RWTH Aachen **WS 2018**
Lehrgebiet Theoretische Informatik Problem Set 1
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Parameterized Algorithms Tutorial

Tutorial Exercise T1

The Independent Set problem is defined as follows. Given a graph $G = (V, E)$ and an integer k, is ther a set S of size k such that for all $u, v \in S$ where $u \neq v$ it holds $uv \notin E(G)$? Is Independent Set restricted to graphs of maximal degree d, where d is a constant, fixed paramater tractable parameterized by the size of the solution k?

Tutorial Exercise T2

Since any planar graph is has a four coloring, any instance of the Planar Independent Set problem is guaranteed to have a solution of at least size $n/4$. Is the above guarantee version of the problem fixed parameter tractable paramertized by the solution size k?

Tutorial Exercise T3

The Cluster Vertex Deletion problem is defined as follows: given a graph $G = (V, E)$ and an integer parameter k, does there exist a set S of size at most k such that $G[V \setminus S]$ consists of a collection of disjoint cliques. The cliques are disjoint in the sense that they do not share vertices and/or edges and there is no edge with one endpoint in one clique and the other in a different clique. Design an algorithm that runs in FPT-time w.r.t. k as parameter.

Homework H1

The Triangle Vertex Deletion problem is defined as follows. Given a graph $G = (V, E)$ and an integer parameter k, are there k vertices whose deletion results in a graph with no cycles of length three? Show that this problem is fixed-parameter tractable. What is the running time of your algorithm? Is there some easy way to improve the running time?

Homework H2

Implement the Closest String algorithm that was presented in class and let it run on the example given. What is the run time? Ask a friend that does not know parameterized algorithms to design and implement an algorithm for the same problem and compare it with your implementation.