

Journal Pre-proof

Algorithmic aspects of upper paired-domination in graphs

Michael A. Henning, D. Pradhan

PII: S0304-3975(19)30695-4
DOI: <https://doi.org/10.1016/j.tcs.2019.10.045>
Reference: TCS 12251

To appear in: *Theoretical Computer Science*

Received date: 10 January 2019
Revised date: 23 October 2019
Accepted date: 29 October 2019

Please cite this article as: M.A. Henning, D. Pradhan, Algorithmic aspects of upper paired-domination in graphs, *Theoret. Comput. Sci.* (2019), doi: <https://doi.org/10.1016/j.tcs.2019.10.045>.

This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

© 2019 Published by Elsevier.



Algorithmic aspects of upper paired-domination in graphs

Michael A. Henning^{a,1}, D. Pradhan^{b,2,*}

^a*Department of Pure and Applied Mathematics
University of Johannesburg
Auckland Park, 2006 South Africa*

^b*Department of Mathematics and Computing
Indian Institute of Technology (ISM), Dhanbad*

Abstract

A set D of vertices in a graph G is a paired-dominating set of G if every vertex of G is adjacent to a vertex in D and the subgraph induced by D contains a perfect matching (not necessarily as an induced subgraph). A paired-dominating set of G is minimal if no proper subset of it is a paired-dominating set of G . The upper paired-domination number of G , denoted by $\Gamma_{\text{pr}}(G)$, is the maximum cardinality of a minimal paired-dominating set of G . In UPPER-PDS, it is required to compute a minimal paired-dominating set with cardinality $\Gamma_{\text{pr}}(G)$ for a given graph G . In this paper, we show that UPPER-PDS cannot be approximated within a factor of $n^{1-\varepsilon}$ for any $\varepsilon > 0$, unless $\text{P}=\text{NP}$ and UPPER-PDS is APX-complete for bipartite graphs of maximum degree 4. On the positive side, we show that UPPER-PDS can be approximated within $O(\Delta)$ -factor for graphs with maximum degree Δ . We also show that UPPER-PDS is solvable in polynomial time for threshold graphs, chain graphs, and proper interval graphs.

Keywords: Domination; Paired-domination; Upper paired-domination; Polynomial time algorithm; NP-complete; APX-complete.

1. Introduction

A set D of vertices of a graph $G = (V, E)$ is a *dominating set* of G if every vertex in $V \setminus D$ is adjacent to some vertex in D . The concept of domination and its variations have many applications and have been widely studied in literature (see [16, 17]); a rough estimate says that it occurs in more than 6000 papers to date. A dominating set of a graph G is *minimal* if no proper subset of it is a dominating set of G . The *domination number* of G , denoted by $\gamma(G)$, is the minimum

*Corresponding Author

Email addresses: mahenning@uj.ac.za (Michael A. Henning), dina@iitism.ac.in (D. Pradhan)

¹Research supported in part by the University of Johannesburg and the South African National Research Foundation.

²Supported in part by DST-SERB project.

Download English Version:

<https://daneshyari.com/en/article/13431503>

Download Persian Version:

<https://daneshyari.com/article/13431503>

[Daneshyari.com](https://daneshyari.com)