Interval Valued Intutionstic Fuzzy Graphs And It's Some Property

V.Lambodharan, N.Anitha, J.Venketsan, M.Latha, G.Geetha

Abstract: In this paper we explore, learn and propose a new technique we can define the interval valued intutionstic fuzzy Cartesian product and composition, union and intersection on interval-valued intutionstic fuzzy graphs and examine various of their properties. We also initiate the idea of interval-valued intutionstic fuzzy complete graphs and some properties also interval-valued intutionstic fuzzy complete graphs and interval valued intutionstic fuzzy isomorphisom.

Keywords : Fuzzy set, Interval-valued fuzzy graph, Interval-valued intutionstic fuzzy graph , Interval-valued intutionstic fuzzy complete graph, interval valued intutionstic fuzzy isomorphic graph

1. INTRODUCTION

Importance of Graph theory using in many uses of application problems. Latest applications in graph theory is fairly exciting analyzing any difficult situations and in addition in technical applications. It has got many applications OR, analyzing, complex routing, to analyze any complete in sequence we create concentrated apply of graphs. For operational on incomplete in order or partial in order or to switch the systems containing the basics of uncertainty we know that fuzzy logic and its participation in graph theory is applied. In, Rosenfeld [21] in 1975 analyzed the idea of fuzzy graphs whose ideas are given by Kauman [18] in 1973. The relation of fuzzy sets were also measured by Rosenfeld who give the idea of the formation of fuzzy graphs, finding various related results of more graph theoretical ideas. Bhattacharya [4] create few comments of fuzzy graphs Atanassov introduced the theory of IFR and IFG [2],[3],[32],[33]. Rashmanlou and Talebi [36] study and give the isomorphism property and complement of IVFG They give isomorphism and some new operations on vague graphs [37], [38]. Rashmalou and Borzooei research different idea of vague graphs [5], degree of nodes in vague graphs [6], and some concept of vague graphs.

2 PRELIMINARIES:

A graph $\overline{G}$ = (V, E), consists of a setoff objects $V=\{v_1, v_2, \dots\}$ called the set of nodes (points or vertices) and $E=\{e_1, e_2, \dots\}$ be the set of edges in $\overline{G}$. and $\overline{\varphi}$ is a mapping from the set of edges $E=\{e_1, e_2, \dots\}$ be the pairs of elements of $V=\{v_1, v_2, \dots\}$ .Two edges are adjacent if they are incident on a common vertex in $\overline{G}$. (For simplicity an edge {x, y} will be denoted by xy.) A graph which has no self loops no multiple edges that graph is called simple graph. A complete graph, in a graph, if the edges between every pair of nodes, such a graph is called complete graph. In which every pair of different nodes is connected by an edge. The complete graph on n nodes has $\frac{n(n-1)}{2}$ edges. By a complementary graph $\overline{G}^*$ of a simple graph $\overline{G}$ we mean a graph having the same nodes as $\overline{G}$ and such that two nodes are adjacent in $\overline{G}^*$ iff they are not adjacent in $\overline{G}^*$ Two graph $\overline{G}_1$ and $\overline{G}_2$ are called isomorphism to each other , if there exists a 1-1 correspondence between the nodes sets preserves adjacency of the nodes . Isomorphic graphs are denoted by $\overline{G}_1 \backsimeq \overline{G}_2$.

Two graph are sait to Cartesian product of $\overline{G}_1$ and $\overline{G}_2$ and defined by $\overline{G}_1=(\overline{V}_1, \overline{E}_1)$ and $\overline{G}_2=(\overline{V}_2, \overline{E}_2)$ then the Cartesian product defined by $\overline{G}_1 \times \overline{G}_2 = (V, E)$ with $V=(\overline{V}_1 \times \overline{V}_2)$ and $E=(\overline{E}_1 \times \overline{E}_2)$,Here we take $\in \overline{V}_1, a_1b_1 \in \overline{E}_1$, $c \in \overline{E}_2, a_2b_2 \in \overline{V}_2$. two simple graphs $\overline{G}_1$ and $\overline{G}_2$ whose union is defined as $\overline{G}_1 \cup \overline{G}_2 = (\overline{V}_1 \cup \overline{V}_2, \overline{E}_1 \cup \overline{E}_2)$. The sum of two simple groups $\overline{G}_1$ and $\overline{G}_2$ is defined as $\overline{G}_1 + \overline{G}_2 = (\overline{V}_1 \cup \overline{V}_2, \overline{E}_1 \cup \overline{E}_2 \cup \overline{E'})$, where $\overline{E'}$ be set of edges joined by the verities $\overline{V}_1$ and $\overline{V}_2$ that is we assumed $\overline{E'} = \overline{V}_1$ and $\overline{V}_2$ non empty.

2.1 Definition Fuzzy set: If X is a collection of members denoted by x then a fuzzy set A in X is defined as a set of pairs $\overline{A}=\{x, \mu_{\overline{A}}(x) / \ \ x \in X\}$, where $\mu_{\overline{A}}(x)$ is called the membership value of the fuzzy set $\overline{A}$ that maps every member of X to a membership degree between 0 and 1.

2.2 Fuzzy subset: We can define a fuzzy subset μ on the universal set $\overline{X}$, the mapping $\mu: \overline{X} \to I$ and the mapping $\lambda: \overline{X} \times \overline{X} \to I$ is called fuzzy relation on $\overline{X}$, here $\lambda(x,y) \leq \{($ minimum $(\mu(x), \mu(y)) \forall\, x, y \in \overline{X}$. Wher I mean closed interval $[0,1]$.The close interval fuzzy number $\overline{S}$ is an closed interval $[a_-, a^+]$ along with $0 \leq a_-, a^+ \leq 1$, here the closed interval $\overline{S}[0,1]$.

Let $\overline{S}_1 = [\overline{a}_{1-}, \overline{a}_2{}^+]$ and $\overline{S}_2 = [\overline{b}_{1-}, \overline{b}_2{}^+]$,then we can define the follows

Min$(\overline{S}_1, \overline{S}_2)$ =min$([\overline{a}_{1-}, \overline{a}_2{}^+], [\overline{b}_{1-}, \overline{b}_2{}^+])$ =

{min$\{[\overline{a}_{1-}, \overline{a}_2{}^+]\}$,min$\{[\overline{b}_{1-}, \overline{b}_2{}^+]\}$

Max$(\overline{S}_1, \overline{S}_2)$ =max$([\overline{a}_{1-}, \overline{a}_2{}^+], [\overline{b}_{1-}, \overline{b}_2{}^+])$ =

{max$\{[\overline{a}_{1-}, \overline{a}_2{}^+]\}$,max$\{[\overline{b}_{1-}, \overline{b}_2{}^+]\}$

Also we can define the following operation

$(i). \overline{S}_1 + \overline{S}_2 = \left\{ \left[\overline{a}_{1-}, \overline{a}_2{}^+ - \overline{a}_{1-} \times \overline{a}_2{}^+, \overline{b}_{1-}, \overline{b}_2{}^+ - \overline{b}_{1-} \times \overline{b}_2{}^+ \right] \right\}$.

$(ii)\ \overline{S}_1 \leq \overline{S}_2 \Leftrightarrow \overline{a}_{1-} \leq \overline{b}_{1-} \Leftrightarrow \overline{a}_2{}^+ \leq \overline{b}_2{}^+$.

$(ii)\ \overline{S}_1 \geq \overline{S}_2 \Leftrightarrow \overline{a}_{1-} \geq \overline{b}_{1-} \Leftrightarrow \overline{a}_2{}^+ \geq \overline{b}_2{}^+$.

$(iv)\ \overline{S}_1 = \overline{S}_2 \Leftrightarrow \overline{a}_{1-} = \overline{b}_{1-} \Leftrightarrow \overline{a}_2{}^+ = \overline{b}_2{}^+$.

$(v)\ \overline{S}_1 < \overline{S}_2 \Leftrightarrow \overline{S}_1 < \overline{S}_2 , \overline{S}_1 \neq \overline{S}_2$.

$(vi)\ \overline{S}_1 > \overline{S}_2 \Leftrightarrow \overline{S}_1 > \overline{S}_2 , \overline{S}_1 \neq \overline{S}_2$. Etc.

2.3 Definition Interval valued fuzzy set: Let X be the set of all closed subintervals and $\mathbb{G} = [\mathbb{G}^-, \mathbb{G}^+] \in [0,1]$. where $\mathbb{G}^-$lower boundary value are $\mathbb{G}^+$ are upper boundary value respectively. Then we can define the interval valued fuzzy set is $\mathbb{G} = \{(x, \mu_{\overline{\mathbb{G}}}(x), \gamma_{\overline{\mathbb{G}}}(x) \ / \ x \in X\}$ Here $\mu_{\overline{\mathbb{G}}} : X \to [0,1]$ defines the value of membership value of an element x to $\mathbb{G}$, also $\mu_{\overline{\mathbb{G}}}(x) \leq \gamma_{\overline{\mathbb{G}}}(x)$.

2.4 Definition: interval valued intuitionistic fuzzy set (ivifs)
Let X be the universal set, then we can define an IVIF set $\mathbb{G}$ is defined as follows

$\overline{\mathbb{G}} = \{\left(x, \left(\left[\mathbb{R}_{\overline{\mathbb{G}}-}(x), \mathbb{R}_{\overline{\mathbb{G}}+}(x)\right], \left[\mathbb{S}_{\overline{\mathbb{G}}-}(x), \mathbb{S}_{\overline{\mathbb{G}}+}(x)\right]\right)\right), x \in X\}$

Here $\mathbb{N}_{\overline{A}}(x): X \to [0,1]$ and $\mathbb{U}_{\overline{A}}(x): X \to [0,1]$ are the value of the membership and non-membership, $0 \leq \mathbb{R}_{\overline{\mathbb{G}}-}(x), \mathbb{R}_{\overline{\mathbb{G}}+}(x) + \mathbb{S}_{\overline{\mathbb{G}}-}(x), \mathbb{S}_{\overline{\mathbb{G}}+}(x) \leq 1, \forall \ x \in X$.Where $-$ and $+$ means lower and upper values of [0,1]. Let any two IVIFS $\overline{\mathbb{G}} = \left[\mathbb{R}_{\overline{\mathbb{G}}-}(x), \mathbb{R}_{\overline{\mathbb{G}}+}(x)\right], \left[\mathbb{S}_{\overline{\mathbb{G}}-}(x), \mathbb{S}_{\overline{\mathbb{G}}+}(x)\right]$ and $\overline{\mathbb{F}} = \left[\mathbb{R}_{\overline{\mathbb{F}}-}(x), \mathbb{R}_{\overline{\mathbb{F}}+}(x)\right], \left[\mathbb{S}_{\overline{\mathbb{F}}-}(x), \mathbb{S}_{\overline{\mathbb{F}}+}(x)\right]$ in X. Then we can define union and intersection defined as follows. $\overline{\mathbb{G}} \cup \overline{\mathbb{F}} = \{\begin{pmatrix} x, \max\left(\mathbb{R}_{\overline{\mathbb{G}}-}(x), \mathbb{R}_{\overline{\mathbb{G}}-}(x), \mathbb{R}_{\overline{\mathbb{F}}+}(x), \mathbb{R}_{\overline{\mathbb{F}}+}(x)\right), \\ \max\left(\mathbb{S}_{\overline{\mathbb{G}}-}(x), \mathbb{S}_{\overline{\mathbb{G}}-}(x), \mathbb{S}_{\overline{\mathbb{F}}+}(x), \mathbb{S}_{\overline{\mathbb{F}}+}(x)\right), \forall x \in X \end{pmatrix}\}$.

$\overline{\mathbb{G}} \cap \overline{\mathbb{F}} = \{\begin{pmatrix} x, \min\left(\mathbb{R}_{\overline{\mathbb{G}}-}(x), \mathbb{R}_{\overline{\mathbb{G}}-}(x), \mathbb{R}_{\overline{\mathbb{F}}+}(x), \mathbb{R}_{\overline{\mathbb{F}}+}(x)\right), \\ \min\left(\mathbb{S}_{\overline{\mathbb{G}}-}(x), \mathbb{S}_{\overline{\mathbb{G}}-}(x), \mathbb{S}_{\overline{\mathbb{F}}+}(x), \mathbb{S}_{\overline{\mathbb{F}}+}(x)\right), \forall x \in X \end{pmatrix}\}$.

If $\overline{G} = (\overline{V}, \overline{E})$ be the simple graph, then IVIF relation $\overline{\mathbb{A}}$ on the set $\overline{E}$, which mean we define IVIF
$\mu_{\overline{\mathbb{A}}}(xy) \leq$
$\min(\mu_{\overline{\mathbb{A}}+}(x), \mu_{\overline{\mathbb{A}}+}(x), \mu_{\overline{\mathbb{A}}+}(y), \mathbb{S}_{\overline{\mathbb{A}}}(y)) \ \mu_{\overline{\mathbb{A}}}(xy) \leq$ min
$(\mu_{\overline{\mathbb{A}}-}(x), \mu_{\overline{\mathbb{A}}-}(x) \ \mu_{\overline{\mathbb{A}}-}(y), \mu_{\overline{\mathbb{A}}-}(y))$, $\forall xy \in \overline{E}$.

3 Operation on ivifg.

3.1 Definition: Let $\overline{G} = (\overline{V}, \overline{E})$ be the IVIFG the $G = (A, B)$ be the two ordered pair, where
$A = [(\mu_{A-}(x), \mu_{A-}(x)), (\mu_{A+}(x), \mu_{A+}(x))]$ be the IVIF set on $\overline{V}$ and $B = [(\mu_{B-}(x), \mu_{B-}(x)), (\mu_{B+}(x), \mu_{B+}(x))]$ be the IVIF relation on the set $\overline{E}$.

3.2 Definition: The Cartesian product of IVIFG $\overline{G} = (\overline{V}, \overline{E})$, then take $\overline{G}_1 = (A \times \overline{A}_1, B \times \overline{B}_1)$and $\overline{G}_2 = (A \times \overline{A}_2, B \overline{\times B_2})$ of the graph $G^*{}_1 = (V \times \overline{V}_1, E \times \overline{E}_1)$ and $G^*{}_2 = (V \times \overline{V}_2, E \times \overline{E}_2)$ then we can defined as a pair $[(A \times \overline{A}_1, A \times \overline{A}_2), (B \times \overline{B}_1, B \times \overline{B}_2)]$, then we define as follows.

$$(1)\begin{cases} [(\mu_{A-} \times \mu_{\overline{A}_1-}), (\mu_{A-} \times \mu_{\overline{A}_2-})](xx_1, xx_2) = \\ \min\{[(\mu_{A-}(x) \times \mu_{\overline{A}_1-}(x_1), \mu_{A-}(x) \times \mu_{\overline{A}_2-}(x_2)]\} \\ [(\mu_{A+} \times \mu_{A_1+}), (\mu_{A+} \times \mu_{\overline{A}_2+})](xx_1, xx_2) = \\ \min\{[(\mu_{A+}(x) \times \mu_{\overline{A}_1+}(x_1), \mu_{A+}(x) \times \mu_{\overline{A}_{2+}}(x_2)]\} \end{cases}$$
$\forall x, x_1, x_2 \in \overline{V}$.

$$(2)\begin{cases} [(\mu_{B-} \times \mu_{\overline{B}_1-}), (\mu_{B-} \times \mu_{B_2-})](xx_1, xx_2)(yy_1, yy_2) = \\ \min\{[(\mu_{B-}(x) \times \mu_{B_1-}(y), \mu_{A-}(x_1y_1) \times \mu_{A_1-}(x_2y_2)]\} \\ [(\mu_{B+} \times \mu_{\overline{B}_1+}), (\mu_{B+,} \times \mu_{\overline{B}_2+})](xx_1, xx_2)(yy_1, yy_2) = \\ \min\{[(\mu_{A+}(x) \times \mu_{A_1+}(y), \mu_{A+}(x_1y_1) \times \mu_{A_1+}(x_2y_2)]\} \end{cases}$$
$\forall x, y \in V_1, x_1, x_2, y_1, y_2 \in \overline{E}_2$.

$$(3)\begin{cases} [(\mu_{B-} \times \mu_{\overline{B}_1-}), (\mu_{B-} \times \mu_{B_2-})](xx_1, zz_1)(yy_1, zz_2) = \\ \min\{[(\mu_{B-}(x) \times \mu_{B_1-}(z)), (\mu_{A-}(x_1z_1) \times \mu_{A_1-}(y_2z_2)]\} \\ [(\mu_{B+} \times \mu_{\overline{B}_1+}), (\mu_{B+} \times \mu_{\overline{B}_2+})](xx_1, zz_1)(yy_1, zz_2) = \\ \min\{[(\mu_{A+}(x) \times \mu_{A_1+}(z), \mu_{A+}(x_1z_1) \times \mu_{A_1+}(y_2z_2)]\} \end{cases}$$
$\forall z, z_2 \in V_2, x, x_1, y, y_1 \in \overline{E}_1$.

3.2 Definition: IVIFG of composition of two simple graphs $Go\overline{G}_1[G \ o\overline{G}_2]$ is denoted by
$(Go\overline{G}_1, Go\overline{G}_2) = [(Ao\overline{A}_1, Ao\overline{A}_2), (Bo\overline{B}_1, Bo\overline{B}_2)]$ of two IVIFG $[(G^*o\overline{G}_1{}^*, G^* o\overline{G}_2{}^*)]$is defined as follows

$$(1)\begin{cases} [(\mu_{A-}o \ \mu_{\overline{A}_1-}), (\mu_{A-}o \ \mu_{\overline{A}_2-})](xx_1, xx_2) = \\ \min\left\{[(\mu_{A-}(x)o\mu_{\overline{A}_1-}(x_1)\right), (\mu_{A-}(x)o\mu_{\overline{A}_2-}(x_2))]\} \\ [(\mu_{A+}o \ \mu_{A_1+}), (\mu_{A+}o \ \mu_{\overline{A}_2+})](xx_1, xx_2) = \\ \min\left\{[(\mu_{A+}(x)o\mu_{\overline{A}_1+}(x_1)\right), (\mu_{A+}(x)o\mu_{\overline{A}_{2+}}(x_2))]\} \end{cases}$$
$\forall x, x_1, x, x_2 \in V$.

$$(2)\begin{cases} [(\mu_{B-}o \ \mu_{\overline{B}_1-}), (\mu_{B-}o \ \mu_{B_2-})](xx_1, xx_2)(yy_1, yy_2) = \\ \min\left\{[(\mu_{B-}(x)o\mu_{B_1-}(y)\right), (\mu_{A-}(x_1y_1)o\mu_{A_1-}(x_2y_2))]\} \\ [(\mu_{B+}o \ \mu_{\overline{B}_1+}), (\mu_{B+}o \ \mu_{\overline{B}_2+})](xx_1, xx_2)(yy_1, yy_2) = \\ \min\{[(\mu_{A+}(x)o\mu_{A_1+}(y)), (\mu_{A+}(x_1y_1)o\mu_{A_1+}(x_2y_2)\} \end{cases}$$
$\forall x, y \in \overline{V}_1 \ and \ x_1, x_2, y_1, y_2 \in \overline{E}_2$.

$$(3)\begin{cases} [(\mu_{B-}o \ \mu_{\overline{B}_1-}), (\mu_{B-}o \ \mu_{B_2-})](xx_1, zz_1)(yy_1, zz_2) = \\ \min\left\{[(\mu_{B-}(x)o\mu_{B_1-}(z)\right), (\mu_{A-}(x_1z_1)o\mu_{A_1-}(y_2z_2)\} \\ [(\mu_{B+}o \ \mu_{\overline{B}_1+}), (\mu_{B+}o \ \mu_{\overline{B}_2+})](xx_1, zz_1)(yy_1, zz_2) = \\ \min\{[(\mu_{A+}(x)o\mu_{A_1+}(z)), (\mu_{A+}(x_1z_1)o\mu_{A_1+}(y_2z_2)]\} \end{cases}$$
$\forall z, z_2 \in V_2, x, x_1, y, y_1 \in \overline{E}_1$.

3.3 Definition: The union IVIFG of $\overline{G} = (\overline{V}, \overline{E})$, then take $\overline{G}_1 = (A\overline{A}_1, B\overline{B}_1)$ and $\overline{G}_2 = (A\overline{A}_2, B\overline{B}_2)$ of the graph $G^*{}_1 = (V\overline{V}_1, E\overline{E}_1)$ and $G^*{}_2 = (V\overline{V}_2, E\overline{E}_2)$ then we have the pair $[(A \cup \overline{A}_1, A \cup \overline{A}_2), (B \cup \overline{B}_1, B \cup \overline{B}_2)]$, then we define as follows,

$$(1)\begin{cases} [(\mu_{A-} \cup \mu_{\overline{A}_1-}), (\mu_{A-} \cup \mu_{\overline{A}_2-})](x) = \\ [(\mu_{A-}(x) \cup \mu_{\overline{A}_1-}(x) \text{if } x \in \overline{V}_1, x \notin \overline{V}_2 \\ [(\mu_{A-} \cup \mu_{\overline{A}_1-}), (\mu_{A-} \cup \mu_{\overline{A}_2-})](x) = \\ [(\mu_{A-}(x) \cup \mu_{\overline{A}_2-}(x) if x \notin \overline{V}_1, x \in \overline{V}_2 \\ [(\mu_{A-} \cup \mu_{\overline{A}_1-}), (\mu_{A-} \cup \mu_{\overline{A}_2-})](x) = \\ max(\mu_{A-}(x), \mu_{\overline{A}_2-}(x) if x \in \overline{V}_1 \cap \overline{V}_2 \end{cases}$$

$$(2)\begin{cases} [(\mu_{A+} \cup \mu_{\overline{A}_1+}), (\mu_{A+} \cup \mu_{\overline{A}_2+})](x) = \\ [(\mu_{A+}(x) \cup \mu_{\overline{A}_1+}(x) \text{if } x \in \overline{E}_1, x \notin \overline{E}_2 \\ [(\mu_{A+} \cup \mu_{\overline{A}_1+}), (\mu_{A+} \cup \mu_{\overline{A}_2+})](x) = \\ [(\mu_{A+}(x) \cup \mu_{\overline{A}_2+}(x) if x \notin \overline{E}_1, x \in E_2 \\ [(\mu_{A+} \cup \mu_{\overline{A}_1+}), (\mu_{A+} \cup \mu_{\overline{A}_2+})](x) = \\ max(\mu_{A+}(x), \mu_{\overline{A}_2+}(x) if x \in \overline{V}_1 \cap \overline{V}_2 \end{cases}$$

$$(3)\begin{cases} [(\mu_{B-} \cup \mu_{\overline{B}_1-}), (\mu_{B-} \cup \mu_{\overline{B}_2-})](xy) = \\ [(\mu_{B-}(xy) \cup \mu_{\overline{B}_1-}(xy) \text{if } xy \in \overline{E}_1, xy \notin \overline{E}_2 \\ [(\mu_{B-} \cup \mu_{\overline{B}_1-}), (\mu_{B-} \cup \mu_{\overline{B}_2-})](xy = \\ [(\mu_{B-}(x) \cup \mu_{\overline{B}_2-}(x) if xy \notin \overline{E}_1, xy \in \overline{E}_2 \\ [(\mu_{B-} \cup \mu_{\overline{B}_1-}), (\mu_{B-} \cup \mu_{\overline{B}_2-})](xy) = \\ max(\mu_{B-}(xy), \mu_{\overline{B}_2-}(xy) \ if xy \in \overline{V}_1 \cap \overline{V}_2 \end{cases}$$

$$(4)\begin{cases}[(\mu_{B+}\cup\ \mu_{\overline{B}_1+}),(\mu_{B-}\cup\ \mu_{\overline{B}_2-})](xy)=\\ [(\mu_{B+}(xy)\cup\ \mu_{\overline{B}_1+}(\mathrm{xy})\text{ if }\mathrm{xy}\in\overline{\mathrm{E}}_1,\mathrm{x}\notin\overline{\mathrm{E}}_2\\ [(\mu_{B+}\cup\ \mu_{\overline{B}_1+}),(\mu_{B+}\cup\ \mu_{\overline{B}_2+})](xy)=\\ [(\mu_{B+}(x)\cup\ \mu_{\overline{B}_2+}(xy)\ if\ \mathrm{xy}\notin\overline{\mathrm{E}}_1,\mathrm{xy}\in\overline{\mathrm{E}}_2\\ [(\mu_{B+}\cup\ \mu_{\overline{B}_1+})\cup(\mu_{B+}\cup\ \mu_{\overline{B}_2+})](xy)=\\ max(\mu_{B+}(xy),\mu_{\overline{B}_2+}(xy)\ if\ xy\in\overline{V}_1\cap\overline{V}_2\end{cases}$$

3.4 Theorem:The Cartesian product $[(G\times\overline{G}_1),(G\times\overline{G}_2)])=[(A\times A_1,A\times A_2),(B\times B_1,B\times B_2)]$ of two IVIFGs of the graphs $G^*G^*{}_1$ and $G^*G^*{}_2$ is an interval valued Intuitionistic fuzzy graphs$[(G^*\times G^*{}_1),(G^*\times G^*{}_2)]$.

Proof: we have to verify for condition for $(B\times B_1,B\times B_2)$ and $(A\times A_1,A\times A_2)$ is evidently true. Let

$\mathrm{xy}\in\overline{\mathrm{V}}_1,\mathrm{x_1y_1x_2y_2}\in\mathrm{E}_2$

$[(\mu_{B-}\times\ \mu_{\overline{B}_1-}),(\mu_{B-}\times\ \mu_{\overline{B}_2-})](xy,x_1x_2)(xy,y_1\,y_2)$

$=\min(\mu_{A-}\times\ \mu_{\overline{A}_1-}(xy,x_1x_2),(\mu_{A-}\times\ \mu_{\overline{A}_2-}(xy,y_1\,y_2)$

$\le$

$\min(\ \min(\mu_{A-}\times\ \mu_{\overline{A}_1-}(xy,x_1x_2),\min\ (\mu_{A-}\times\ \mu_{\overline{A}_2-}(x_1\,x_2),(\mu_{A-}\times\ \mu_{\overline{A}_2-}(y_1\,y_2),$

$\le\min(\ \min(\mu_{A-}\times\ \mu_{\overline{A}_1-}(xy,x_1x_2),\min(\mu_{A-}\times\ \mu_{\overline{A}_2-}(x_1\,x_2),\min(\mu_{A-}\times\ \mu_{\overline{A}_2-}(y_1\,y_2)$

$=\min((\mu_{A-}\times\ \mu_{\overline{A}_1-})\,(xy,x_1x_2),min(\mu_{A-}\times\ \mu_{\overline{A}_2-})(xy,y_1\,y_2)$

$[(\mu_{B+}\times\ \mu_{\overline{B}_1+}),(\mu_{B+}\times\ \mu_{\overline{B}_2+})](xy,x_1x_2)(xy,y_1\,y_2)$

$=\min(\mu_{A+}\times\ \mu_{\overline{A}_1+}(xy,x_1x_2),(\mu_{A+}\times\ \mu_{\overline{A}_2+}(xy,y_1\,y_2$

$\le$

$\min(\ \min(\mu_{A+}\times\ \mu_{\overline{A}_1+}(xy,x_1x_2),\min\ (\mu_{A+}\times\ \mu_{\overline{A}_2+}(x_1\,x_2),(\mu_{A+}\times\ \mu_{\overline{A}_2+}(y_1\,y_2),$

$\le\min(\ \min(\mu_{A+}\times\ \mu_{\overline{A}_1+}(xy,x_1x_2),\min(\mu_{A+}\times\ \mu_{\overline{A}_2+}(x_1\,x_2),\min(\mu_{A+}\times\ \mu_{\overline{A}_2+}(y_1\,y_2)$

$=\min((\mu_{A+}\times\ \mu_{\overline{A}_1+})\,(xy,x_1x_2),(\mu_{A+}\times\ \mu_{\overline{A}_2+})(xy,y_1\,y_2)]$

Also we can prove $zz_1\in V_2,\mathrm{x_1y_1x_2y_2}\in\mathrm{E}_1$

$[(\mu_{B-}\times\ \mu_{\overline{B}_1-}),(\mu_{B-}\times\ \mu_{\overline{B}_2-})](xx_1,zz_1)(yy_1,zz_1)$

$=\min(\mu_{A-}\times\ \mu_{\overline{A}_1-}(xx_1,zz_1),(\mu_{A-}\times\ \mu_{\overline{A}_2-}(yy_1,zz_1)$

$\le$

$\min(\ \min(\mu_{A-}\times\ \mu_{\overline{A}_1-}(xx_1,zz_1),\min\ (\mu_{A-}\times\ \mu_{\overline{A}_2-}(yy_1),(\mu_{A-}\times\ \mu_{\overline{A}_2-}(zz_1),$

$\le$

$\min(\ \min(\mu_{A-}\times\ \mu_{\overline{A}_1-}(xx_1,zz_1),\min(\mu_{A-}\times\ \mu_{\overline{A}_2-}(yy_1\,),min(\mu_{A-}\times\ \mu_{\overline{A}_2-}(zz_1)$

$=$

$\min((\mu_{A-}\times\ \mu_{\overline{A}_1-})\,(xx_1,zz_1),(\mu_{A-}\times\ \mu_{\overline{A}_2-})(yy_1,zz_1)]$

$[(\mu_{B+}\times\ \mu_{\overline{B}_1+}),(\mu_{B+}\times\ \mu_{\overline{B}_2+})](xx_1,zz_1)(yy_1,zz_1)$

$=\min(\mu_{A+}\times\ \mu_{\overline{A}_1+}(xx_1,zz_1),(\mu_{A+}\times\ \mu_{\overline{A}_2+}(yy_1,zz_1)$

$\le$

$\min(\ \min(\mu_{A+}\times\ \mu_{\overline{A}_1+}(xx_1,zz_1),\min\ (\mu_{A+}\times\ \mu_{\overline{A}_2+}(yy_1),(\mu_{A+}\times\ \mu_{\overline{A}_2+}(zz_1),$

$\le\min(\ \min(\mu_{A+}\times\ \mu_{\overline{A}_1+}(xx_1,zz_1),\min(\mu_{A-}\times\ \mu_{\overline{A}_2+}(yy_1\,),\min(\mu_{A+}\times\ \mu_{\overline{A}_2+}(zz_1)$

$=$

$\min((\mu_{A+}\times\ \mu_{\overline{A}_1+})\,(xx_1,zz_1),(\mu_{A+}\times\ \mu_{\overline{A}_2+})(yy_1,zz_1)]$

Hence complete the theorem.

3.6 Theorem:The IVIFG of $G\ \ \overline{G}_1$ and $G\ \ \overline{G}_2$ and then composition function $[G\ \circ\overline{G}_1\ ,\ G\ \circ\overline{G}_2]$ of $G^*\overline{G}^*{}_1$ and $G^*\overline{G}^*{}_2$ that form the composition function $[G^*\ \circ\overline{G}^*{}_1\ ,\ G^*\ \circ\overline{G}^*{}_2]$.

Proof: we have to verify for condition for $(B\circ B_1,B\circ B_2)$ and $(A\circ A_1,A\circ A_2)$ is evidently true. Let $\mathrm{xy}\in\overline{\mathrm{V}}_1,\mathrm{x_1y_1x_2y_2}\in\mathrm{E}_2$

$[(\mu_{B-}\circ\ \mu_{\overline{B}_1-}),(\mu_{B-}\circ\ \mu_{\overline{B}_2-})](xy,x_1x_2)(xy,y_1\,y_2)$

$=\min(\mu_{A-}\circ\ \mu_{\overline{A}_1-}(xy,x_1x_2),(\mu_{A-}\circ\ \mu_{\overline{A}_2-}(xy,y_1\,y_2$

$\le\min(\ \min(\mu_{A-}\circ\ \mu_{\overline{A}_1-}(xy,x_1x_2),min\ (\mu_{A-}\circ\ \mu_{\overline{A}_2-}(x_1\,x_2),(\mu_{A-}\circ\ \mu_{\overline{A}_2-}(y_1\,y_2),$

$\le\min(\ \min(\mu_{A-}\circ\ \mu_{\overline{A}_1-}(xy,x_1x_2),min(\mu_{A-}\circ\ \mu_{\overline{A}_2-}(x_1\,x_2),min(\mu_{A-}\circ\ \mu_{\overline{A}_2-}(y_1\,y_2)$

$=\min((\mu_{A-}\circ\ \mu_{\overline{A}_1-})\,(xy,x_1x_2),min(\mu_{A-}\circ\ \mu_{\overline{A}_2-})(xy,y_1\,y_2)$

$[(\mu_{B+}\circ\ \mu_{\overline{B}_1+}),(\mu_{B+}\circ\ \mu_{\overline{B}_2+})](xy,x_1x_2)(xy,y_1\,y_2)$

$=\min(\mu_{A+}\circ\ \mu_{\overline{A}_1+}(xy,x_1x_2),(\mu_{A+}\circ\ \mu_{\overline{A}_2+}(xy,y_1\,y_2$

$\le\min(\ \min(\mu_{A+}\circ\ \mu_{\overline{A}_1+}(xy,x_1x_2),min\ (\mu_{A+}\circ\ \mu_{\overline{A}_2+}(x_1\,x_2),(\mu_{A+}\circ\ \mu_{\overline{A}_2+}(y_1\,y_2),$

$\le\min(\ \min(\mu_{A+}\circ\ \mu_{\overline{A}_1+}(xy,x_1x_2),min(\mu_{A+}\circ\ \mu_{\overline{A}_2+}(x_1\,x_2),min(\mu_{A+}\circ\ \mu_{\overline{A}_2+}(y_1\,y_2)$

$=\min((\mu_{A+}\circ\ \mu_{\overline{A}_1+})\,(xy,x_1x_2),(\mu_{A+}\circ\ \mu_{\overline{A}_2+})(xy,y_1\,y_2)]$

Similarly we can prove $zz_1\in V_2,\mathrm{x_1y_1x_2y_2}\in\mathrm{E}_1$

$[(\mu_{B-}\circ\ \mu_{\overline{B}_1-}),(\mu_{B-}\circ\ \mu_{\overline{B}_2-})](xx_1,zz_1)(yy_1,zz_1)$

$=\min(\mu_{A-}\circ\ \mu_{\overline{A}_1-}(xx_1,zz_1),(\mu_{A-}\circ\ \mu_{\overline{A}_2-}(yy_1,zz_1)$

$\le$

$\min(\ \min(\mu_{A-}\circ\ \mu_{\overline{A}_1-}(xx_1,zz_1),min\ (\mu_{A-}\circ\ \mu_{\overline{A}_2-}(yy_1),(\mu_{A-}\circ\ \mu_{\overline{A}_2-}(zz_1),$

$\le$

$\min(\ \min(\mu_{A-}\circ\ \mu_{\overline{A}_1-}(xx_1,zz_1),min(\mu_{A-}\circ\ \mu_{\overline{A}_2-}(yy_1\,),min(\mu_{A-}\circ\ \mu_{\overline{A}_2-}(zz_1)$

$=\min((\mu_{A-}\circ\ \mu_{\overline{A}_1-})\,(xx_1,zz_1),(\mu_{A-}\circ\ \mu_{\overline{A}_2-})(yy_1,zz_1)]$

$[(\mu_{B+}\circ\ \mu_{\overline{B}_1+}),(\mu_{B+}\circ\ \mu_{\overline{B}_2+})](xx_1,zz_1)(yy_1,zz_1)$

$=\min(\mu_{A+}\circ\ \mu_{\overline{A}_1+}(xx_1,zz_1),(\mu_{A+}\circ\ \mu_{\overline{A}_2+}(yy_1,zz_1)$

$\le$

$\min(\ \min(\mu_{A+}\circ\ \mu_{\overline{A}_1+}(xx_1,zz_1),min\ (\mu_{A+}\circ\ \mu_{\overline{A}_2+}(yy_1),(\mu_{A+}\circ\ \mu_{\overline{A}_2+}(zz_1),$

$\le$

$\min(\ \min(\mu_{A+}\circ\ \mu_{\overline{A}_1+}(xx_1,zz_1),min(\mu_{A-}\circ\ \mu_{\overline{A}_2+}(yy_1\,),min(\mu_{A+}\circ\ \mu_{\overline{A}_2+}(zz_1)$

$=\min((\mu_{A+}\circ\ \mu_{\overline{A}_1+})\,(xx_1,zz_1),(\mu_{A+}\circ\ \mu_{\overline{A}_2+})(yy_1,zz_1)]$

Hence complete the theorem.

4 Isomorphism of interval valued intuitionistic fuzzy graph.

4.1 Definition: Let $GG_1 = (AA_1, AA_2)$ and $GG_2 = (BB_1, BB_2)$ be the two IVIFGs. A homomorphism $f: GG_1 \rightarrow GG_2$ and the mapping $f: VV_1 \rightarrow VV_2$ then
$(i)\mu_{A-}(xx_1) \leq \left(\mu_{A-}(f(xx_1)\right), \mu_{A+}(xx_1) \leq \left(\mu_{A+}(f(xx_1)\right)$
$, \left(\mu_{B-}(x_1x_2), \mu_{B-}(y_1y_2)\right) \leq$
$(\mu_{B-}(f(x_1x_2), \mu_{B-}f(y_1y_2), \left(\mu_{B+}(x_1x_2), \mu_{B+}(y_1y_2)\right) \leq$
$(\mu_{B+}(f(x_1x_2), \mu_{B+}f(y_1y_2). \forall xx_1 \in V, x_1x_2, y_1y_2 \in E_1.$
Conculation: It is well recognized that IVIFS form a overview of the concept of fuzzy sets. IVIFS methods provide new accuracy; give the classification as compared to the standard and fuzzy methods. So we hold introduced IVFS and have accessible some properties in this paper. The further study of IVIFGs may also be use with many applications.

REFERENCE

[1] P. Bhattacharya, Some remarks on fuzzy graphs, Pattern Recognition Letter 6 (1987)297- 302.
[2] K.R. Bhutani, On automorphism of fuzzy graphs, Pattern Recognition Letter 9 (1989 159-162.
[3] K.T. Atanassov, G. Pasi, R. Yager, V. Atanassova, Intuitionistic fuzzy graph, interpretations of multi-person multi-criteria decision making, Proceedings of EUSFLAT Conf, (2003), 177182.
[4] P. Bhattacharya, Some remarks on fuzzy graphs, Pattern Recog. Lett., 7 (198), 297 302.
[5] R.A. Borzooei, H. Rashmanlou, New concepts of vague graphs, Int. J. Mach. Learn. Cybern. 192 S. lavanya, p.k. kishore kumar, h. rashmanlou and m.n. jouybari
[6] R.A. Borzooei, H. Rashmanlou, Degree of vertices in vague graphs, J. Appl.Math. Inf., 33 (2015), 545-557.
[7] R.A. Borzooei, H. Rashmanlou, More results on vague graphs, UPB Sci. Bul. Ser. A, 78, (2016), 109-122.
[8] R.A. Borzooei, H. Rashmanlou, Semi global domination sets in vague graphs with application, J. Intell. Fuzzy Syst., 30 (2016), 3645-3652.
[9] R.A. Borzooei, H. Rashmanlou, Degree and total degree of edges in bipolar fuzzy graphs with application, J. Intell. Fuzzy Syst., 30 (2016), 3271-3280.
[10] Ganesh Ghorai and Madhumangal Pal, Regular product vague graphs and product vague line graphs, Cogent Mathematics 3(1)(2016), 1-13 .
[11] Ganesh Ghorai and Madhumangal Pal, Planarity in vague graphs with applications, Acta Mathematica Academiae Paedagogicae Nyiregyhaziensis,33 (2017), 1-21.
[12] Ganesh Ghorai and Madhumangal Pal, Faces and Dual of m-polar fuzzy planar graphs, Journal of Intelligent Fuzzy system, 31 (2016), 2043-2049.
[13] Ganesh Ghorai and Madhumangal Pal, A Note on "Regular bipolar fuzzy graphs", Neural Computing and Applications, 21 2012, 197-205.
[14] Ganesh Ghorai and Madhumangal Pal, Some isomorphic properties of m-polar fuzzy graphs with applications, SpringerPlus, 5 (2016), 1-21.
[15] Ganesh Ghorai and Madhumangal Pal, Novel concepts of strongly edge irregular m-polar fuzzy graphs, International Journal of Applied and Computational Mathematics, DOI:10.1007/s40819-016-0296-y, (2016).
[16] M.G. Karunambigai,R. Parvathi, O.K. Kalaivani, A study on Atanassov's intuitionistic fuzzy graphs, Proceedings of the International Conference on Fuzzy Systems, FUZZ-IEEE Taipei, Taiwan, 2011, 157- 167.
[17] M.G. Karunambigai, O.K. Kalaivani, Self centered intuitionistic fuzzy graph, World Applied Sciences Journal, 14 (2011), 1928-1936.
[18] A. Kau_man, Introduction a la theorie des sous-emsembles ous, MassonetCie, 1973.
[19] J.N. Mordeson, P.S. Nair, Fuzzy graphs and fuzzy hypergraphs, physicaVerlag, Heidelberg, 1998, Second Edition, 2001.
[20] M. Pal, H. Rashmanlou, Irregular interval-valued fuzzy graphs, Ann. Pure Appl. Math, 3 (2013), 56-66. new concepts in interval-valued intuitionistic fuzzy graphs 193
[21] A. Pal, S. Samanta, M. Pal, Concept of fuzzy planar graphs, Proceedings of Science and Information Conference, (2013), October 7-9, 2013, London, UK, 557-563.
[22] M. Pal, S. Samanta, A. Pal, Fuzzy k- competition graphs, Proceedings of Science and Information Conference, 2013, October 7-9, London, UK, 572-576.
[23] A. Rosenfeld. Fuzzy graphs, Fuzzy sets and their applications, (L. A. Zadeh, K. S. Fu, M.Shimura, Eds.), Academic Press New York, 1975, 77-95.
[24] H. Rashmanlou, Y.B. Jun, Complete interval-valued fuzzy graphs, Ann.Fuzzy Math. Inform., 3 (2013), 677-687.
[25] H. Rashmanlou, M. Pal, Antipodal interval- valued fuzzy graphs, International Journal of Applications of Fuzzy Sets and Articial Intelligence, 3 (2013), 107-130.
[26] H. Rashmanlou, M. Pal, Balanced interval- valued fuzzy graph, Journal of Physical Sciences, 17 (2013), 43-57.
[27] H. Rashmanlou, M. Pal, Isometry on interval-Valued fuzzy graphs, Int. J.Fuzzy Math Arch., 3 (2013), 28 -35.
[28] H. Rashmanlou, M. Pal, Some properties of highly irregular interval-valued fuzzy graphs, World Applied Sciences Journal, 27 (2013), 1756-1773.
[29] H. Rashmanlou, M. Pal, Intuitionistic fuzzy graphs with categorical properties, Fuzzy Information and Engineering, 7 (2015), 317 384.
[30] H. Rashmanlou, Young Bae Jun and R.A. Borzoei, More results on highlyirregular bipolar fuzzy graphs, Annals of Fuzzy Mathematics and Informatics, 2014, 2287 6235.
[31] A. Shannon, K.T. Atanassov, Intuitionistic fuzzy graphs from and(a; b)levels, Notes on Intuitionistic Fuzzy Sets, 1 (1995), 32-35.
[32] A. Shannon, K.T. Atanassov, A _rst step to a theory of the intuitionistic fuzzy graphs, Proceeding of FUBEST (Lakov, D., Ed.), So_a, 1994, 59-61.

[33] S. Samanta, M. Pal, Bipolar fuzzy hypergraphs, Int. J. Fuzzy Logic Syst., 2(2012), 17-28. 194 S. LAVANYA, P.K. kishore kumar, h. rashmanlou and m.n. jouybari
[34] A.A. Talebi, H. Rashmanlou, Isomorphism on interval-valued fuzzy graphs,Ann. Fuzzy Math. Inform., 6 (2013), 47-58.
[35] A.A. Talebi, H. Rashmalou, N. Mehdipoor, Isomorphism on vague graphs,Ann. Fuzzy Math. Inform., 6 (2013), 575-588.
[36] A.A. Talebi, H. Rashmanlou and Reza Ameri, New concepts on product interval-valued Fuzzy graphs, Journal of Applied Mathematics and Informatics, 34 (2016), 179-192.