RWTH Aachen **WS 2018**
Lehrgebiet Theoretische Informatik Problem Set 10
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Parameterized Algorithms Tutorial

Tutorial Exercise T1

The $k \times k$-*permutation clique problem* is defined as follows:

- Input: A graph $G = (V, E)$ with $V = \{1, \ldots, k\}^2$.
- Parameter: k
- Is there a permuation $\pi \in S_k$ such that $\{ (i, \pi(i)) \mid i = 1, \ldots, k \}$ is a clique in G?

With other words: Is there a k-clique that uses exactly one vertex from each row and one vertex from each column?

a) What do you know about the similar $k \times k$-clique problem?

b) Show that $k \times k$-permutation clique can be solved in time $2^{O(k \log k)}$.

c) Show that the bound in b) is tight, i.e., that we cannot solve the problem in time $2^{o(k \log k)}$ unless ETH fails.

Tutorial Exercise T2

Develop an efficient algorithm for triangle packing on graphs with treewidth k. Use dynamic programming. What are the states in your table?
The triangle packing problems asks how many vertex disjoint triangles exist in a graph as subgraphs. The parameter is the treewidth of the graph.

Homework H1

Prove that the Strong Exponential Time Hypothesis implies the Exponential Time Hypothesis.

Homework H2

Show that assuming ETH implies that we cannot solve Dominating Set in time $f(k)n^{o(k)}$ for any computable function f (where k is the size of the dominating set and n the size of the graph).