

# Homework 10: Separators and Cuts Part I

Algorithms on Directed Graphs, Winter 2018/9

Due: 26.01.2019 by 16:00

For definitions please take a look at the chapter 8 of the parametrized algorithm book.

Most of the upcoming exercises are the missing proofs from the lecture and you can find them in the book. Your actual task is to read and understand them and express your understanding.

**Exercise 1** (Pushing lemmas). Prove the followings.

1. Prove correctness of pushing lemma for EDGE MULTIWAY CUT problem. (lemma 8.18)
2. Prove correctness of pushing lemma for SKEW EDGE MULTICUT problem.

**Exercise 2** (Reduce FVS to FAS). We discussed a sketch of a parameter preserving reduction from FVS to FAS (Proposition 8.42); provide a full proof for it.

**Exercise 3** (FPT algorithm for FAS). I had an impression that not everybody understood the proof of the last theorem in the lecture. So this exercise is for you to prove me wrong.

Assuming existence of FPT algorithm with running time  $f(k+|W|)Poly(n)$  for DIRECTED FEEDBACK ARC SET COMPRESSION problem, provide an FPT algorithm for FAS with running time  $g(k)Poly(n)$  ( $f, g : \mathbb{N} \rightarrow \mathbb{N}$ ). I basically ask for the proof of Theorem 8.46.