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Eternal Roman Domination in Trees

Imagine a collection of mobile guards located at the vertices of a graph G such that there are 0, 1 or 2 guards located at each vertex. If every vertex with 0 guards is adjacent at a vertex with 2 guards, then the configuration of guards is called a Roman dominating configuration. We consider a discrete-time, dynamic process in which the goal is to maintain a Roman dominating configuration for all time. At each time step a vertex v with 0 guards is specified and the guards must reconfigure so that 1 or 2 guards relocate to v and the the resulting configuration of guards is a Roman dominating configuration. During the reconfiguration each guard either stays in place of moves along an edge to an adjacent vertex. We show that if G is a tree with n vertices, then it is always possible to eternally maintain a Roman dominating configuration with $\left\lceil \frac{7n}{8} \right\rceil$ guards, and describe all trees for which no smaller number of guards suffices.