclude the best farmer u_k has the maximum value. since u_k produced healthy and quality of paddy.

Step-6: If s_k has more than one value, then go to step (1) so as to repeat the process by reassessing the parameter for selecting the best farmer.

V. ECHNOLOGY IN A DECISION MAKING PROBLEM

Let $\tilde{G}^1_{A,V_1}$ and $\tilde{G}^2_{B,V_2}$be two intuitionistic fuzzy soft graph representing the selection of four farmers from the universal set U = {U_1, U_2, U_3, U_4} by the experts x and Y. Let = {e_1, e_2, e_3} be the set of parameters which stand for different types of manures like chemical fertilizer, natural manure Hybrid seeds and pesticides will be taken to identify the best farmer by testing the paddy which will be considered for good health to human race.

Consider a simple graph G* = (V, E) such that V = {a_1, a_2, a_3, a_4} and E = {a_1a_2, a_2a_3, a_3a_4, a_2a_4} Let A = {e_1, e_2, e_3} and B = {e_2, e_3, e_4 } be the subsets of the parameters set and V_1 = {a_1, a_2, a_3, a_4} ⊆ V and V_2 = {a_1, a_2, a_3, a_4} ⊆ V
E1 = {a_1a_2, a_2a_3, a_3a_4},
E2 = {a_1a_2, a_2a_3, a_2a_4}
($\tilde{F}^1_{\mu,\gamma}$, A), ($\tilde{F}^2_{\mu,\gamma}$, B) be a intuitionistic fuzzy soft set over V with intuitionistic fuzzy approzimate function
$\tilde{F}^1_{\mu,\gamma}$: A → I F^{V_1} and $\tilde{F}^2_{\mu,\gamma}$: B → I F^{V_2}
$\tilde{F}^1_{\mu,\gamma}$ (e_1) = {a_1/ (0.1, 0.8), a_2/(0.5, 0.4), a_3/(0.8, 0.2), a_4/(0.2, 0.7)}
$\tilde{F}^1_{\mu,\gamma}$ (e_2) = {a_1/ (0.8, 0.1), a_2/(0.2, 0.8), a_3/(0.3, 0.6), a_4/(0.9, 0.1)}
$\tilde{F}^1_{\mu,\gamma}$ (e_3) = {a_1/ (0.3, 0.6), a_2/(0.7, 0.2), a_3/(0.7, 0.2), a_4/(0, 0.6)}
and
$\tilde{F}^2_{\mu,\gamma}$ (e_2) = {a_1/ (0.2, 0.7), a_2/(0.3, 0.6), a_3/(0.2, 0.7), a_4/(0.7, 0.3)}
$\tilde{F}^2_{\mu,\gamma}$ (e_3) = {a_1/ (0.6, 0.3), a_2/(0.4, 0.6), a_3/(0.5, 0.4), a_4/(0, 0.7)}
$\tilde{F}^2_{\mu,\gamma}$ (e_4) = {a_1/ (0, 0.6), a_2/(0.7, 0.2), a_3/(0.5, 0.4), a_4/(0.4, 0.6)}
Then
($\tilde{K}_{\rho,\tau}$ (e_1), A) and $\tilde{K}^2_{\rho,\tau}$ (e_2), B) are intuitionistic fuzzy soft set over E such that
$\tilde{K}^1_{\rho,\tau}$ (e_1) = {a_1 a_2/ (0.1, 0.7), a_2a_3/(0.4, 0.4), a_3a_4/(0.1, 0.6)}
$\tilde{K}^1_{\rho,\tau}$ (e_2) = {a_1 a_2/ (0.2, 0.8), a_2a_3/(0.2, 0.7), a_3a_4/(0.2, 0.5)}
$\tilde{K}^1_{\rho,\tau}$ (e_3) = {a_1 a_2/ (0.2, 0.6), a_2a_3/(0.5, 0.2), a_3a_4/(0, 0.6)}

and

$\widetilde{K}^2_{\rho,\tau}$ (e_2) = {a_1 a_2/ (0.2, 0.5), a_2a_3/ (0.2, 0.7), a_2a_4/ (0.6, 0.2)}

$\widetilde{K}^2_{\rho,\tau}$ (e_3) = {a_1 a_2/ (0.4, 0.6), a_2a_3/ (0.3, 0.5), a_2a_4/ (0, 0.7)}

$\widetilde{K}^2_{\rho,\tau}$ (e_4) = {a_1 a_2/ (0, 0.6), a_2a_3/ (0.4, 0.3), a_3a_4/ (0.3, 0.5)}

Then the union of two intuitionistic fuzzy soft graph is

$\widetilde{G}^3_{C,V_3}$ = $\widetilde{F}^3_{\mu,\gamma}$ (e_i), $\widetilde{K}^3_{\rho,\tau}$ (e_i)) Figure 5.3 such that

$\widetilde{F}^3_{\mu,\gamma}$ (e_1) = {a_1/ (0.1, 0.8), a_2/ (0.5, 0.4), a_3/(0.8, 0.2), a_4/(0.2, 0.7)}

$\widetilde{F}^3_{\mu,\gamma}$ (e_2) = {a_1/ (0.8, 0.1), a_2/ (0.3, 0.6), a_3/(0.3, 0.6), a_4/(0.9, 0.1)}

$\widetilde{F}^3_{\mu,\gamma}$ (e_3) = {a_1/ (0.6, 0.3), a_2/ (0.7, 0.2), a_3/(0.7, 0.2), a_4/(0, 0.6)}

$\widetilde{F}^3_{\mu,\gamma}$ (e_4) = {a_1/ (0, 0.6), a_2/ (0.7, 0.2), a_3/(0.5, 0.4), a_4/(0.4, 0.6)}

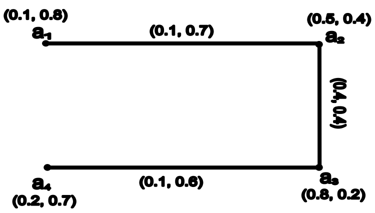
and

$\widetilde{K}^3_{\rho,\tau}$ (e_1) = {a_1 a_2/ (0.1, 0.7), a_2a_3/ (0.4, 0.4), a_3a_4/(0.1, 0.6), a_2a_4/(0, 1)}

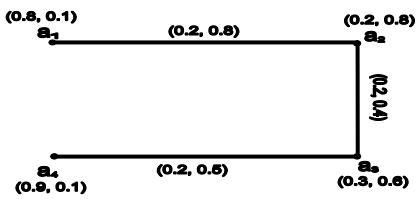
$\widetilde{K}^3_{\rho,\tau}$ (e_2) = {a_1 a_2/ (0.2, 0.7), a_2a_3/ (0.2, 0.7), a_3a_4/(0.2, 0.5), a_2a_4/(0.6, 0.2)}

$\widetilde{K}^3_{\rho,\tau}$ (e_3) = {a_1 a_2/ (0.4, 0.6), a_2a_3/ (0.5, 0.2), a_3a_4/(0, 0.6), a_2a_4/(0, 0.7)}

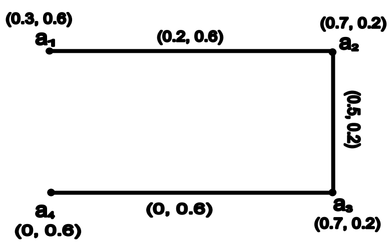
$\widetilde{K}^3_{\rho,\tau}$ (e_4) = {a_1 a_2/ (0, 0.6), a_2a_3/ (0.4, 0.3), a_3a_4/(0, 1), a_2a_4/(0.3, 0.5)}



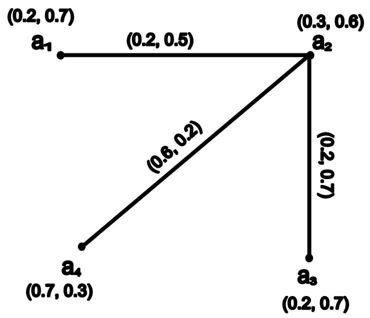
IFSG$_1$ Corresponding to the parameter e_1 (Figure 5.1)



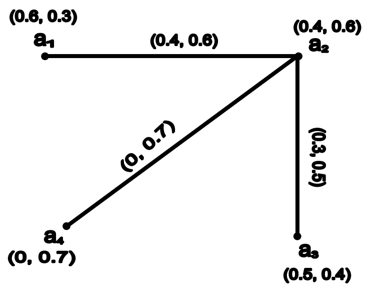
IFSG$_1$ Corresponding to the parameter e_2 (Figure 5.1)



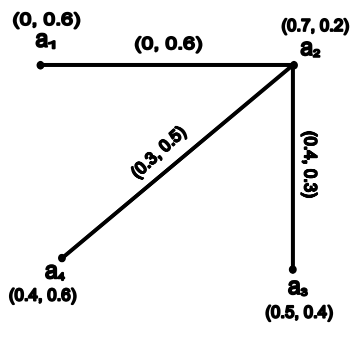
IFSG$_1$ Corresponding to the parameter e_3 (Figure 5.1)



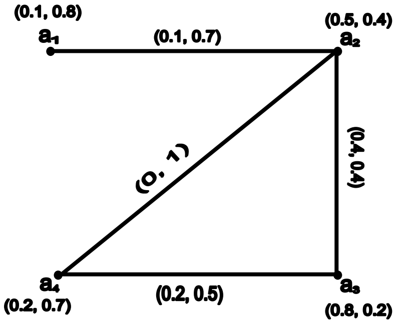
IFSG$_2$ Corresponding to the parameter e_2(Figure 5.2)

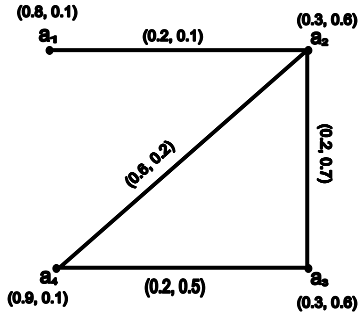


IFSG$_2$ Corresponding to the parameter e_3 (Figure 5.2)

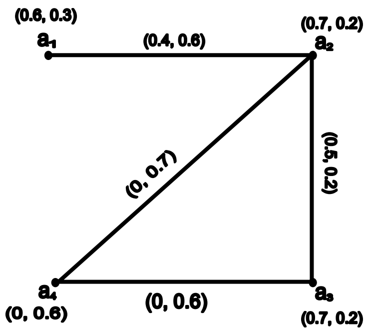


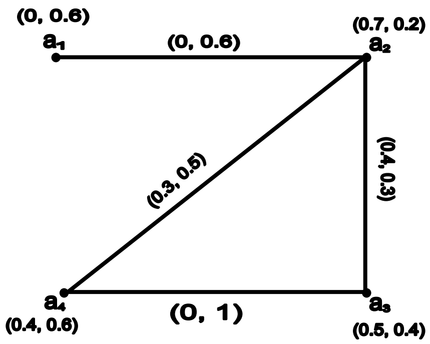
IFSG$_2$ Corresponding to the parameter e_4 (Figure 5.2)





IFSG$_3$ Corresponding to the parameter e$_1$(Figure 5.3) Union of two intuitionistic fuzzy soft graph Corresponding to the parameter e$_2$(Figure 5.3)





UTIFSG$_3$ Corresponding to the parameter e$_3$(Figure5.3) UTIFSG$_3$Corresponding to the parameter e$_4$ (Figure 5.3)

next to find V($\tilde{G}^3_{c,V_3}$) (figure 5.4)

V ($\tilde{F}^3_{\mu,\gamma}$ (e$_1$)) = {a$_1$/-0.7, a$_2$/0.1, a$_3$/0.6, a$_4$/-0.5}

V ($\tilde{F}^3_{\mu,\gamma}$ (e$_2$)) = {a$_1$/0.7, a$_2$/0.3, a$_3$/0.3, a$_4$/0.8}

V ($\tilde{F}^3_{\mu,\gamma}$ (e$_3$)) = {a$_1$/0.3, a$_2$/0.5, a$_3$/0.5, a$_4$/-0.6}

V ($\tilde{F}^3_{\mu,\gamma}$ (e$_4$)) = {a$_1$/-0.6, a$_2$/0.5, a$_3$/0.1, a$_4$/-0.2}

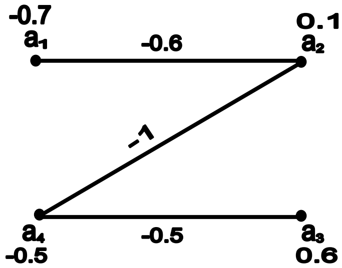
and

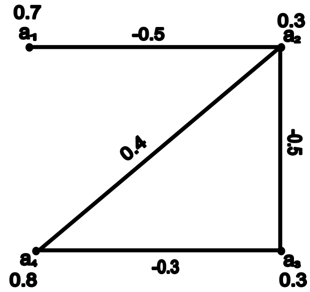
V ($\tilde{K}^3_{\rho,\tau}$ (e$_1$)) = {a$_1$a$_2$/-0.6, a$_2$a$_3$/0.0, a$_3$a$_4$/-0.5, a$_2$a$_4$/-1}

V ($\tilde{K}^3_{\rho,\tau}$ (e$_2$)) = {a$_1$a$_2$/-0.5, a$_2$a$_3$/-0.5, a$_3$a$_4$/-0.3, a$_2$a$_4$/0.4}

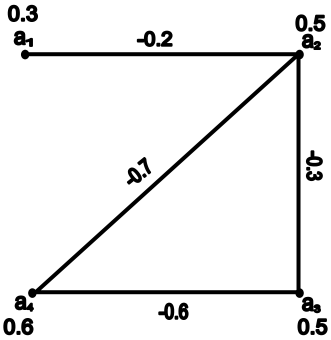
V ($\tilde{K}^3_{\rho,\tau}$ (e$_3$)) = {a$_1$a$_2$/-0.2, a$_2$a$_3$/0.3, a$_3$a$_4$/-0.6, a$_2$a$_4$/-0.7}

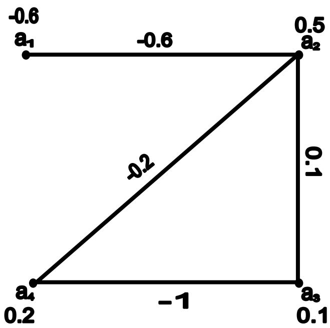
V ($\tilde{K}^3_{\rho,\tau}$ (e$_4$)) = {a$_1$a$_2$/-0.6, a$_2$a$_3$/0.1, a$_3$a$_4$/-1, a$_2$a$_4$/-0.2}





Value of then IFS graph $_3$ corresponding to the parameter e$_1$ Value of the IFSG$_3$ corresponding to the parameter

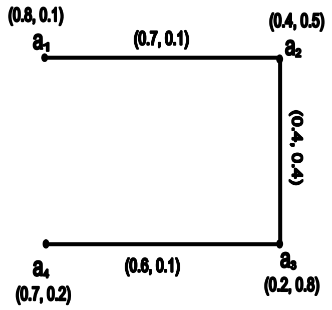


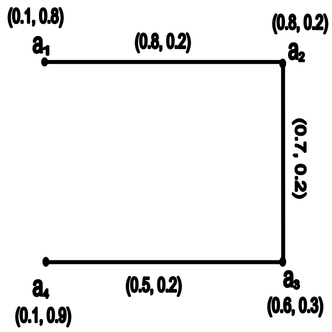


Value of the IFSG$_3$ corresponding to the parameter e$_3$ Value of the IFSG corresponding to the parameter e$_4$

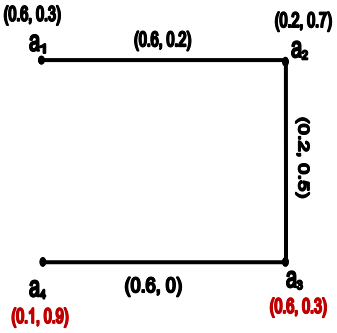
(Figure 5.4)

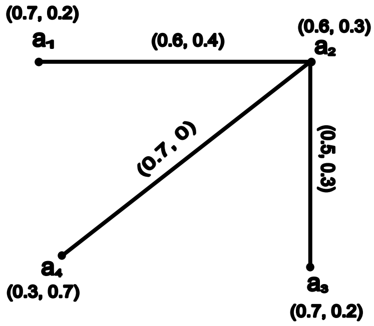
Then the complement of the intuitionistic fuzzy soft graphs are
$\tilde{F}^{1^C}_{\mu,\gamma}$ (e_1) = {a_1/ (0.8, 0.1), a_2/ (0.4, 0.5), a_3/ (0.2, 0.8), a_4/(0.7, 0.2)}
$\tilde{F}^{1^C}_{\mu,\gamma}$ (e_2) = {a_1/ (0.1, 0.8), a_2/ (0.8, 0.2), a_3/ (0.6, 0.3), a_4/(0.1, 0.9)}
$\tilde{F}^{1^C}_{\mu,\gamma}$ (e_3) = {a_1/ (0.6, 0.3), a_2/ (0.2, 0.7), a_3/ (0.2, 0.7), a_4/(0.6, 0)}
and
$\tilde{F}^{2^C}_{\mu,\gamma}$ (e_2) = {a_1/ (0.7, 0.2), a_2/ (0.6, 0.3), a_3/ (0.7, 0.2), a_4/(0.3, 0.7)}
$\tilde{F}^{2^C}_{\mu,\gamma}$ (e_3) = {a_1/ (0.3, 0.6), a_2/ (0.6, 0.4), a_3/ (0.4, 0.5), a_4/(0.7, 0)}
$\tilde{F}^{2^C}_{\mu,\gamma}$ (e_4) = {a_1/ (0.6, 0), a_2/ (0.2, 0.7), a_3/ (0.5, 0.4), a_4/(0.6, 0.4)}
Then,
$\tilde{K}^{1^C}_{\rho,\tau}$ (e_1) = {a_1a_2/ (0.7, 0.1), a_2a_3/ (0.4, 0.4), a_3 a_4/(0.6, 0.1)}
$\tilde{K}^{1^C}_{\rho,\tau}$ (e_2) = {a_1a_2/ (0.8, 0.2), a_2a_3/ (0.7, 0.2), a_3 a_4/(0.5, 0.2)}
$\tilde{K}^{1^C}_{\rho,\tau}$ (e_3) = {a_1a_2/ (0.6, 0.2), a_2a_3/ (0.2, 0.5), a_3 a_4/(0.6, 0)}
and
$\tilde{K}^{2^C}_{\rho,\tau}$ (e_2) = {a_1a_2/ (0.5, 0.2), a_2a_3/ (0.7, 0.2), a_3 a_4/(0.2, 0.6)}
$\tilde{K}^{2^C}_{\rho,\tau}$ (e_3) = {a_1a_2/ (0.6, 0.4), a_2a_3/ (0.5, 0.3), a_3 a_4/(0.7, 0)}
$\tilde{K}^{2^C}_{\rho,\tau}$ (e_4) = {a_1a_2/ (0.6, 0), a_2a_3/ (0.3, 0.4), a_3 a_4/(0.5, 0.3)}
$\therefore$ $\tilde{G}^{3^C}_{C,V_3}$ = $\tilde{F}^{3^C}_{\mu,\gamma}$ (e_i), $\tilde{K}^{3^C}_{\rho,\tau}$ (e_i)) (Figure 5.9)
$\tilde{F}^{3^C}_{\mu,\gamma}$ (e_1) = {a_1/ (0.8, 0.1), a_2/ (0.4, 0.5), a_3/(0.2, 0.8), a_4/(0.7, 0.2)}
$\tilde{F}^{3^C}_{\mu,\gamma}$ (e_2) = {a_1/ (0.7, 0.2), a_2/ (0.8, 0.2), a_3/(0.7, 0.2), a_4/(0.3, 0.7)}
$\tilde{F}^{3^C}_{\mu,\gamma}$ (e_3) = {a_1/ (0.6, 0.3), a_2/ (0.6, 0.4), a_3/(0.4, 0.5), a_4/(0.7, 0)}
$\tilde{F}^{3^C}_{\mu,\gamma}$ (e_4) = {a_1/ (0.6, 0), a_2/ (0.2, 0.7), a_3/(0.5, 0.4), a_4/(0.6, 0.4)}
and
$\tilde{K}^{3^C}_{\rho,\tau}$ (e_2) = {a_1a_2/ (0.7, 0.1), a_2a_3/ (0.4, 0.4), a_3 a_4/ (0.6, 0.1)}
$\tilde{K}^{3^C}_{\rho,\tau}$ (e_2) = {a_1a_2/ (0.8, 0.2), a_2a_3/ (0.7, 0.2), a_2a_4/ (0.2, 0.6), a_3a_4/(0.5, 0.2)}
$\tilde{K}^{3^C}_{\rho,\tau}$ (e_3) = {a_1a_2/ (0.6, 0.2), a_2a_3/ (0.5, 0.3), a_2a_4/ (0.7, 0.1), a_3a_4/(0.6, 0)}
$\tilde{K}^{3^C}_{\rho,\tau}$ (e_4) = {a_1a_2/ (0.6, 0), a_2a_3/ (0.3, 0.4), a_2a_4/ (0.5, 0.3)}
To find
V ($\tilde{G}^{3^C}_{C,V_3}$) (Figure 5.10)
V ($\tilde{F}^{3^C}_{\mu,\gamma}$ (e_1)) = {a_1/0.7, a_2/-0.1, a_3/-0.6, a_4/0.5}
V ($\tilde{F}^{3^C}_{\mu,\gamma}$ (e_2)) = {a_1/0.5, a_2/0.3, a_3/0.5, a_4/-0.4}
V ($\tilde{F}^{3^C}_{\mu,\gamma}$ (e_3)) = {a_1/0.3, a_2/0.2, a_3/-0.1, a_4/0.7}
V ($\tilde{F}^{3^C}_{\mu,\gamma}$ (e_4)) = {a_1/0.6, a_2/-0.5, a_3/0.1, a_4/0.2}
V ($\tilde{K}^{3^C}_{\rho,\tau}$ (e_1)) = {a_1a_2/0.6, a_2a_3/0, a_3 a_4/0.5, a_2a_4/1}
V ($\tilde{K}^{3^C}_{\rho,\tau}$ (e_2)) = {a_1a_2/0.6, a_2a_3/0.5, a_3 a_4/0.3, a_2a_4/1}
V ($\tilde{K}^{3^C}_{\rho,\tau}$ (e_3)) = {a_1a_2/0.4, a_2a_3/0.2, a_3 a_4/1, a_2a_4/0.6}
V ($\tilde{K}^{3^C}_{\rho,\tau}$ (e_1)) = {a_1a_2/0.6, a_2a_3/-0.1, a_3 a_4/1, a_2a_4/0.2}





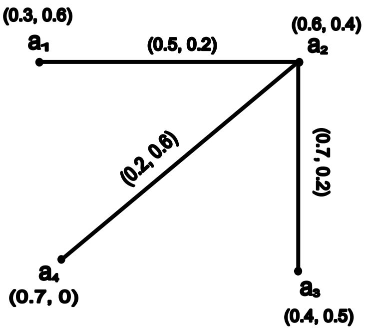
Complement of $IFSG_1$ corresponding to the parameter e_1 Complement of $IFSG_1$ corresponding to the parameter e_2(Figure 5.7)

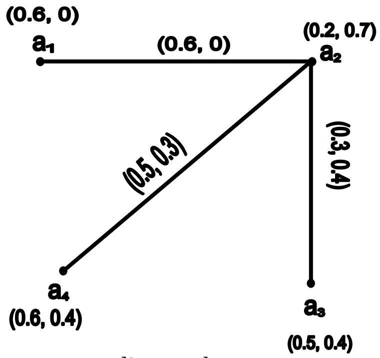




Complement of IFSG$_1$ corresponding to the parameter e_3 (Figure 5.7)

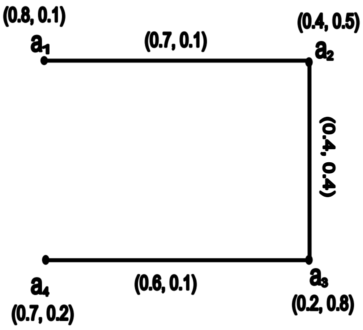
CIFSG$_2$ corresponding to the parameter e_2(Figure 5.8)

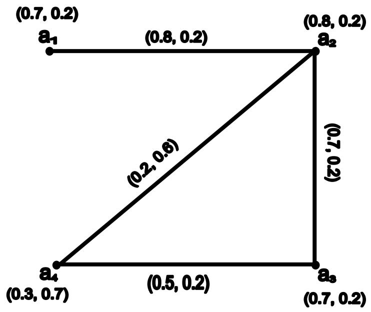


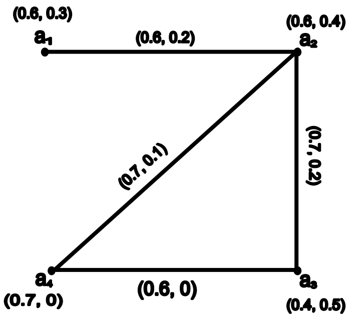


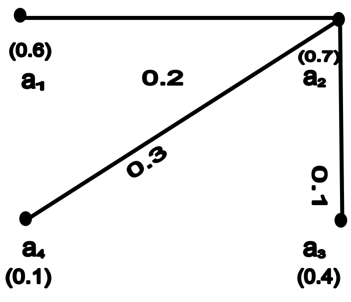
CIFSG$_2$ corresponding to the parameter e_3 (Figure 5.8)

CIFSG$_2$ corresponding to the parameter e_4 (Figure 5.8)



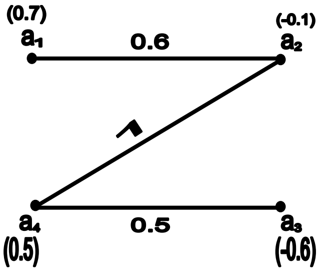


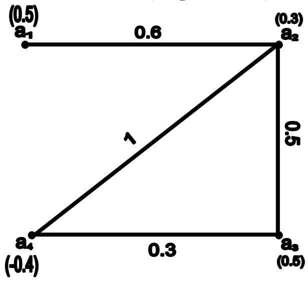




UCIFSG$_2$ corresponding to the parameter e_3 (Figure 5.9)

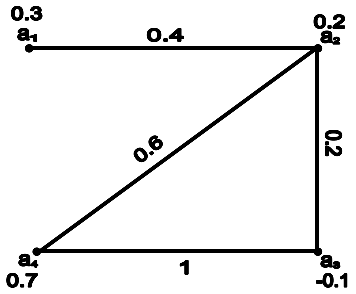
UCIFSG$_2$ corresponding to the parameter e_4 (Figure 5.9)

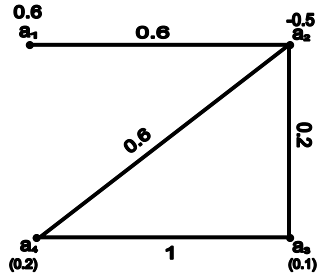




Value of complement of IFSG corresponding to the parameter e_1

Value of the IFSG corresponding to the parameter e_2





Value of the IFSG corresponding to the parameter e_3 VCIFSG Corresponding to the parameter e_4

(Figure 5.10)

Calculate the score (Figure 5.11)

$V(F(e_1)) = \{a_1/0, a_2/0, a_3/0, a_4/0\}$

$V(F(e_2)) = \{a_1/1.2, a_2/0.6, a_3/0.8, a_4/0.4\}$

$V(F(e_3)) = \{a_1/1.6, a_2/0.7, a_3/0.4, a_4/0.1\}$

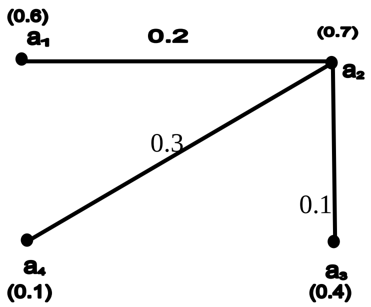
$V(F(e_4)) = \{a_1/0, a_2/0, a_3/0.2, a_4/0\}$ and

$V(K(e_1)) = \{a_1a_2/0, a_2a_3/0, a_3a_4/0, a_2a_4/0\}$

$V(K(e_2)) = \{a_1a_2/0.1, a_2a_3/0, a_3a_4/0, a_2a_4/0\}$

$V(K(e_3)) = \{a_1a_2/0.2, a_2a_3/0.5, a_3a_4/0, a_2a_4/-0.1\}$

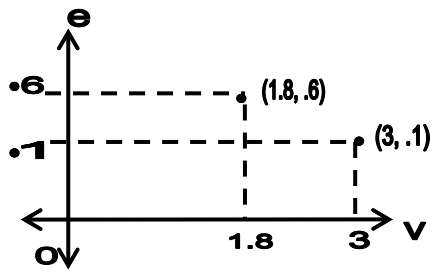
The total score for the best former who produced quality of paddy.



SIFSG Corresponding to the parameter e_3 (Figure 5.11)

Total score for the best farmer

	v	e
S_1	0	0
S_2	3.0	0.1
S_3	1.8	0.6
S_4	0.2	0



Total SIFS Graph(Figure 5.12)

We know that S_2 has the maximum value and the farmer who has used natural manure has the maximum yield. Thus we conclude that from both the scientific experts opinion farmer u_1 is selected as best one.

CONCLUSION

In this paper, we have proposed the concept of intuitionistic fuzzy soft graph and applied various new technologies on the graphs. Finally a new efficient solution procedure has been developed to solve intuitionistic fuzzy soft set based on real life decision making problems, which will contain more than one decision technology put forth in this paper may emerge a note worthy result in this field.

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