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 notes

Next year German first.
Organisation

Flipped Classroom

- ≈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

☐ TBA

☐ 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
Further Reading

- [Sanders, Mehlhorn, Dietzfelbinger, Dementiev] Sequential and Parallel Algorithm and Data Structures — The Basic Toolbox

- [Mehlhorn, Näher] 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
“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?