A STUDY ON WHOLE INTIMIDATION NUMBER AND CHROMATIC NUMBER OF A FUZZY GRAPH

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ABSTRACT

Research of the notations of fuzzy units has been withessing an exponential A Subset S of V is named a growth; each inside arithmetic and it is domination set in G if every vertex V-S applications.This ties form conventional is adjacent to minimum of one vertex in S. Mathematical topics like logic,topology. A dominating set is claimed to be fuzzy algebra,evaluation etc.Therefore fuzzy total dominating set if every vertex in V is arithmetic has energed as capacity region adjacent to a minimum of on vertex in S of interdisciplinary studies and fuzzy graph minimum cardinality taken over all total ideas is of new interest.

A SUBSET S of V is named a domination set in G if every vertex in $V - S$ is adjacent to a minimum of one vertex in S. A dominating set is claimed to be Fuzzy Total Dominating set if every vertex in V is adjacent to a minimum of on vertex in S. Minimum cardinality taken over all total dominating set is called as fuzzy total domination number and is denoted by$\gamma_{ft}(G)$. The minimum domination number of colors all the pictures vertices such adjacent vertices do not set of ordered pairs $A = \{x, \mu\ A\ x\}$ receive an equivalent colour is that the $x \in X, \mu A(x)$ is called the membership $x\ in\ A$ has a function that transfer x to the chromatic number$\chi(G)$. For any graph G an membership space M(when M contains entire sub graph of G is named a clique of G only the two points 0 to 1) let ∈ be the In this paper we discover an boundary for (crisp) set of nodes. The total domination is the sum of the fuzzy total domination and a fuzzy graph is the defined by chromatic number in fuzzy graphs and characterize the corresponding external $G, x_i, x_j = \{x_i, x_j, \mu G\ \ x_i, x_j\ \ x_i, x_j \in E\ x\}$fuzzy graphs E. Then $H\ x_i, x_j$is a fuzzy sub graph of $G\ x_i, x_j$.

General Terms

$G(\mu, \sigma)$ be simple undirected fuzzy graph.

Keywords

Fuzzy Total Domination Number, Chromatic Number, Clique, Fuzzy Graphs.

INTRODUCTION

Any vertex u in G has a degree.The observe of dominating units in is the number of intersecting edges with u and graphs become began through Cockayne is denoted by $d(u)$ and Hedetniemi. A Mathematical the minimum and maximum degree framework to explain the phenomena of a the name of vertex is $\delta(G)$ and $\Delta(G)$ uncertainty in actual international scenario is first counseled through L.A.Zadeh in 1965.

Research at the notation of fuzzy units has been witnessing an exponential growth; each inside arithmetic and in its applications. This tiers from conventional mathematical topics like logic, topology, algebra, evaluation etc. therefore fuzzy arithmetic has emerged as capacity region of interdisciplinary studies and fuzzy graph idea is of new interest.

PRELIMINARES

If X is collection of objects denoted generically by x, then a Fuzzy set $\tilde{A}$ in X is a set of ordered pairs: $\tilde{A} = \{(x, \mu_{\tilde{A}}(x))/ x \in X\}, \mu_{\tilde{A}}(x)$ is called the membership function of x in $\tilde{A}$ that maps X to the membership space M (when M contains only the two points 0 to 1). Let E be the (crisp) set of nodes.

A fuzzy graph is then defined by, $\tilde{G}(x_i, x_j) = \{(x_i, x_j), \mu_{\tilde{G}}(x_i, x_j)\ (x_i, x_j) \in E \times E\}$.

$\widetilde{H}(x_i, x_j)$ is a Fuzzy Sub graph of $\tilde{G}(x_i, x_j)$ if $\mu_{\tilde{A}}(x_i, x_j) \le \mu_{\tilde{G}}(x_i, x_j) \forall (x_i, x_j) \in E \times E, \widetilde{H}(x_i, x_j)$ is a spanning fuzzy sub graph of $\tilde{G}(x_i, x_j)$ if the node set of $\widetilde{H}(x_i, x_j)$ and $\tilde{G}(x_i, x_j)$are equal, that is if they differ only in there are weights.

Let $G(\mu, \sigma)$ be simple undirected fuzzy graph. The degree of any vertex u in G is the number of edges incident with u and is denoted by$d(u)$.

The minimum and maximum degree of a vertex is denoted by $\delta(G)$ and $\Delta(G)$ respectively, P_n denotes the path on n vertices. The vertex connectivity $k(G)$ of a graph G is the minimum number of vertices whose removal results in a disconnected graph. The chromatic number χ is defined to be the minimum number of colours required to colour all the vertices such that adjacent vertices do not receive the same colour. For any graph G a complete sub graph of G is called a clique of G. The number of vertices in a largest clique of G is called the clique number of G.

A subset S of V is called a dominating set in G, if every vertex in $V - S$ is adjacent to at least one vertex is S. The minimum cardinality taken over all minimal dominating sets in G is called the dominating set in G is called the domination number of G and is denoted by γ. A dominating set S is said to be fuzzy total dominating set if every vertex in V is adjacent to at least one vertex in$S$. Minimum cardinality taken over all total dominating set is called as fuzzy total domination number and is denoted by $\gamma_{ft}(G)$. We use the following previous results

MAIN RESULTS

Theorem:

For any connected fuzzy graph G, $\gamma_t(G) + \chi(G) \le 2n$ and the equality holds if and only if $G \cong K_1$

Proof:

$\gamma_t(G) + \chi(G) \le \quad n + \Delta + 1 = n + (n-1) + 1 \le 2n$. If $\gamma_t(G) + \chi(G) = 2n$ the only possible case is $\gamma_t(G) = n$ and $\chi(G) = n$, Since $\chi(G) = n$, $G = K_n$, But for K_n, $\gamma_t(G) = 1$, so that $G \cong K_1$. Converse is obvious.

Theorem:

For any connected fuzzy graph $G, \gamma_t(G) + \chi(G) = 2n - 1$ and the equality holds if and only if $G \cong K_2$

Proof:

Assume that $\gamma_t(G) + \chi(G) = 2n - 1$. This is possible only if $\gamma_t(G) = n$ and $\chi(G) = n - 1$ (or) $\gamma_t(G) = n - 1$ and $\chi(G) = n$.

Case (i).

Let $\gamma_t(G) = n$ and $\chi(G) = n - 1$.

Since $\chi(G) = n - 1$, G contains a clique K on n-1 vertices.

Let x be a vertex of $G - K_{n-1}$. Since G is connected the vertex x is adjacent to one vertex u_i for some i in $K_{n-1}\{u_i\}$ is γ_t −set, so that $\gamma_t(G) = 1$,

we have n=1. Then $\chi = 0$, which is a contradiction.

Hence no fuzzy graph exists.

Case(ii).

Let $\gamma_t(G) = n - 1$ and $\chi(G) = n$

Since $\chi(G) = n, G = K_n$,

But for $K_n, \gamma_t(G) = 1$,

so that $n = 2, \chi = 2$.

Hence $G \cong K_2$ Converse is obvious.

Theorem:

For any connected fuzzy graph $G, \gamma_t(G) + \chi(G) = 2n - 2$ and the equality holds if and only if $G \cong K_3$

Proof:

Assume that$\gamma_t(G) + \chi(G) = 2n - 2$. This is possible only if $\gamma_t(G) = 1$

and $\chi(G) = n - 2$ (or) $\gamma_t(G) = n - 1$ and $\chi(G) = n - 1$ (or) $\gamma_t(G) = n - 2$ and $\chi(G) = n$.

Case (i)

Let $\gamma_t(G) = n$ and $\chi(G) = n - 2$.

Since $\chi(G) = n - 2, G$ contains K on n-2 vertices.

Let $S = \{x, y\} \epsilon\, V - S$. Then $< S > K_2$ or $\overline{K_2}$

Sub case (a)

Let $< S \geq K_2$. Since G is connected, x is adjacent to some u_i of K_{n-2}. Then y is adjacent to the same u_i of K_{n-2}. Then $\{u_i\}\, \gamma_t$ –set, so that $\gamma_t(G) = 1$ and hence$n = 1$.

But $\chi(G) = n - 2 =$negative value. Which is a contradiction

Hence no fuzzy graph exists, or y is adjacent to u_j of K_{n-2} for $i \neq j$. In this case $\{u_i, u_j\}\gamma_t$ –set, so that $\gamma_t(G) = 2$ and

Hence$n = 2$. But $\chi(G) = 0$. This is a contradiction. Hence no fuzzy graph exists.

Case (ii)

Let $\gamma_t(G) = n - 1$ and $\chi(G) = n - 1$.

Since $\chi(G) = n - 1$, G contains a clique K on $n - 1$ vertices. Let x be a vertex of $G - K_{n-1}$.

Since G is connected, x is adjacent to one vertex u_i for some i in K_{n-1}, so that $\gamma_t(G) = 1$, we have $n = 2$.

Then $\chi = 1$, which is a contradiction. Hence no fuzzy graph exists.

Case (iii)

Let $\gamma_t(G) = n - 2$ and $\chi(G) = n$

Since $\chi(G) = n, G = K_n$,

But for $K_n, \gamma_t(G) = 1$, so that $n = 3, \chi = 3$.

Hence $G \cong K_3$. Converse is obvious.

Theorem:

For any connected fuzzy graph $G, \gamma_t(G) + \chi(G) = 2n - 3$ and the equality holds if and only if $G \cong P_3, K_4$

Proof:

Assume that $\gamma_t(G) + \chi(G) = 2n - 3$. This is possible only $\gamma_t(G) = n$

and $\chi(G) = n - 3$ (or) $\gamma_t(G) = n - 1$ and $\chi(G) = n - 2$ (or) $\gamma_t(G) = n - 2$ and $\chi(G) = n - 1$ (or) $\gamma_t(G) = n - 3$ and $\chi(G) = n$.

Case (i).

Let $\gamma_t(G) = n$ and $\chi(G) = n - 3$.

Since $\chi(G) = n - 3, G$ contains a clique K on n-3 vertices.

Let $S = \{x, y, z\} \in V - S$.

Then $< S \geq K_3, \overline{K_3}, K_2 \cup K_1, P_3$

Sub case (i)

Let $< S \geq K_3$. Since G is connected, x is adjacent to some u_i of K_{n-3}.

Then $\{x, u_i\}$ is γ_t –set, so that $\gamma_t(G) = 2$ and hence $n = 2$.

But $\chi(G) = n - 3 =$negative value Which is a contradiction.

Hence no fuzzy graph exists.

Sub case (ii)

Let $< S >= \overline{K_3}$ since G is connected, one of the vertices of K_{n-3} say u_i is adjacent to all the vertices of S or two vertices of S or one vertex of S. if u_i for some I is adjacent to all the vertices of S, then $\{u_i\}$ in K_{n-3} is a γ_t –set of G, so that $\gamma_t(G) = 1$ and

hence $n = 1$.

But $\chi(G) = n - 3 =$negative value. Which is a contradiction.

Hence no fuzzy graph exists. Since G is connected u_i for some i is adjacent to two vertices of S say x and y and z is adjacent to u_i for $i \neq j$ in K_{n-3}, then $\{u_i, u_j\}$ in K_{n-3} is γ_t –set of G, so that $\gamma_t(G) = 2$ and

hence $n = 2$.

But $\chi(G) = n - 3 =$negative value. Which is a contradiction.

Hence no fuzzy graph exists. If u_i for some i is adjacent to x and u_j is adjacent to y and u_k is adjacent to z, then $\{u_i, u_j, u_k\}$ for $i \neq j \neq k$ in K_{n-3} is a γ_t –set of G.

so that $\gamma_t(G) = 3$ and hence $n = 3$. But$\chi(G) = n - 3 = 0$. This is a contradiction.

Hence no fuzzy graph exists.

Sub case (iii)

Let $< S > = P_3 = \{x, y, z\}$. Since G is connected, x (or equivalently z) is adjacent to u_i for some i in K_{n-3}.

Then$\{x, y, u_i\}$ is a γ_t –set of G. so that $\gamma_t(G) = 3$ and hence $n = 3$.

But $\chi(G) = n - 3 = 0$. This is a contradiction

Hence no fuzzy graph exists. If u_i is adjacent to y then $\{u_i, y\}$ is a γ_t −set of G. so that $\gamma_t(G) = 2$ and

hence $n = 2$.

But $\chi(G) = n - 3 =$negative value Which is a contradiction.

Hence no fuzzy graph exists.

Sub case (iv)

Let $< S >= K_2 \cup K_1$. Let xy be the edge and z be the isolated vertex of $K_2 \cup K_1$. Since G is connected, there exists a u_i in K_{n-3} is adjacent to x and z. Then $\{u_i\}$ is γ_t −set of G, so that $\gamma_t(G) = 1$ and

hence $n = 1$.

But $\chi(G) = n - 3 =$negative value Which is a contradiction

Hence no fuzzy graph exists. If z is adjacent to u_i for some $i \neq j$ then $\{u_i, u_j\}$ for $i \neq j$ is γ_t −set of G, so that $\gamma_t(G) = 2$ and hence $n = 2$.

But $\chi(G) = n - 3 =$negative value which is a contradiction

Hence no fuzzy graph exists.

Case (ii)

Let $\gamma_t(G) = n - 1$ and $\chi(G) = n - 2$.

Since $\chi(G) = n - 2$, G contains a clique K on n-2 vertices.

Let $S = \{x, y\} \in V - S$. Then $< S >= K_2$ or $\overline{K_2}$

Sub case (a)

Let $< S >= K_2$ since G is connected, x(or equivalently y) is adjacent to some u_i of K_{n-2}.

Then $\{x, u_i\}$ is γ_t −set, so that $\gamma_t(G) = 2$ and hence $n = 3$.

But $\chi(G) = n - 2 = 1$ for which G is totally disconnected, which is a contradiction.

Hence no fuzzy graph exists.

Sub case (b)

Let $< S >= \overline{K_2}$ since G is connected, x is adjacent to some u_i of K_{n-2}. Then y is adjacent to the same u_i of K_{n-2}.

Then y is adjacent to the same u_i of K_{n-2}. Then $\{u_i\}$ is γ_t −set, so that $\gamma_t(G) = 1$ and hence $n = 2$.

But $\chi(G) = n - 2 = 0$. Which is a contradiction

Hence no fuzzy graph exists.

Otherwise x is adjacent to u_i of K_{n-2} for some I and y is adjacent to u_i of K_{n-2} for $i \neq j$. In this $\{u_i, u_j\}\gamma_t$ −set,

so that $\gamma_t(G) = 2$ and hence $n = 3$.

But $\chi(G) = 1$ for which G is totally disconnected.

Which is a contradiction.

In this case also no fuzzy graph exists.

Case (iii)

Let $\gamma_t(G) = n - 2$ and $\chi(G) = n - 1$.

Since $\chi(G) = n - 1, G$ contains a clique K on n-1 values.

Let x be a vertex of K_{n-1}.

Since G is connected the vertex x is adjacent to one vertex u_i for some i in K_{n-1} so that $\gamma_t(G) = 1$,

we have $n = 3$ and $\chi = 2$.

Then $K = K_2 = uv$. If x is adjacent to u_i then $G \cong P_3$.

Case (iv)

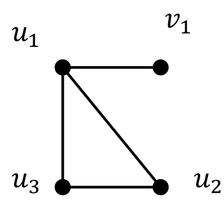
Let $\gamma_t(G) = n - 3$ and $\chi(G) = n$

Since $\chi(G) = n, G = K_n, \gamma_t(G) = 1$, so that $n = 4, \chi = 4$.

Hence $\cong K_4$. converse is obvious.

Theorem:

For any connected fuzzy graph G, $\gamma_t(G) + \chi(G) = 2n - 4$ and the equality holds if and only if $G \cong P_4, K_5$ or the graph is figure



Proof:

Assume that $\gamma_t(G) + \chi(G) = 2n - 4$. This is possible only if $\gamma_t(G) = n$

and $\chi(G) = n - 4$ or $\gamma_t(G) = n - 1$
and $\chi(G) = n - 3$ (or) $\gamma_t(G) = n - 2$
and $\chi(G) = n - 2$ (or) $\gamma_t(G) = n - 3$
and $\chi(G) = n - 1$ (or) $\gamma_t(G) = n - 4$
and $\chi(G) = n$.

Case (i)

Let $\gamma_t(G) = n$ and $\chi(G) = n - 4$.

Since $\chi(G) = n - 4, G$ contains a clique K on n-4 vertices.

Let $S = \{V_1, V_2, V_3, V_4\}$. Then the induced subgraph $< S >$ has the following possible cases $K_4, \overline{K_4}, P_4, P_3 \cup K_1, K_2 \cup K_2, K_3 \cup K_1, K_{1,3}$

In all the above cases, it can be verified that no new fuzzy graphs exists.

Case (ii)

Let $\gamma_t(G) = n - 1$ and $\chi(G) = n - 3$.

Since $\chi(G) = n - 3, G$ contains a clique K on n-3 vertices.

Let$S = \{x, y, z\} \in V - S$.

Then $< S >= K_3, \overline{K_3}, K_2 \cup K_1, P_3$

Sub case (i)

Let$< S > = K_3$. Since G is connected, x is adjacent to some u_i of K_{n-3}.

Then $\{x, u_i\}$ is γ_t −set, so that $\gamma_t(G) = 2$ and hence $n = 3$.

But $\chi(G) = n - 3 = 0$. Which is a contradiction.

Hence no fuzzy graph exists.

Sub case (ii)

Let $< S >= \overline{K_3}$ since G is connected, one of the vertices of K_{n-3} say u_i is adjacent to all the vertices of S or two vertices of S or one vertex of S.

If u_i for some i is adjacent to all the vertices of S, then $\{u_i\}$ in K_{n-3} is γ_t −set of G. so that $\gamma_t(G) = 1$ and hence $n = 2$.

But $\chi(G) = n - 3 =$negative value. Which is a contradiction.

Hence no fuzzy graph exists. If u_i for some i is adjacent to two vertices of S say x and y then G is connected, z is adjacent to u_j for $i \neq j$ in K_{n-3}, then $\{u_i, u_j\}$ in K_{n-3} is γ_t −set of G,

so that $\gamma_t(G) = 2$ and hence $n = 3$.

But $\chi(G) = n - 3 = 0$. Which is a contradiction.

Hence no fuzzy graph exists. If u_i for some i is adjacent to x and u_j is adjacent to y and u_k is adjacent to z, then $\{u_i, u_j, u_k\}$ for $i \neq j \neq k$ in K_{n-3} is γ_t −set of G. so that $\gamma_t(G) = 3$ and

hence $n = 4$. But $\chi(G) = 1$ for which G is totally disconnected. Which is a contradiction.

Hence no fuzzy graph exists.

Sub case (iii)

Let $< S > = P_3 = \{x, y, z\}$. Since G is connected, x (or equivalently z) is adjacent to u_i for some i in K_{n-3}.

Then $\{x, y, u_i\}$ is γ_t −set of G so that $\gamma_t(G) = 3$ and hence $n = 4$.

But $\chi(G) = n - 3 = 1$. Which is a contradiction.

Hence no fuzzy graph exists. If u_i is adjacent to y then $\{u_i, y\}$ is γ_t −set of G. so that $\gamma_t(G) = 2$ and

hence $n = 3$. But $\chi(G) = n - 3 = 0$. Which is a contradiction.

Hence no fuzzy graph exists.

Sub case (iv)

Let $< S >= K_2 \cup K_1$. Let xy be the edge and z be a isolated vertex or $K_2 \cup K_1$. Since G is connected, there exists a u_i in K_{n-3} is adjacent to x and z also adjacent to same u_i.

Then $\{u_i\}$ is a γ_t −set of G. so that $\gamma_t(G) = 1$ and hence $n = 2$.

But $\chi(G) = n - 3 =$negative value. Which is a contradiction.

Hence no fuzzy graph exists. If z is adjacent to u_j for some $i \neq j$ then $\{u_i, u_j\}$ for $i \neq j$ is a is a γ_t −set of G. so that $\gamma_t(G) = 2$ and hence $n = 3$.

But $\chi(G) = n - 3 = 0$. Which is a contradiction.

Hence no fuzzy graph exists.

Case (iii)

Let $\gamma_t(G) = n - 2$ and $\chi(G) = n - 2$. Since $\chi(G) = n - 2, G$ contains a clique K on n-2 vertices. Let $S = \{x, y\} \in V - S$.

Then $< S >= K_2$ or $\overline{K_2}$

Sub case (a)

Let $< S > = K_2$. Since G is connected, x (or equivalently y) is adjacent to some u_i of K_{n-2}.

Let $\gamma_t(G) = n - 3$ and $\chi(G) = n - 1$. Since $\chi(G) = n - 1, G$ contains a clique $u_i\}$ is γ_t −set, so that $\gamma_t(G) = 2$ and

hence $n = 4$.

But $\chi(G) = n - 2 = 2$.

Then $G \cong P_4$.

Case (iv)

K on n-1 vertices. Let x be a vertex of $G - K_{n-1}$.

Since G is connected the vertex x is adjacent to one vertex u_i for some I in K_{n-1}, so that $\gamma_t(G) = 1$,

we have $n = 4$ and $\chi = 3$. Then $K = K_3$ let u_1, u_2, u_3 be the vertices of K_3.

Then x must be adjacent to only one vertex of $G - K_3$. Without loss of generality let x be adjacent to u_i. If $d(x) = 1$, then $G \cong G_1$. (in Fig 2.1)

Case (v)

Let $\gamma_t(G) = n - 4$ and $\chi(G) = n$

Since $\chi(G) = n, G = K_n$.

But $\gamma_t(G) = 1$,

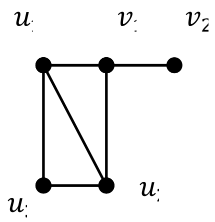
so that $n = 5, \chi = 5$.

Hence $G \cong K_5$. Converse is obvious.

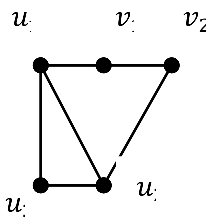
Theorem 3.6

For any connected fuzzy graph G, $\gamma_t(G) + \chi(G) = 2n - 5$ for any $n > 4$, if and only if G is isomorphic to

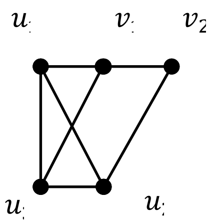
$K_6, K_3(P_3), K_3(1,1,0), P_5, K_4(1,0,0,0), K_{1,3}$ (or) any one of the following fuzzy graphs in figure



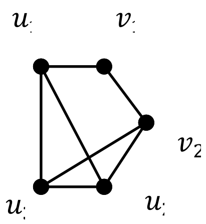
G_1



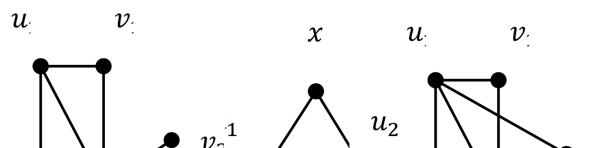
G_2



G_3



G_4



If G is any one or one graphs in the theorem, then it can be verified that $\gamma_t(G) + \chi(G) = 2n - 5$.

Conversely set

$\gamma_t(G) + \chi(G) = 2n - 5$

then $\gamma_t(G) = n$ and $\chi(G) = n - 5$ (or)

$\gamma_t(G) = n - 1$ and $\chi(G) = n - 4$ (or)

$\gamma_t(G) = n - 2$ and $\chi(G) = n - 3$ (or)

$\gamma_t(G) = n - 3$ and $\chi(G) = n - 2$ (or)

$\gamma_t(G) = n - 4$ and $\chi(G) = n - 1$ (or)

$\gamma_t(G) = n - 5$ and $\chi(G) = n$.

Case (i):

Let $\gamma_t(G) = n$ and $\chi(G) = n - 5$

Since $\chi(G) = n - 5, G$ contains a clique K in n-5 vertices (or) does not contain a clique K on n-5 vertices.

Let $S = \{V_1, V_2, V_3, V_4, V_5\}$. Then the induced subgraph $< S >$ has the following possible cases. $K_5, \overline{K_5}, P_5, P_3 \cup P_2, P_3 \cup \overline{K_2}, K_4 \cup K_1, P_4 \cup K_1, K_3 \cup K_2, K_3 \cup \overline{K_2}$.

In all the above cases, it can be verified that no new fuzzy graph exists.

Case (ii):

Let $\gamma_t(G) = n - 1$ and $\chi(G) = n - 4$.

Since $\chi(G) = n - 4\ G$ contains a clique K on n-4 vertices.

Let $S = \{V_1, V_2, V_3, V_4\}$. Then the induced subgraph $< S >$ has the following possible case $K_4, \overline{K_4}, P_4, P_3 \cup K_1, K_2 \cup K_2, K_3 \cup K_1$ in all the above cases, it can be verified that no new fuzzy graph exists.

Case (iii):

Let $\gamma_t(G) = n - 2$ and $\chi(G) = n - 3$

Since $\chi(G) = n - 3, G$ contains a clique with n-3 vertices.

Let $S = \{V_1, V_2, V_3\}$. Then the induced subgraph $< S >$ has the following possible cases $K_3, \overline{K_3}, K_2 \cup K_1, P_3$.

Sub case (i):

Let $< S >= K_3$. Since G is connected there exists a vertex u_i in K_{n-3} which is adjacent to any one of $\{V_1, V_2, V_3\}$ without loss of generality let u_i be adjacent to V_1, then $\{v_1, u_j\}$ is γ_t –set of G,

so that $n = 4$. But $\chi(G) = 1$ which is a contradiction. Hence no graph exists.

Sub case (ii):

Let $< S > = \overline{K_3}$. Let $\{V_1, V_2, V_3\}$ be the vertices of $\overline{K_3}$ are adjacent to one vertex say u_i in K_{n-3} (or) 2 vertices of $\overline{K_3}$ are adjacent to the vertex u_i and remaining one vertex of $\overline{K_3}$ is adjacent to the vertex u_j for $i \neq j$ in K_{n-3} (or) all the vertices of $\overline{K_3}$ are adjacent to the distinct vertices of K_{n-3}. If all the vertices of $\overline{K_3}$ are adjacent to one vertex say u_i in K_{n-3}, the $\{v_1, u_i\}$ is $\gamma_t(T)$ –set of G, so that $n = 4, \chi(G) = 1$ which is a contradiction. Hence no fuzzy graph exists.

If two vertices of $\overline{K_3}$ are adjacent to the vertex u_i and the remaining one is adjacent to u_j $i \neq j$ in K_{n-3} then $\{u_i, u_j, v_3\}$ is $\gamma_t(T)$ –set of G. So that $n = 4$ which is a contradiction. Hence no graphs exists. If all the vertices of $\overline{K_3}$ are adjacent to the vertices u_i, u_j, u_k $i \neq j \neq k$ respectively.

Then $\{u_i, u_j, v_3\}$ is γ_t –set of G. Hence $n = 5, \chi(G) = 2$ which is a contradiction.

Hence no graph exists.

Sub case (iii):

Let $< S >= P_3$. Since G is connected there exists a vertex u_i is adjacent to any one of $\{v_1, v_3\}$ or v_2.

If u_i is adjacent to any of the $\{v_1, v_3\}$, then $\{v_1, v_2, u_i\}$ is γ_t –set of G. Hence $n = 5$ so that $K = K_2$.

Let u_1, u_2 are the vertices of K_2. Let v_1 be adjacent to u_i and if $d(v_1) = d(v_2) = 2, d(v_3) = 1$ then $G \cong P_5$. If v_2 is adjacent to u_i then $\{u_i, v_2\}$ is γ_t –set of G.

Hence $n = 4$ $\chi(G) = 1$ which is a contradiction.

Hence no graph exists if the degree of the vertices is increased then no new fuzzy graphs exists.

Sub case (iv):

Let $< S > = K_2 \cup K_1$. Let $\{v_1, v_2\}$ be the vertices of K_2 and v_3 be the isolated vertex. Since G is connected, there exists a vertex u_i is adjacent to any one of $\{v_1, v_2\}$ and u_j for $i \neq j$ is adjacent to v_3.

If u_i is adjacent to any one of $\{v_1, v_2\}$ and $v_3, \{v_1, v_2\}$ and $\{u_i, v_1\}$ is γ_t –set of G.

Hence $n = 4$ and $\chi(G) = 1$ which is a contradiction.

Hence no graph exists.

If u_i is adjacent to any one of $\{v_1, v_2\}$ and u_j $j \neq i$ is adjacent to v_3.

In this case $\{v_1, u_i, u_j\}$ is γ_t –set of G.

Hence $n = 5$ $\chi(G) = 2$.

Then $G \cong P_5$. If the degree of the vertices is increased then no new fuzzy graphs exists.

Case (iv):

Let $\gamma_t(G) = n - 3, \chi(G) = n - 2$.

Since $\chi(G) = n - 2$, G contains a clique K on $n - 2$ vertices.

If G contains a clique K on n-2 vertices.

Let$S = \{v_1, v_2\} \in V(G) - V(K)$. Then the induced sub graph $< S >$ has the following possible cases.

Sub case (i):

Let$< S > = K_2$. Since G is connected, there exists a vertex u_i in K_{n-2} is adjacent to any one of$\{v_1, v_2\}$.

Then $\{u_i, v_1\}$ is a γ_t –set of G. Hence $\gamma_t(G) = 2$, so that $n = 5, \chi(G) = 3$. Hence $K \cong K_3$. Let u_{1i}, u_2, u_3 be the vertices of K_3. Let u_i be adjacent to v_i.

If $d(v_1) = 2$ $d(v_2) = 1$ then $G \cong k_3(p_3)$ if $d(v_1) = 3$ $d(v_2) = 1$ $G \cong G_1$.

Let u_1 be adjacent to v_1 and u_2 be adjacent to v_2. If $d(v_1) = d(v_2) = 2$ the $G \cong G_2$. If $d(v_1) = 3$ $d(v_2) = 2$ then $G \cong G_3$ If $d(v_1) = 2, d(v_2) = 3$ then $G \cong G_4$.

If the degree of the *vertices* is increased then no new *fuzzy* graphs exists.

Sub case (ii).

Let$< S \geq \overline{K}_2$. Since G is connected all the vertices of $\overline{K}_2$ are adjacent to one vertex say u_i in k_{n-2} (or) distinct vertices in k_{n-2}.

If all the vertices of $\overline{K}_2$ are adjacent to one vertex say u_i in k_{n-2}. In this case $\{u_i\}$ is γ_t -set of G.

Since $\gamma_t(G) = 1$so that $= 4$ $\chi(G) = 2$. Hence $K \cong K_2$.

Let u_1 be adjacent to both v_1 and $v_2$then $G \cong K_{1,3}$. If the two vertices of $\overline{K}_2$ are adjacent to the distinct of k_{n-2}.

In this case $\{u_i, u_j\}$ for $i \neq j$ forms γ_t -set of G. Hence $n = 5$,$\chi(G) = 3$.

So that $K \cong K_3$. Let $\{u_1, u_2, u_3\}$ be the vertices of k_3.

Let u_1 be adjacent to v_1 and u_2 be adjacent to v_2 then $G \cong k_3(1,1,0)$. If $d(v_1) = 2$ $d(v_2) = 2$ then $G \cong G_7$.

If the degree of the vertices is increased then no new fuzzy graphs exists.

Case (v):

Let $\gamma_t(G) = n - 4$ $\chi(G) = n - 1$

Since $\chi(G) = n - 1, G$ contains a clique K on n-1 vertices.

Let x be a vertex of $G - k_{n-1}$. Since G is connected the vertex x is adjacent to one vertex u_i of k_{n-1} so that $\gamma_t(G) = 1$.

Hence $n = 5$ $\chi(G) = 4$, so that $K \cong K_4$. Let $\{u_1, u_2, u_{3,} u_4\}$ be the vertices of K_4. Without loss of generality let x be adjacent to u_1, of K_4, then $G \cong K_4(P_2)$. If $d(v_1) = 2$ then $G \cong G_8$. If $d(v_1) = 3$ then $G \cong G_9$.

Case (vi):

Let $\gamma_t(G) = n - 5$ $\chi(G) = n$

Since $\chi(G) = n, G \cong K_n$.

But for $K_n \gamma_t(G) = 1$, so that $n = 6$.

Hence $G \cong K_6$.

CONCLUSION

In this paper, upper bound of the sum of total domination and chromatic number is proved. In future this result can be extended to various domination parameters. The structure of the graphs had been given in this paper can be used in models and networks. The authors have obtained similar results with large cases of graphs for which $\gamma_t(G) + \chi(G) = 2n - 8$

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