CERTIFIED DOMINATING SETS WITH CERTIFICATES PRACTICAL APPLICATION OF AN ILP MODEL

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Let $G = (V, E)$ be a finite simple graph. A set $S \subseteq V$ is called a *certified dominating set* if every $v \in V \setminus S$ has at least one neighbor in S, and for each $u \in S$, $N(u) \setminus S \neq 1$. We consider the Minimum Certified Dominating Set problem and introduce an integer linear program with binary variables x_v for $v \in V$ and auxiliary variables to enforce the certification constraint. We prove that feasible solutions of the ILP correspond bijectively to certified dominating sets of G, and that the objective $\min \sum_{v \in V} x_v$ yields a minimum-cardinality solution. Experiments on representative network graphs demonstrate that our model solves instances with thousands of vertices efficiently. Moreover, the framework admits seamless incorporation of further linear constraints—such as capacity or connectivity requirements—without compromising integrality.

References

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