INTUITIONISTIC FUZZY GRAPH OF CUBIC TYPE

[1]Mrs.V.Pushpalatha, [2]Ms.K.Lakshmidivya

[1]Assistant Professor, [2]M.Phil Research Scholar
Department of Mathematics,
Navarasam College for Women, Erode - 638 111, Tamil Nadu, India.

***Abstract*: In this paper, we introduce the concept of Intuitionistic Fuzzy Graph of Cubic Type and its Subgraph. By using the conditions of degree of vertex, infimum degree vertex, Supremum degree vertex, we find out the values of membership and non-membership functions.**

***Keywords*: Intuitionistic Fuzzy Graph, Intuitionistic Fuzzy Graph of Square Type, Intuitionistic Fuzzy Graph of Cubic Type, Intuitionistic Fuzzy Subgraph of Cubic Type.**

1. INTRODUCTION

Fuzzy sets were introduced by Lotfi.A.Zadeh in 1965 as a generalisation of classical sets. Further the fuzzy sets are generalized by Krassimir. T.Atanassov[1] in which he has taken non-membership values also into consideration and Introduced Intuitionistic Fuzzy Graph and the extension of Intuitionistic Fuzzy Graph namely Intuitionistic Fuzzy Graph of Cubic Type. In this paper using the conditions of degree of vertex, infimum degree vertex, Supremum degree vertex, we find out the values of membership and non-membership functions.

2. PRELIMINARIES

Definition 1: An intuitionistic fuzzy graph is of the form $D = (S, T)$ here $S = \{\beta_1, \beta_2, \dots\dots\dots\dots \beta_m\}$ set of vertices and T is the set of edges. Surely, σ is a fuzzy membership function defined as $S \to [0,1]$ and ρ is a fuzzy non-membership function defined as $S \to [0,1]$ of the component $\beta_j \in S$ and $1 \geq \sigma_1(\beta_j) + \rho_1(\beta_j) \geq 0 \ \forall \ \beta_j \in S$, $j = (1,2,3, \dots\dots\dots m)$. $T \subseteq S \times S$ here $\sigma_2: S \times S \to [0,1]$ and $\rho_2: S \times S \to [0,1]$ are obviously,

$$\sigma_2(\beta_j, \beta_k) \leq \inf\ [\sigma_1(\beta_j), \sigma_1(\beta_k)]$$

$$\rho_2(\beta_j, \beta_k) \leq \sup\ [\rho_1(\beta_j), \rho_1(\beta_k)]\ \&$$

$$1 \geq \sigma_2(\beta_j, \beta_k) + \rho_2(\beta_j, \beta_k) \geq 0\ \forall\ (\beta_j, \beta_k) \in T, (j, k = 1,2, \dots m)$$

Definition 2: An intuitionistic fuzzy graph $D = [S, T]$, D has the sub graph of graph D'. Here expressing $D' = [S', T']$ if $S(D) \supseteq S'(D')$ & $T(D) \supseteq T'(D')$. i.e., $\sigma'_{1j} \leq \sigma_{1j}, \rho'_{1j} \geq \rho_{1j}, \sigma'_{2jk} \leq \sigma_{2jk}, \rho'_{2jk} \geq \rho_{2jk}, \forall\ (j, k = 1,2, \dots . m)$.

Definition 3: The square type IFG is $D = [S, T]$ here $S = \{\beta_1, \beta_2, \dots \dots \beta_m\}$ is the collection of vertices and T is the collection of edges. σ is a fuzzy membership function defined as $S \to [0,1]$ and ρ is a fuzzy non-membership function defined as $S \to [0,1]$ of the component $\beta_j \in S$, & $1 \geq \sigma_1(\beta_j^2) + \rho_1(\beta_j^2) \geq 0\ \forall\ \beta_j \in S, (j = 1,2,3, \dots m)$. $T \subseteq S \times S$ here $\sigma_2: S \times S \to [0,1]$ & $\rho_2: S \times S \to [0,1]$ obviously, $\sigma_2(\beta_j, \beta_k) \leq \inf\ [\sigma_1(\beta_j)^2, \sigma_1(\beta_k)^2]$ & $\rho_2(\beta_j, \beta_k) \leq \sup\ [\rho_1(\beta_j)^2, \rho_1(\beta_k)^2]$, $1 \geq \sigma_2(\beta_j, \beta_k)^2 + \rho_2(\beta_j, \beta_k)^2 \geq 0$ $\forall\ (\beta_j, \beta_k) \in T$,

$(j, k = 1,2, \dots m)$.

Definition 4: An intuitionistic fuzzy graph of square type, $D = [S, T]$, D' is a sub graph of graph D. D' is denoted by $D' = [S', T']$ if $S(D) \supseteq S'(D')$ & $T(D) \supseteq T'(D')$ ie.,$\sigma'_{1j} \leq \sigma_{1j}, \rho'_{1j} \geq \rho_{1j}, \sigma'_{2jk} \leq \sigma_{2jk}, \rho'_{2jk} \geq \rho_{2jk}, \forall\ (j, k = 1,2, \dots m)$.

3. Intuitionistic Fuzzy Graph of Cubic Type: In this section, we define the Intuitionistic Fuzzy Graphs of Cubic Type and its subgraph. Also establish some of their properties.

Definition1: In a graph D, every vertex with degree 3 is simply called as cubic graph. ie., A cubic graph is also a cubic regular graph.

Definition2: Let $D = [S, T]$ be the cubic type IFG. Here $S = \{\beta_1, \beta_2, \beta_3, \dots \dots \dots \beta_k\} \ni \sigma_1 \to [0,1]$ & $\rho_1 \to [0,1]$ mark the degree of membership and the degree of non-membership of the element $\beta_j \in S$. Also $1 \geq \sigma_1(\beta_j)^3 + \rho_1(\beta_j)^3 \geq 0 \ \forall\ \beta_j \in S\ (j = 1,2, \dots\dots\dots k)$. $T \subseteq S \times S$ here $\sigma_2: \beta \times \beta \to [0,1]$ and $\rho_2: \beta \times \beta \to [0,1]$. Such that, $\sigma_2(\beta_j, \beta_k) \leq \inf[\sigma_1(\beta_j)^3, \sigma_1(\beta_k)^3]$, $\rho_2(\beta_j, \beta_k) \leq \sup[\rho_1(\beta_j)^3, \rho_1(\beta_k)^3]$ then $1 \geq \sigma_2(\beta_j, \beta_k)^3 + \rho_2(\beta_j, \beta_k)^3 0\ \forall\ (\beta_j, \beta_k) \in T\ (j, k = 1,2, \dots\dots\dots m)$.

Definition 3: Let the cubic type IFG D and its subgraph is D'. A cubic type IFG $D' = [S', T']$ is called cubic type IFSG means if $S \supseteq S'$ & $T \supseteq T'$ ie., $\sigma'_{2jk} \leq \sigma_{jk}, \rho'_{jk} \leq \rho_{jk}, \sigma'_{2jk} \leq \sigma_{2jk}, \rho'_{2jk} \leq \rho_{2jk}$,forevery $j, k = 1,2,3,4, \ldots\ldots m$.

THEOREM 1:

Let $D = [S, T]$ be the cubic type IFG has the subgraph $D' = [S', T']$. Then the cubic type IFG $[S_a, T_a]$ has the subgraph $[S'_a, T'_a]$, for each $1 \geq a \geq 0$.

PROOF:

Let the cubic type IFG $D = [S, T]$.

We have $S \supseteq S'$ & $T \supseteq T'$.

To show that the cubic type IFG $[S_a, T_a]$ has the subgraph $[S'_a, T'_a]$ is an intuitionistic fuzzy cubic sub graph of $[S_A, T_A]$.

There is nothing to prove, $S_a \supseteq S'_a$ & $T_a \supseteq T'_a$.

consider $\beta_j \in S'_a$

$(\beta'_{1j})^3 \leq a$

$\beta^3_{1j} \leq a$

obviously, $(\beta'_{1j})^3 \geq \beta^3_{1j}$

$\Longrightarrow \beta_j \in S_a$

Thus, $S_a \supseteq S'_a$.

Further assume that, $(\beta_j, \beta_k) \in T'_a$

$(\beta'_{2jk})^3 \leq a$

$S_{2jk}{}^3 \leq a$ $S^3_{2jk} \leq a$

Obviously, $(\beta'_{2jk})^3 \geq \beta^3_{2jk}$

$\Longrightarrow (\beta_j, \beta_k) \in T_a$

thus $T_a \supseteq T'_a$.

Hence $[S_A, T_A]$ has the subgraph cubic type IFG $[S'_A, T'_A]$.

THEOREM 2:

If $D = [S, T]$ is an cubic type IFG. Then $\sigma_2(\beta_j, \beta_k)^3 \nleq \sigma_1(\beta_j)^3 \wedge \sigma_1(\beta_k)^3$& $\rho_2(\beta_j, \beta_k)^3 \leq \rho_1(\beta_j)^3 \wedge \rho_1(\beta_k)^3$.

PROOF:

Consider the cubic type IFG $D = [S, T]$ .To prove that,

$(i) \sigma_2(\beta_j, \beta_k)^3 \nleq \sigma_1(\beta_j)^3 \wedge \sigma_1(\beta_k)^3$

(ii) $\rho_2(\beta_j, \beta_k)^3 \leq \rho_1(\beta_j)^3 \wedge \rho_1(\beta_k)^3$

Consider the first part,

Let $\sigma_2(\beta_j, \beta_k)^3 \leq \sigma_1(\beta)^3 \wedge \sigma_1(\beta_k)^3$

Through the definition (4.3),$1 \geq \sigma_1(\beta_j)^3 + \rho_1(\beta_j)^3 \geq 0$

Here we defining the collections,

$(\sigma_1, \rho_1): S \rightarrow [0,1]$ by $\sigma_1(\beta_j)^3 = \inf \beta_j(\sigma(\beta_j\beta_k))^3$ & $\rho_1(\beta_j)^3 = \sup \beta_j(\rho(\beta_j\beta_k))^3, \forall\, \beta_j, \beta_k \in S$.

Obviously, $\sigma_1(\beta_j)^3 = \inf v_j(\sigma(\beta_j\beta_k))^3$

$$\leq \sigma_2(\beta_j\beta_k)^3$$

Thus, $\sigma_1(\beta_j)^3 \wedge \sigma_1(\beta_k)^3 \leq \sigma_1(\beta_j)^3 \leq (\sigma_2(\beta_j\beta_k))^3$

$$\sigma_1(\beta_j)^3 \wedge \sigma_1(\beta_k)^3 \leq (\sigma_2(\beta_j\beta_k))^3$$

Our assumption is contradiction.

$\therefore\ \sigma_2(v_j, v_k)^3 \nleq \sigma_1(v_j)^3 \wedge \sigma_1(v_k)^3$

As well as assume the next part,

$\rho_2(\beta_j, \beta_k)^3 \leq \rho_1(\beta_j)^3 \wedge \rho_1(\beta_k)^3$.

since, $\rho_1(\beta_j)^3 = \sup \beta_j(\rho(\beta_j\beta_k))^3$

$$\geq \rho_2(\beta_j\beta_k)^3$$

Thus, $\rho_1(\beta_j)^3 \wedge \rho_1(\beta_k)^3 \geq \rho_1(\beta_j)^3 \geq (\rho_2(\beta_j\beta_k))^3$

$$\rho_1(\beta_j)^3 \wedge \rho_1(\beta_k)^3 \geq (\rho_2(\beta_j\beta_k))^3$$

Hence proved.

CONCLUSION

In this paper, we have defined the Intuitionistic Fuzzy Graphs of Cubic Type and Subgraph. Also established some of their properties. In future we will study some more properties and application of Intuitionistic Fuzzy Graph of Cubic Type.

REFERENCES

[1] Atanassov.K.T.,1999,"Intuitionistic fuzzyset– theory and applications", Springer Verlag., New York.

[2] Bhattacharya.P,1987,"Some remarks on fuzzy graph", Pattern Recognition Letters,6(5),pp.297-302.

[3] Parvathi.R and Karunambigai.M.G, 2006,"Intuitionistic fuzzy graph", Computational intelligence, Theory and applications, pp.139-150.

[4] Parvathi.R and Karunambigai.M.G, 2009,"Operations on intuitionistic fuzzy graph", 1396-1401.

[5] Sheik Dhavudh.S and Srinivasan.R, 2017,"Intuitionistic fuzzy graph of square type", Advances in Fuzzy Mathematics.

[6] Syed siddiqua begum, R.Srinivasan, Some properties on Intuitionistic fuzzy sets of cubic type.