



# Introduction

Algorithm Theory  
WS 2017/18

Fabian Kuhn

## Design and analysis techniques for algorithms

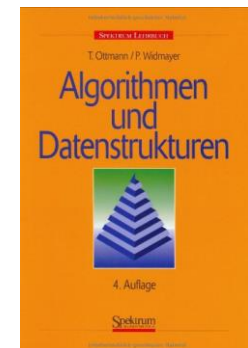
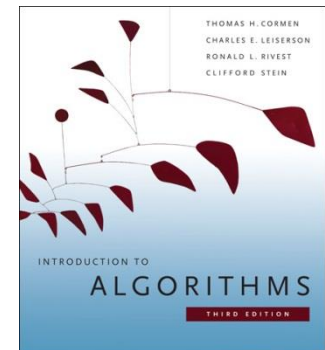
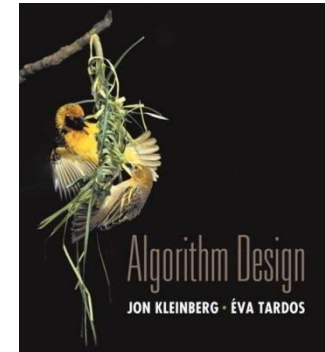
- Topics of the course:
  - divide and conquer
  - greedy
  - dynamic programming
  - advanced data structures
  - amortized analysis
  - graph algorithms
  - randomization
  - approximation algorithms
  - online algorithms
  - parallel algorithms

# 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 (≈ every 2<sup>nd</sup> week)
- Thursday 10:15 – 11:45

## Exercise Tutorials (101-00-026 + 051-00-006)

- Monday 14:15 – 16:00 (≈ every 2<sup>nd</sup> week)
- **First exercise tutorial on Mon, Nov. 6**

## 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 2017/18 → 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 Mohamad Ahmadi ([mahmadi@cs.uni-freiburg.de](mailto:mahmadi@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

- **Mondays, 14:15 – 16:00 (every 2<sup>nd</sup> week, first on Nov. 6)**



# Exercises

## Exercise groups

- 2 exercise groups (1 in English, 1 in German)
  - English group: Mohamad Ahmadi ([mahmadi@cs.uni-freiburg.de](mailto:mahmadi@cs.uni-freiburg.de))
  - German group: Philipp Schneider ([philipp.schneider@cs.uni-freiburg.de](mailto:philipp.schneider@cs.uni-freiburg.de))
  - sign up by email to Mohamad (see last slide)

## Assistants

- Mohamad Ahmadi, Philipp Schneider, Jara Uitto

## Handing in solutions

- Solutions are always due on Thursdays at 10:15 (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