University of Freiburg
Dept. of Computer Science
Prof. Dr. F. Kuhn
P. Bamberger, P. Schneider

Algorithm Theory

Exercise Sheet 7

Due: Tuesday, 22nd of December 2020, 4 pm

Exercise 1: Global Min-Cut *(8 Points)*

Given a simple, undirected graph $G = (V, E)$ and a subset $A \subset V$ with $A \neq \emptyset$ and $A \neq V$, we call the number of edges between A and $V \setminus A$ the *size* of the cut $(A, V \setminus A)$. A min-cut of G is a cut of minimum size.
Give an algorithm that computes the size of a min-cut of G in time $O(|E| \cdot |V|^2)$. Explain why the algorithm is correct and analyze the runtime.

Exercise 2: Scheduling *(12 Points)*

Assume there are n students $s_1, \ldots, s_n$. Each student has finished some individual project and now has to present the results to some professors. There are k professors $p_1, \ldots, p_k$. Each professor p_i hands in a list $L_i \subseteq \{s_1, \ldots, s_n\}$ of students for whose projects he/she is an expert. Each professor p_i is willing to attend at most a_i presentations.
The exam regulations require that at each presentation, x professors that are experts on the topic are present.

(a) Describe a polynomial-time algorithm that computes an assignment of the professors to the student's presentations such that the given constraints are fulfilled, or reports that no such assignment exists. *(6 Points)*

(b) As there is a shortage of professors, the university loosens the requirements such that among the x professors that need to be present at each presentation, at least y need to be an expert on the topic, for some $y < x$. Describe how to construct a feasible schedule in this case. *(6 Points)*