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Triple Connected Domination Number of Graph

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ABSTRACT: The concept of triple connected graphs with real life application was prefaced by considering the existence of a path containing any three vertices of a graph G. In this paper, we introduce a new domination parameter, called triple connected domination number of a graph. A subset S of V of a nontrivial graph G is said to be triple connected dominating set, if S is a dominating set and the induced sub graph is triple connected. The minimum cardinality undertake all triple connected dominating sets. Then which is called the triple connected domination number and is denoted by γtc.

Key Words: *Dominating set, triple connected graph, triple connected domination number.*

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I. INTRODUCTION

Once of the fastest growing areas in graph theory is the study of domination. It takes back to 1850's with the study of the problem of determining the minimum number of queen which are necessary to cover an n*n chessboard. More than 50 types of domination parameters have been studied by different authors. Ore, Berg introduced the concept of domination sets. Extensive research activity is going on in Domination set of graphs. Acharya B.D, SampathKumar.E,V.RKulli, Waliker H.B are some of the Indian Mathematicians who have madesubstantial contribution to the study of domination ingraphs.

Domination is applied in many fields. Some of themare

1. Communicationnetwork
2. Facility locationproblem
3. Land surveying
4. Routings etc.,

Thisprojectdealswithdominationingraphs.Amongmanyresults, some of them are discussedhere.

ChapterIdealswiththebasicconceptsofgraphtheorythatareused in the subsequentchapters.

In chapter II the concepts of triple connected dominationnumber of a graph isdiscussed.

Chapter III explains the paired triple connecteddomination number of agraph.

ThechapterIVandchapterVrespectivelyconsidersthestrong triple and weak triple connected domination number of agraph.

In Chapter VI the Dom strong triple connected dominationnumber of graph is discussed indetail.

BASICDEFINITIONS

1.1 Graph

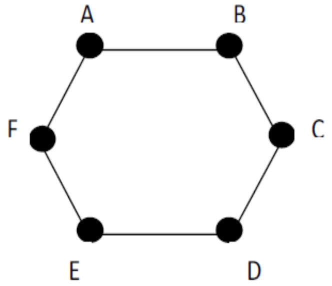
A graph consists of a set $V = \{v_1, v_2, \ldots\ldots, v_n\}$ called verticesandanotherset $E = \{e_1, e_2, \ldots\ldots, e_m\}$ whoseelement arecalled edges such thateach edge e_k is identified with an unordered pair (v_i, v_j) of vertices,the vertices (v_i, v_j) associatedwithoftheedge e_k arecalledtheendverticesoftheedge e_k.

1.2 Order and Size of agraph

The number of vertices in V(G) is called the order of G and the numberof edges in E(G) is called the size ofG.

1.3 SimpleGraph

A graph has no loops and multiple edges which is called a simplegraph



1.4 Multigraph

A graph has multiple edges but no loops whichis called amultigraph.

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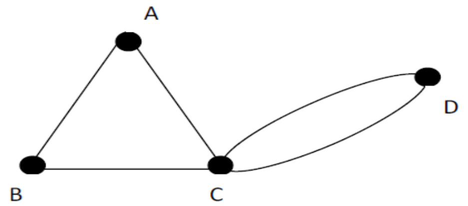


1.5 Generalgraph

A graph contains multiple edges or loops (or both) which is calleda generalgraph.

II. TRIPLE CONNECTED DOMINATION NUMBER OFAGRAPH

2.1 Definition

If the induced sub graph < S > is tripleconnected, a dominating set S of a connected graph G is said to be a tripleconnected dominating set of G. The minimum cardinality taken over all triple connected dominatingsets isthetripleconnecteddominationnumberandisdenotedby $\gamma t(G)$.

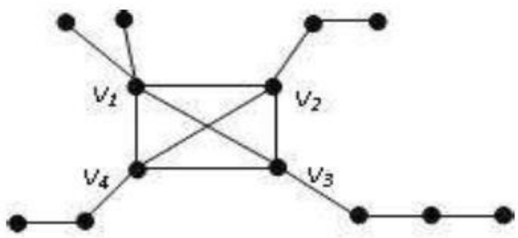
2.2 Theorem

AconnectedgraphGisnottripleconnected ⇔ thereexistsa H-cutwithω(G−H)≥3suchthat|V(H)∩N(Ci)|=1foratleastthree components C1, C2 and C3 of G −H.

LetGbeanyconnectedgraphwithmvertices $\{v_1, v_2, \ldots\ldots, v_m\}$. Thegraph take from G by attaching n1 times a pendant vertex of Pl1 on the vertex v1,n2 times a pendant vertex of Pl2 on the vertex v2 and so on, is denoted by G(n1Pl1, n2Pl2 , n3Pl3 , . . . , nmPlm) where ni, li ≥ 0 and 1 ≤ i ≤ m.

Example:

Let $V = \{v_1, v_2, v_3, v_4\}$ betheverticesofK4.ThegraphK4(2P2,P3,P4,P3)is obtainedfromK4byattaching2timesapendantvertexofP2onv 1,1timea pendantvertexofP3onv2,1timeapendantvertexofP4onv3and 1timea pendant vertex of P3 onv4.



K4 (2P2, P3, P4,P3)

III. PAIRED TRIPLE CONNECTED DOMINATION NUMBEROFAGRAPH

3.1 Definition

A subset S of V of a nontrivial graph G is said to be a paired triple connected dominating set, if S is a triple connected dominating set and the induced subgraph<S> has a perfect matching. The minimum cardinality undertake all paired triple connected dominating sets is called the pairedtriple connected domination number and is denoted by γptc. Any paired triple connected dominating set with γptcvertices is said asγptc-set ofG.

Example:

For the graph $C_5 = \{v_1 v_2 v_3 v_4 v_5 v_1\}$, $S = \{v_1, v_2, v_3, v_4\}$ forms a paired triple connected dominating set. Hence γptc(C5)=4.

3.2 Theorem

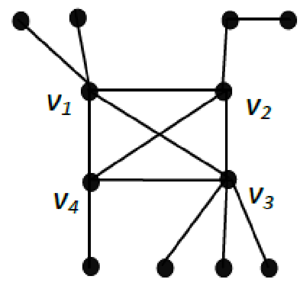
Gissemi-completegraphwithp≥4verticessuchthatthereisavertex with consequent neighbourhood number p – 3. Then γ(G) ≤2.

Let G be a connected graph with m vertices $v1,2,v2,\ldots\ldots,vm.,.$ The graph $(n1Pl1,n2Pl2,n3Pl3,\ldots\ldots.,nmPlm)$ where ni,li≥0 and 0 ≤ i ≤ m, is obtained from G by pasting n1 times a pendant vertex of $Pl1$ on the vertex v1, n2 times a pendant vertex of $Pl2$ on the vertex v1 and so on.

Example:

Let $\{v_1, v_2, v_3, v_4\}$ betheverticesof*K4*,thegraph*K4(2P2,P3,3P2,P2)*isobtainedfrom*K4*bypasting2timesapendantvertexof*P2*onv*1*,1timesa pendantvertexof*P3*onv*2*,3timesapendantvertexof*P2*onv*3*and1timesa pendant vertex of *P2* on *v4* and the graph in*G1*.

G_1:



IV. STRONG TRIPLE CONNECTED DOMINATIONNUMBEROF AGRAPH

4.1 Definition

AsubsetSofVofanontrivialgraphGissaidtobeastrongtriple connected dominating set, if S is a strong dominating set and theinduced

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subgraph<S>istripleconnected.Theminimumcardinalitytakenoverallstrong triple connected dominating sets is called the strong triple connecteddomination numberofGandisdenotedby$\gamma st(G)$. Anystrongtripleconnecteddominatingsetwithγstcverticesiscalledastc-setofG.

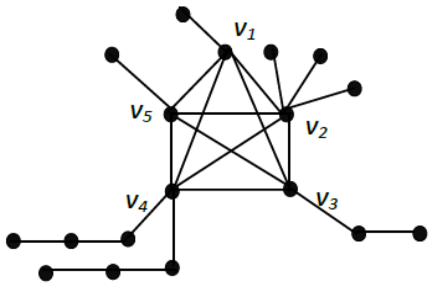
4.1 Theorem

Let G be a graph and D be a dominating set of G. Then $|V-D| \le \sum_{u\in V(D)} \deg(u)$ andequalityholdinthisrelationifandonlyifDhasthe followingproperties.

i. D isindependent
ii. For every $u \in V-D$, and also there exists a unique vertex $v \in D$such that$N(u)\cap D = \{v\}$.

Example:

Let v1, v2, v3, v4, be the vertices of K5. The graph K5(P2, 3P2, P3, 2P4,P2) isobtainedfromK5byattaching1timeapendantvertexofP2on v1,3timea pendantvertexofP2onv2,1timeapendantvertexofP3onv3and 2timesa pendant vertex of P4 on v4, 1 time a pendant vertex ofP2.



K5 (P2, 3P2, P3, 2P4,P2)

CONCLUSION

The concept of triple connected digraphs and domination in tripleconnected digraphscanbeappliedtophysicalproblemssuchasflownetworkswithvalvesinthe pipesandelectricalnetworks,neuralnetworksetc.Theyareutilizedinabstract representations of computer programs and are an invaluable tools in the study of sequentialmachines.Infuturethispapercanbeextendedtostudiesofstrongandweak domination in triple connecteddigraphs.

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