

Algorithmen / Algorithms II

Peter Sanders

Exercise:

Daniel Seemaier, Tobias Heuer

Institute of Theoretical Informatics

Web:

http://algo2.iti.kit.edu/AlgorithmenII_WS20.php



Language

Experimental! Partially bilingual.

English: Slides, video from this year, Q&A life, Exam questions, Exam answers

Deutsch: Slides, video from last year, Q&A life,Exam questions, Exam answers, lecture notesNext year German first.



Organisation

Flipped Classroom

 $\exists \approx$ 120min recorded materials per week replaces classical lectures and exercise material

Questions and Discussion. Mo 10:00–10:45 and Di 16:00–16:45.

Exercise sheet every 14 days.

Virtual for the time being.



Organisation

Office hours:

Peter Sanders, Dienstag 13:45–14:45 Uhr https: //i10meeting.iti.kit.edu/OfficeHour please send me an email anyway

ΤΒΑ

TBA

Ilias Forum: Link at

http://algo2.iti.kit.edu/AlgorithmenII_WS20.php

Last lecture: February 16th, 2020

Exam: Wednesday, March 17th



Materials

☐ Slides

Problem sheets

Book:

P. Sanders, K. Mehlhorn, M. Dietzfelbinger, R. Dementiev

Sequential and Parallel

Algorithms and Data Structures — The Basic Toolbox

Springer 2019. Ca. 45 % of the lecture.

Lecture notes: Minimal notes on subjects not contained in the

book, with references to primary literature

Language: German.

But literature and slides are in English

Sanders: Algorithms II - November 8, 2020 – Supplement



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Further Reading

[Sanders, Mehlhorn, Dietzfelbinger, Dementiev]

Sequential and Parallel Algorithm and Data Structures — The Basic Toolbox

- [Mehlhorn, N\u00e4her] Algorithm Engineering, Flows, Geometrie
 The LEDA Platform of Combinatorial and Geometric Computing.
- □ [Ahuja, Magnanti, Orlin] Network Flows
- [de Berg, Cheong, van Kreveld, Overmars]
 Geometrie
 Computational Geometry: Algorithms and Applications
- [Gonzalo Navarro]

Succinct Data Structures

Compact Data Structures: A Practical Approach

[R. Niedermeier] Invitation to Fixed-Parameter Algorithms



Contents I

- Algorithm Engineering
- Advanced data structures using priority queues as example
 - addressable
 - integer keys
 - (external)
- Advanced graph algorithms
 - Shortest paths II: negative cycles, potential method
 - Strongly connected components
 - Maximum flows and matchings



Contents II

- Subareas of algorithmics
 - Randomized algorithms
 - External algorithms
 - Parallel algorithms
 - String algorithms: sorting, indexing,...
 - Geometric algorithms
 - Approximation algorithms
 - Fixed-Parameter algorithms
 - Online algorithms



Recap – Role of Algorithmics

- Core discipline of computer science
- The heart of every non-trivial computer application
- Algorithm engineering leads to well understood solutions for a large number of problems



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"Machine Learning does it Automatically?"

- ☐ Machine learning algorithms are algorithms too
- Specialized algorithms find better, faster and more robust solutions for well understood problems
- Split problem into well understood part and the rest
- Machine learning for parameter tuning?
- Specialized algorithms for well understood part, e.g., feature extraction or index data structure?



