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

Algorithms Theory

Grading Guidelines Exercise Sheet 1

Due: Tuesday, 10th of November 2020, 4 pm (*please note the information given on page 2*)

Exercise 1: Landau-Notation *(3+3+3 Points)*

Prove or disprove the following statements.

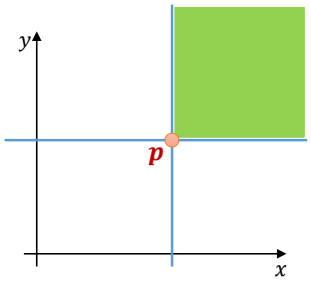
(a) $n^3 - 9n^2 \in \Omega(n^3)$.

(b) $\left(\log(\sqrt{n})\right)^2 \in \Theta(\log n)$.

(c) $n^n \in \Omega\big((2n)!\big)$.

Exercise 2: Divide-and-Conquer *(11 Points)*

Consider a set of n points in the plane given by their x and y coordinates ($x, y \geq 0$). We say that $p = (x, y)$ is a *Pareto optimal* point if for all other points $p' = (x', y')$ it holds $x' < x$ or $y' < y$. That is, a point p is *Pareto optimal* if in the following picture, the area marked green is empty:



Give a divide-and-conquer algorithm that finds all *Pareto optimal* points in time $O(n \log n)$. Analyze the runtime.

Submission Information

Format: This semester we will only accept digital submissions! All submissions must be in, or converted to pdf format. We strongly recommend to prepare your solutions with Latex for best readability. Solutions prepared with Word or similar text editors are ok. Scans or photos of handwritten solutions in pdf format are ok as well, but must be well readable!

Submission Guidelines: The exercises will be conducted online with the course management system Daphne. The solution of each exercise **must** be uploaded to your SVN repository each one in a separate folder named *exercise-XY*, where *XY* is the exercise number (with a leading 0 if that number is smaller than 10). More on the submission via SVN on our website.

Team Submission: Teams will be allowed. Teams may have at most 3 members! In case you submit your solution as part of a team, each team member must still submit a copy of the solution pdf to their respective SVN-repository (c.f. explanations on our website). The members of the teams must be clearly marked on the top of the solution pdf.