# On Star Cover and Star Partition of Graphs

(Restricted Variants of the Dominating Set Problem)

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## Abstract

A graph that is isomorphic to $K_{1,r}$ for some $r \geq 0$ is called a star. Given a graph $G = (V, E)$, a collection $(V_1, \ldots, V_k)$ of subsets of $V$ such that $V_1 \cup \ldots \cup V_k = V$ is called a star cover of $G$ (of size $k$) if each set in the collection induces a star. A star cover $(V_1, \ldots, V_k)$ of $G$ is called a star partition (of size $k$) if $(V_1, \ldots, V_k)$ is a partition of $V$. We study the associated optimization problems.

Given a graph $G$, the problem MIN STAR COVER asks for a star cover of minimum size. Given a graph $G$, the problem MIN STAR PARTITION asks for a star partition of minimum size. We also consider the corresponding decision versions of these problems: Given a graph $G$ and a positive integer $k$, STAR COVER asks whether $G$ has a star cover of size at most $k$ and STAR PARTITION asks whether $G$ has a star partition of size at most $k$.

These problems may be thought of as an amalgamation of the well-known coloring and dominating set problems. Indeed both these problems coincide with the dominating set problem when restricted to triangle-free graphs (and hence bipartite graphs).

In this seminar talk, I will present our work on STAR COVER and STAR PARTITION restricted to hereditary graph classes in general and butterfly-free graphs and split graphs in particular. Specifically, I will present an $O(\log)$-approximation algorithm for STAR COVER on any hereditarygraph class. I will show that the problems are polynomially equivalent, up to the optimum value, for butterfly-free graph and have $(n^{14})$ time $O(\log n)$-approximatin algorithms. I will also present our improved NP-completeness results, approximation algorithms and special case polynomial time algorithms for the problems on split graphs.