

SIGNED TOTAL ROMAN DOMINATION IN DIGRAPHS

LUTZ VOLKMANN

Lehrstuhl II für Mathematik
RWTH Aachen University
52056 Aachen, Germany

e-mail: volkm@math2.rwth-aachen.de

Abstract

Let D be a finite and simple digraph with vertex set $V(D)$. A signed total Roman dominating function (STRDF) on a digraph D is a function $f : V(D) \rightarrow \{-1, 1, 2\}$ satisfying the conditions that (i) $\sum_{x \in N^-(v)} f(x) \geq 1$ for each $v \in V(D)$, where $N^-(v)$ consists of all vertices of D from which arcs go into v , and (ii) every vertex u for which $f(u) = -1$ has an inner neighbor v for which $f(v) = 2$. The weight of an STRDF f is $w(f) = \sum_{v \in V(D)} f(v)$. The signed total Roman domination number $\gamma_{stR}(D)$ of D is the minimum weight of an STRDF on D . In this paper we initiate the study of the signed total Roman domination number of digraphs, and we present different bounds on $\gamma_{stR}(D)$. In addition, we determine the signed total Roman domination number of some classes of digraphs. Some of our results are extensions of known properties of the signed total Roman domination number $\gamma_{stR}(G)$ of graphs G .

Keywords: digraph, signed total Roman dominating function, signed total Roman domination number.

2010 Mathematics Subject Classification: 05C20, 05C69.

REFERENCES

- [1] S. Arumugam, K. Jacop and L. Volkmann, *Total and connected domination in digraphs*, Australas. J. Combin. **39** (2007) 283–292.
- [2] T.W. Haynes, S.T. Hedetniemi and P.J. Slater, *Fundamentals of Domination in Graphs* (Marcel Dekker, Inc., New York, 1998).
- [3] T.W. Haynes, S.T. Hedetniemi and P.J. Slater, *Editors, Domination in Graphs, Advanced Topics* (Marcel Dekker, Inc., New York, 1998).

- [4] M.A. Henning, *Signed total domination in graphs*, Discrete Math. **278** (2004) 109–125.
doi:10.1016/j.disc.2003.06.002
- [5] E. Shan and T.C.E. Cheng, *Remarks on the minus (signed) total domination in graphs*, Discrete Math. **308** (2008) 3373–3380.
doi:10.1016/j.disc.2007.06.015
- [6] S.M. Sheikholeslami, *Signed total domination numbers of directed graphs*, Util. Math. **85** (2011) 213–218.
- [7] S.M. Sheikholeslami and L. Volkmann, *The Roman domination number of a digraph* Acta Univ. Apulensis Math. Inform. **27** (2011) 77–96.
- [8] L. Volkmann, *Signed total Roman domination in graphs*, J. Comb. Optim. **32** (2016) 855–871.
doi 10.1007/s10878-015-9906-6
- [9] B. Zelinka, *Signed total domination numbers of a graph*, Czechoslovak Math. J. **51** (2001) 225–229.
doi:10.1023/A:1013782511179

Received 28 August 2015

Revised 15 April 2016

Accepted 15 April 2016