**Oberseminar Theoretische Informatik**
Sommersemester 2010

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# Graph and Election Problems Parameterized by Feedback Set Numbers

Di. 15.06.2010 um 12:00 (c.t.) im Seminarraum 3319 (Ernst-Abbe-Platz 2, 3. Stock).

This work investigates the parameterized complexity of three related graph modification problems. Given a directed graph, a distinguished vertex, and a positive integer $k$, Minimum Indegree Deletion asks for a vertex subset of size at most $k$ whose removal makes the distinguished vertex the only vertex with minimum indegree. Minimum Degree Deletion is analogously defined, but deals with undirected graphs. Bounded Degree Deletion is also defined on undirected graphs, but has a positive integer $d$ instead of a distinguished vertex as part of the input. It asks for a vertex subset of size at most $k$ whose removal results in a graph in which every vertex has degree at most $d$. The first two problems have applications in computational social choice whereas the third problem is used in computational biology. We investigate the parameterized complexity with respect to the parameters "treewidth", "size of a feedback vertex set" and "size of a feedback edge set" respectively "size of a feedback arc set". Each of these parameters measures the "degree of acyclicity" in different ways. For Minimum Indegree Deletion we show that it is W[2]-hard with respect to both parameters that are defined on acyclic graphs. We describe a branch-and-bound algorithm whose running time is $O(s \cdot (k+1)^s \cdot n^2)$, where $n$ is the number of vertices, $k$ is the "number of vertices to delete", and $s$ is the "size of a feedback set". For Minimum Degree Deletion we show W[1]-hardness with respect to the parameter "number of vertices to delete". With respect to each of the parameters that measures the "degree of acyclicity" we show fixed-parameter tractability. We describe a simple search tree algorithm with running time $O(2^s \cdot n^3)$ where $n$ is the number of vertices and $s$ is the "size of a feedback edge set" and two concrete fixed-parameter algorithms with respect to the parameter "size of a feedback vertex set that does not contain the distinguished vertex". For Bounded Degree Deletion we present a search-tree algorithm with running time $O(3^s \cdot n^2)$ where $n$ is the number of vertices and $s$ is the "size of a feedback edge set".
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