Discussiones Mathematicae
Graph Theory 36 (2016) 629–641
doi:10.7151/dmgt.1878

VARIOUS BOUNDS FOR LIAR'S DOMINATION NUMBER

Abdollah Alimadadi[1]

[1,2]*Department of Mathematics*
University of Tafresh, Tafresh, Iran
e-mail: abd.alimadadi@yahoo.com

Doost Ali Mojdeh[2]

[2]*Department of Mathematics*
University of Mazandaran, Babolsar, Iran
e-mail: damojdeh@umz.ac.ir

and

Nader Jafari Rad

Department of Mathematics
Shahrood University of Technology, Shahrood, Iran
e-mail: n.jafarirad@gmail.com

Abstract

Let $G = (V, E)$ be a graph. A set $S \subseteq V$ is a dominating set if $\bigcup_{v \in S} N[v] = V$, where $N[v]$ is the closed neighborhood of v. Let $L \subseteq V$ be a dominating set, and let v be a designated vertex in V (an intruder vertex). Each vertex in $L \cap N[v]$ can report that v is the location of the intruder, but (at most) one $x \in L \cap N[v]$ can report any $w \in N[x]$ as the intruder location or x can indicate that there is no intruder in $N[x]$. A dominating set L is called a liar's dominating set if every $v \in V(G)$ can be correctly identified as an intruder location under these restrictions. The minimum cardinality of a liar's dominating set is called the liar's domination number, and is denoted by $\gamma_{LR}(G)$. In this paper, we present sharp bounds for the liar's domination number in terms of the diameter, the girth and clique covering number of a graph. We present two Nordhaus-Gaddum type relations for $\gamma_{LR}(G)$, and study liar's dominating set sensitivity versus edge-connectivity. We also present various bounds for the liar's domination component number, that is, the maximum number of components over all minimum liar's dominating sets.

Keywords: liar's domination, diameter, regular graph, Nordhaus-Gaddum.
2010 Mathematics Subject Classification: 05C69.

References

[1] D. Auger, *Induced paths in twin-free graphs*, Electron. J. Combin. **15** #N17 (2008).

[2] J.A. Bondy and U.S.R. Murty, Graph Theory, Graduate Texts in Mathematics **244** (Springer-Verlag, London, 2008).

[3] G. Chartrand and L. Lesniak, Graphs and Digraphs, 4th Ed. (CRC Press, Bocz Raton, 2004).

[4] T.W. Haynes, S.T. Hedetniemi and P.J. Slater, Domination in Graphs, Advanced Topics (Marcel Dekker, Inc., New York, 1998).

[5] T.W. Haynes, S.T. Hedetniemi and P.J. Slater, Fundamentals of Domination in Graph (Marcel Dekker, Inc., New York, 1998).

[6] T.W. Haynes, P.J. Slater and C. Sterling, *Liar's domination in ladders*, Congr. Numer. **212** (2012) 45–56.

[7] I. Honkala, T. Laihonen and S. Ranto, *On codes identifying sets of vertices in Hamming spaces*, Des. Codes Cryptogr. **24** (2001) 193–204. doi:10.1023/A:1011256721935

[8] V. Junnila and T. Laihonen, *Optimal identifying codes in cycles and paths,* Graphs Combin. **28** (2012) 469–481. doi:10.1007/s00373-011-1058-6

[9] M.G. Karpovsky, K. Chakrabarty and L.B. Levitin, *On a new class of codes for identifying vertices in graphs,* IEEE Trans. Inform. Theory **44** (1998) 599–611. doi:10.1109/18.661507

[10] M. Nikodem, *False alarms in fault-tolerant dominating sets in graphs*, Opuscula Math. **32** (2012) 751–760. doi:10.7494/OpMath.2012.32.4.751

[11] B.S. Panda and S. Paul, *Hardness results and approximation algorithm for total liar's domination in graphs*, J. Comb. Optim. **27** (2014) 643–662. doi:10.1007/s10878-012-9542-3

[12] B.S. Panda and S. Paul, *Liar's domination in graphs: Complexity and algorithm*, Discrete Appl. Math. **161** (2013) 1085–1092. doi:10.1016/j.dam.2012.12.011

[13] B.S. Panda and S. Paul, *A linear time algorithm for liar's domination problem in proper interval graphs*, Inform. Process. Lett. **113** (2013) 815–822. doi:10.1016/j.ipl.2013.07.012

[14] M.L. Roden and P.J. Slater, *Liar's domination and the domination continuum*, Congr. Numer. **190** (2008) 77–85.

[15] M.L. Roden and P.J. Slater, *Liar's domination in graphs*, Discrete Math. **309** (2009) 5884–5890.
doi:10.1016/j.disc.2008.07.019

[16] P.J. Slater, *Liar's domination*, Networks **54** (2009) 70–74.
doi:10.1002/net.20295

[17] J. Zhou, Z. Zhang, W. Wu and K. Xing, *A greedy algorithm for the fault-tolerant connected dominating set in a general graph*, J. Comb. Optim. **28** (2014) 310–319.
doi:10.1007/s10878-013-9638-4

Received 11 January 2015
Revised 23 August 2015
Accepted 1 October 2015