RWTH Aachen **WS 2014/15**
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 there 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 parameter tractable parameterized by the size of the solution k?

Tutorial Exercise T2

The Planar Independent Set is the Independent Set problem restricted to planar graphs. Is Planar Independent Set fixed parameter tractable parameterized 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?

[10 points]

Homework H2

This exercise is concerned with the fixed parameter tractable algorithm for the Closest String problem. An input to this problem consists of n strings $s_1, \ldots, s_n \in \Sigma^L$ of length L each and an integer parameter k. The question is whether there exists a string $s \in \Sigma^L$ such that $d(s, s_i) \leq k$, for all $1 \leq i \leq n$. Explain this algorithm and analyze its running time. You should probably start by asking yourself the following question: How many differences can there be between two strings s_1 and s_2, such there can exist a string s such that $d(s, s_1) \leq k$ and $d(s, s_2) \leq k$?

[10 points]