



Introduction

Algorithm Theory
WS 2018/19

Fabian Kuhn

Design and analysis techniques for algorithms

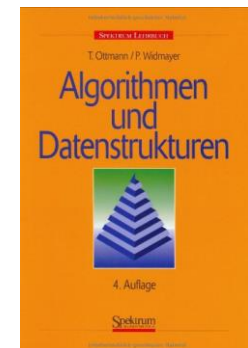
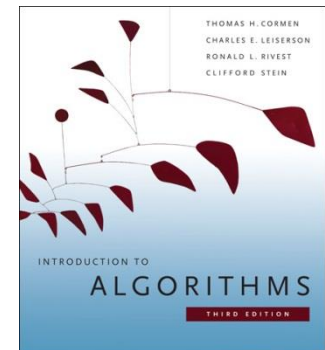
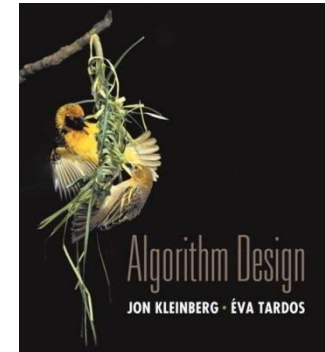
- Topics of the course:
 - divide and conquer
 - greedy
 - dynamic programming
 - advanced data structures
 - amortized analysis
 - graph algorithms
 - randomization
 - approximation algorithms
 - online algorithms
 - parallel algorithms

Requirements

- I assume that you have basic algorithms and data structures knowledge as well as some mathematical maturity
 - E.g., from the Bachelor course Informatik 2 and basic math courses
- In particular, you should be (at least partly) familiar with
 - math. induction, basic combinatorics & (discrete) probability theory, ...
 - Big-O notation and Landau notation more generally
 - searching and sorting (binary search, mergesort, quicksort)
 - binary search trees, balanced binary search trees
 - priority queues (heaps)
 - hash tables
 - basic graph-theoretic definitions
 - representations of graphs
 - basic graph algorithms: traversal (depth-first, breadth-first), minimum spanning trees, shortest paths

Literature

- J. Kleinberg, E. Tardos
Algorithm Design
Addison Wesley, 2005
- T. Cormen, C. Leiserson, R. Rivest, C. Stein
Introduction to Algorithms, Third Edition,
MIT Press, 2009
- T. Ottmann, P. Widmayer
Algorithmen und Datenstrukturen
4th Edition, Spektrum Akademischer Verlag,
Heidelberg, 2002
- Original literature



Lecture

Lecture (101-00-026)

- Monday 14:15 – 15:45
- Thursday 10:15 – 11:45 (\approx every 2nd week)

Exercise Tutorials (101-00-026 + 051-00-034)

- Thursday 10:15 – 12:00 (English) + 16:15 – 18:00 (German)
- **First exercise tutorial on Thu, Nov. 8**

Language

- Lectures will be in English

General Remarks

- Theory lecture (there will be math)

Recordings

- Most lectures will be recorded
- **No guarantee that there's always a recording!**

<http://ac.informatik.uni-freiburg.de>

→ Teaching → Winter Term 2018/19 → Algorithm Theory

- We will publish all important information there!
 - Check in the next days for additional information on the exercises.
- Check the web page regularly!
- Recordings will be put online
 - Sometimes possibly with some delay...

- In addition to the web page, we will also use a **forum**
 - The forum is provided through the Daphne system
 - You need to sign up on Daphne for this course to use the forum
- The link to the forum and for **signing up** will be published on the web page
- If you have a question to the lecture or the exercises, please **use the forum instead of writing an email** to one of us!
 - Like this, all of us and also your colleagues see the question and can answer to it
 - We can directly answer a question for everybody
 - Of course feel free to also use the forum to discuss anything related to the topics and organization of the lecture

Exercises

General Information

- There will be (theoretical) exercises to practice the material
 - We try to provide **sample solutions** (not always guaranteed)
- \approx 1 problem set every 2 weeks
- You need to do the exercises either alone or in groups of 2. We encourage you to team up and do them in groups of 2!
 - send email to Philipp Schneider (philipp.schneider@cs.uni-freiburg.de)
 - write with whom you'd like to do the exercises
 - indicate whether you'd prefer to have a German tutorial group
- 50% of all exercise points are needed to be admitted to the exam

Tutorials

- **Thursdays (every 2nd week, first on Nov. 8)**

Exercises

Exercise groups

- 2 exercise groups (1 in English, 1 in German)
 - English group: Johannes Kalmbach (Thu, 10:15 – 12:00)
 - German group: Pascal Bachor (Thu, 16:15 – 18:00)
 - sign up by email to Philipp Schneider (see last slide)

Assistants

- Mohamad Ahmadi, Philipp Schneider
- Pascal Bachor, Johannes Kalmbach

Handing in solutions

- Solutions are always due on Mondays at 14:15 (before lecture)
- Hand in by email to your tutor or on paper (either in the lecture or the letter box in building 51)

Final Exam

120 mins

- Final exam will take place after the semester
 - As soon as we know the date, we will publish it on the web page
- 50% of the exercise points are required to be admitted
 - Solving exercises is the best exam preparation!
- You will be allowed to bring 5 A4 pages of handwritten notes to the exam. No other material will be allowed
 - 5 A4 pages $\hat{=}$ 5 singly-sided A4 sheets