Exercises to the lecture
Complexity Theory
Sheet 12

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M.Sc. Peter Chini Delivery until 03.02.2016 at 12h

Exercise 12.1 (Parametrized *SAT*)

Consider the following parametrized version of *SAT*:
Input: A formula $\varphi(x_1, \ldots, x_k)$ of size n.
Parameter: $k \in \mathbb{N}$.
Question: Is there a satisfying assignment for φ ?

Construct a parametrized branching algorithm for the above problem and determine its runtime. Which part of the input makes *SAT* so expensive ?

Exercise 12.2 (Unions of cliques)

A **clique** is a graph $K = (V, E)$ such that for all $u, v \in V$ we have: $uv \in E$. Hence, any pair of vertices has a connecting edge. The goal of this exercise is to show that the problem *CLUSTEREDITING* defined below is FPT.
Input: A graph $G = (V, E)$.
Parameter: $k \in \mathbb{N}$.
Question: Is it possible to add or delete at most k edges to turn the graph into a disjoint union of cliques ?

a) Show that a graph G consists of disjoint cliques if and only if there are no three distinct vertices $u, v, w \in V$ so that $uv, vw \in E$ and $uw \notin E$.

b) Prove that *CLUSTEREDITING* is FPT.
Hint: The criterion of Part a) can be used as a branching rule. So far, we have only considered binary branching trees. To solve the above problem, you may need a tree that has a bigger outdegree.

Exercise 12.3 (Total order construction)

Let T be a finite set and $(T, \leq)$ a partial order. Show that there is a total order $(T, \sqsubseteq)$ extending $(T, \leq)$. This means: if $a \leq b$ then we also have $a \sqsubseteq b$.

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