A NOTE ON ROMAN DOMINATION OF DIGRAPHS

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Abstract

A vertex subset $S$ of a digraph $D$ is called a dominating set of $D$ if every vertex not in $S$ is adjacent from at least one vertex in $S$. The domination number of a digraph $D$, denoted by $\gamma(D)$, is the minimum cardinality of a dominating set of $D$. A Roman dominating function (RDF) on a digraph $D$ is a function $f : V(D) \to \{0, 1, 2\}$ satisfying the condition that every vertex $v$ with $f(v) = 0$ has an in-neighbor $u$ with $f(u) = 2$. The weight of an RDF $f$ is the value $\omega(f) = \sum_{v \in V(D)} f(v)$. The Roman domination number of a digraph $D$, denoted by $\gamma_R(D)$, is the minimum weight of an RDF on $D$. In this paper, for any integer $k$ with $2 \leq k \leq \gamma(D)$, we characterize the digraphs $D$ of order $n \geq 4$ with $\delta^-(D) \geq 1$ for which $\gamma_R(D) = \gamma(D) + k$ holds. We also characterize the digraphs $D$ of order $n \geq k$ with $\gamma_R(D) = k$ for any positive integer $k$. In addition, we present a Nordhaus-Gaddum bound on the Roman domination number of digraphs.

Keywords: Roman domination number, domination number, digraph, Nordhaus-Gaddum.

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