

Oberseminar Theoretische Informatik
Sommersemester 2008

Michael Dom

**Capacitated Domination and Covering:
A Parameterized Perspective**

Monday, June 9 at 2pm (c.t.) in room 3319 (Ernst-Abbe-Platz 2, floor 3).

Capacitated versions of Vertex Cover and Dominating Set have been studied intensively in terms of polynomial time approximation algorithms. Although the Dominating Set and Vertex Cover have been subjected to considerable scrutiny in the parameterized complexity world, this is not true for their capacitated versions. Here we make an attempt to understand the behavior of the problems Capacitated Dominating Set and Capacitated Vertex Cover from the perspective of parameterized complexity.

The original, uncapacitated versions of these problems, Vertex Cover and Dominating Set, are known to be fixed parameter tractable when parameterized by a structure of the graph called the treewidth (tw). In this paper we show that the capacitated versions of these problems behave differently. Our results are:

- Capacitated Dominating Set is $W[1]$ -hard when parameterized by treewidth. In fact, Capacitated Dominating Set is $W[1]$ -hard when parameterized by both treewidth and solution size k of the capacitated dominating set.
- Capacitated Vertex Cover is $W[1]$ -hard when parameterized by treewidth.
- Capacitated Vertex Cover can be solved in time $2^{O(tw \log(k))} \cdot n^{O(1)}$ where tw is the treewidth of the input graph and k is the solution size. As a corollary, we show that the weighted version of Capacitated Vertex Cover in general graphs can be solved in time $2^{O(k \log(k))} \cdot n^{O(1)}$. This improves the earlier algorithm of Guo et al. [Theory Comput. Syst., 2007] running in time $O(1.2^{(k^2)} + n^2)$.

Capacitated Vertex Cover is, therefore, to our knowledge the first known “subset problem” which has turned out to be fixed parameter tractable when parameterized by solution size but $W[1]$ -hard when parameterized by treewidth.

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