

## Analysis of Algorithms I: Problem Assignment 6

Due on Gradescope at 11:59pm on Monday, May 2, 2022.

### Instructions

- Problems 1 and 4 are each worth 10 points. Problems 2 and 3 are each worth 15 points.
- Submit your solutions in pdf format. Late submissions will **not** be accepted.
- You can discuss with TAs or other students but you must acknowledge them at the beginning of each problem and your solutions must be written in your own words.

### Problems

1. Problem 23-4 on Page 641: Alternative minimum-spanning-tree algorithms. For each of the three algorithms, either give a counterexample or prove that it always outputs a minimum spanning tree. Make sure your proof is written clearly and concisely. Also there is no need to describe efficient implementations of these algorithms.
2. Problem 24-4 on Page 679: Gabow's scaling algorithm for single-source shortest paths.
3. Problem 25-2 on Page 706: Shortest paths in  $\epsilon$ -dense graphs. Skip a). For a  $d$ -ary min-heap, INSERT takes time  $O(\log_d n)$ ; EXTRACT-MIN takes time  $O(d \cdot \log_d n)$ ; and DECREASE-KEY takes time  $O(\log_d n)$ . Check Chapter 6 and Problem 6-2 if you are interested in  $d$ -ary min-heaps. But for this problem you may use these facts for free.
4. Problem 26.1 on Page 760: Escape problem.