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BIBLIOGRAPHY ON DOMINATION IN GRAPHS AND SOME BASIC DEFINITIONS OF DOMINATION PARAMETERS

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Introduction

The following bibliography on Domination in Graphs has been compiled over the past six years at Clemson University, where we regularly maintain a computer data base on this topic. Several people have been especially helpful in keeping this bibliography up-to-date and we would like to thank them: E.J. Cockayne, Victoria, British Columbia; P.J. Slater, Huntsville, Alabama; Maciej Sysło, Wroclaw, Poland; Bohdan Zelinka, Liberec, Czechoslovakia; E. Sampathkumar, Dharwad, India; A. Brandstädt, Rostock, GDR; and Peter Hammer, New Brunswick, New Jersey.

This bibliography essentially starts with the graph theory texts of König (1950), Berge (1958) and Ore (1962). Although a few research papers on domination were published between 1958 and 1975, a survey paper by Cockayne and Hedetniemi (1975) served to focus attention on the subject sufficiently to 'get the ball rolling'. By 1988 the domination bibliography included well over 300 citations, about one-third of which are concerned with algorithms for computing various domination numbers for special classes of graphs.

In our view, the rapid growth in the number of domination papers is attributable largely to three factors:

(i) the diversity of applications to both real-world and other mathematical 'covering' or 'location' problems;

(ii) the wide variety of domination parameters that can be defined;

(iii) the NP-completeness of the basic domination problem, its close and 'natural' relationships to other NP-complete problems, and the subsequent interest in finding polynomial time solutions to domination problems in special classes of graphs.

Thus we expect that this bibliography will continue to grow at a steady rate.

As far as we know, only four survey papers have been written on domination in graphs:

Cockayne and Hedetniemi, 1975;

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Cockayne, 1978;
Laskar and Walikar, 1980;
Hedetniemi, Laskar and Pfaff, 1986 (a survey of irredundance in graphs).

However, survey information can be found in a variety of Ph.D. dissertations in which domination in graphs is a central topic, including those of:

S.L. Mitchell, University of Virginia, 1977;
H.B. Walikar, Karnatak University, 1980;
M. Farber, Rutgers University, 1981;
G.J. Chang, Cornell University, 1982;
P. Blitch, University of South Carolina, 1983;
J. Pfaff, Clemson University, 1984;
M. Blidia, University of Paris, 1984;
P.S. Neeralagi, Karnatak University, 1985;
L.K. Stewart, University of Toronto, 1985;
M.R. Fellows, University of California at San Diego, 1985;
K. Peters, Clemson University, 1986;
L.L. Kelleher, Northeastern University, 1987;
T.V. Wimer, Clemson University, 1987;
G.A. Domke, Clemson University, 1988;
T.V. Venkatachalam, Karnatak University, 1988;
D.L. Grinstead, University of Albama in Huntsville, 1989;
E.O. Hare, Clemson University, 1989;
F. Maffray, University of Paris;
Jacob, University of Paris.

Although such a task grows increasingly difficult because of the growth of this literature, a 'current' survey paper or research monograph would be most welcome at this time, either on domination theory in graphs, or on the algorithmic aspects of domination in graphs.

The authors would like to apologize for the relatively large number of entries which appear either as 'manuscript', 'technical report', or 'to appear'. We have found it difficult to maintain the 'current' status of all of these papers, some of which may never be published. We would like to request that any and all information concerning additions, updates, corrections or suggested deletions from this bibliography be forwarded to us at Clemson University.

Finally, we present the following definitions of various types of domination, not only to assist the reader in understanding the titles of these papers, but to delimit the scope of this bibliography. In particular, this bibliography does not include the many papers which have been published on:

(i) maximal independent sets of vertices in graphs (which are necessarily minimal dominating sets) or maximal cliques in graphs (which are minimal dominating sets in the complement of a graph). [The reader is referred to P.L. Hammer and M.A. Hujter at Rutgers University, who maintain a comprehensive

bibliography of papers on independent sets and cliques in graphs.]; or
(ii) facility location problems.

Basic definitions of domination parameters

Let $G=(V, E)$ be a graph.

$N(u)$: The *open neighborhood* of a vertex u is the set of vertices adjacent to u.
$N[u]$: *The closed neighborhood of a vertex* $u=\{u\} \cup N(u)$.
$N(S)$: The *open neighborhood of a set* S of vertices is the set of vertices adjacent to any vertex in S.
$N[S]$: The *closed neighborhood of a set* S of vertices $= N(S) \cup \{S\}$.

A set $S \subseteq V$ is a *dominating set* if $N[S]=V$.
A set $S \subseteq V$ is a *total dominating set* if $N(S)=V$.
A set $S \subseteq V$ is a *connected dominating set* if S is a dominating set and the subgraph $\langle S \rangle$ induced by S is connected.
A set $S \subseteq V$ is an *efficient dominating set* if for every $v \in V-S$, $|N[v] \cap S|=1$.
A set $F \subseteq E$ is an *edge dominating set* if every edge not in F has a vertex in common with at least one edge in F.
A set $S \subseteq V$ is a *vertex-cover* if every edge contains at least one vertex in S.
A set $F \subseteq E$ is an *edge-cover* if every vertex is incident with at least one edge in F.
A set $S \subseteq V$ is *irredundant* if for every vertex v in S, $N[v]-N[S-\{v\}] \neq \emptyset$.
A set $S \subseteq V$ is a *neighborhood set* if the union of the induced subgraphs of all the closed neighborhoods of the vertices of S is G, i.e. $\bigcup_{x \in S} \langle N[x] \rangle = G$.
A vertex v and an edge (u, w) *strongly dominate* each other if (i) $v=u$ or $v=w$ or (ii) both (v, u) and (v, w) are edges in G.
A vertex v and an edge (u, w) *weakly dominates* each other if (i) $v=u$ or $v=w$ or (ii) (v, u) or (v, w) is an edge in G.
A set $S \subseteq V$ is *independent* if no two vertices in S are adjacent.

$\gamma(G)$: The *domination number* is the minimum cardinality of a dominating set.
$\Gamma(G)$: The *upper domination number* is the maximum cardinality of a minimal dominating set
$\gamma'(G)$: The *edge-domination number* is the minimum cardinality of an edge-dominating set.
$\gamma_t(G)$: The *total domination number* is the minimum cardinality of a total dominating set.
$\gamma_c(G)$: The *connected domination number* is the minimum cardinality of a connected dominating set.
$\gamma_e(G)$: The *efficient domination number* is the minimum cardinality of an efficient dominating set.
$i(G)$: The *independent domination number* is the minimum cardinality of a dominating set which is independent.

$\beta_0(G)$: The *independence number* is the maximum cardinality of an independent set of vertices.

$\gamma_{01}(G)$: The *vertex–edge weak domination number* is the minimum cardinality of a set of vertices that weakly dominates $E(G)$.

$\gamma_{10}(G)$: The *edge–vertex weak domination number* is the minimum cardinality of a set of edges that weakly dominates $V(G)$.

$S\gamma_{01}(G)$: The *vertex–edge strong domination number* is the minimum cardinality of a set of vertices that strongly dominates $E(G)$.

$S\gamma_{10}(G)$: The *edge–vertex strong domination number* is the minimum cardinality of a set of edges that strongly dominates $V(G)$.

$\varepsilon_f(G)$: The *pendant edge number* is the maximum cardinality of a set of pendant edges in a spanning forest of G.

$\varepsilon_t(G)$: The *endvertex number* is the maximum cardinality of a set of endvertices in a spanning tree of a connected graph G.

$\mathrm{ir}(G)$: The *irredundance number* is the minimum cardinality of a maximal irredundant set of vertices.

$\mathrm{IR}(G)$: The *upper irredundance number* is the maximum cardinality of an irredundant set of vertices.

$n_0(G)$: The *neighborhood number* is the minimum cardinality of a neighborhood set. *Note* that $n_0(G) = S\gamma_{01}(G)$.

$d(G)$: The *domatic number* is the maximum order of a partition of $V(G)$ into sets of vertices such that each such subset is a dominating set.

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