

Introduction, administria

Data Structures and Algorithms for Computational Linguistics III ISCL-BA-07

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/tʃa:r'w tʃœltec'in/

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University of Tübingen
Seminar für Sprachwissenschaft

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What is this course about?

- An intermediate-level course on programming
- Algorithms: (good) solutions to programming problems
- Data structures: (efficient) ways to organize/store information

Prerequisites:

- Data Structures and Algorithms for CL I
- Data Structures and Algorithms for CL II

Module: ISCL-BA-07, Advanced Programming

What is in this course?

A bird's eye view

Introductory lectures on

- Some fundamental data structures: queues, stacks, trees, graphs, ...
- Some fundamental algorithms: searching, sorting, pattern matching, graph algorithms
- Analysis of algorithms
- Finite state automata
- Parsing

Why study algorithms?

- It is one of the fundamental topics in computer science: an algorithm is the way you instruct a computer to do things
- Knowing a clever, efficient solution to one problem helps designing good solutions for other, related problems
- Learning basic algorithmic techniques makes you a better programmer
- Designing good algorithms is an intellectual challenge
- The most popular interview questions for programming jobs are about algorithms

Course overview

- Lectures
 - Monday 14:15-15:45 (OSA-Keplerstr. 001)
 - Wednesday 14:15-15:45 (OSA-Keplerstr. 001)
- Lab: Friday 14:15-17:45 (OSA-Keplerstr. 001)
- Tutors:
 - How Chuen Yu (Kyle)
 - Sung-Jin Miriam Han
- Public course website: <https://dsac13-2025.github.io/>
- Moodle:
<https://moodle.zdv.uni-tuebingen.de/course/view.php?id=1144>
- GitHub: <https://github.com/dsac13-2025/dsac13>

Literature

- *Data Structures and Algorithms in Python*. Goodrich, Tamassia, and Goldwasser (2013)
 - Available through university library (online version):
<https://ebookcentral.proquest.com/lib/unitueb/detail.action?docID=4946360>
 - Website of the book contains source code, hints, examples:
<http://bcs.wiley.com/he-bcs/Books?action=index&bcsId=8029&itemId=1118290275>
- *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*. Jurafsky and Martin (2009)
 - Draft chapters of 3rd edition is available at
<https://web.stanford.edu/~jurafsky/slp3/>
- Course notes will be provided for some topics

Coursework and evaluation

- Reading material for most lectures
- Weekly assignments: ungraded, but **required**: For successful completion of the practical part of the class, you have to complete all the assignments, and at least 60% of them has to be on time.
- Final (written) exam (70 %)
- Final project (30 %)
- Attendance is not required, but you are unlikely to pass without regular attendance

Assignments

- Assignments in Python
- Only online submissions through GitHub
- The assignments can be done in pairs (strongly recommended – knowing your classmates, and learning from them, is an important part of the university experience/education)
- This means **working together on the whole exercise**, not sharing parts of an assignment and working on them independently
- You can pair with the same person only once
- Do we need an automatic/random match-maker?

Topics at a glance

- A recap of what you should already know: arrays, lists, maps, queues, stacks, iteration, recursion, binary search, ...
- Algorithmic analysis
- Common algorithmic patterns: brute force, greedy, divide and conquer, dynamic programming, ...
- Sorting
- Trees
- Priority queues, heaps
- Hashing
- Graphs, graph algorithms
- Pattern matching
- Tries
- Finite state automata and regular expressions
- Finite state transducers
- Parsing



Final remarks

- This course is not about learning programming, or a programming language, it is about solving computational problems
- This is a 12CP course: it means you are expected to spend 360 hours (over 200 hours outside class) studying it
- Please do not be shy, ask your questions during the lectures
- Please take the assignments seriously, learning programming requires practice
- Next:
 - a recap of basic data structures and algorithms
 - Assignment 0

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 - a recap of basic data structures and algorithms
 - Assignment 0
- Time for your questions

Acknowledgments, credits, references

-  Goodrich, Michael T., Roberto Tamassia, and Michael H. Goldwasser (2013). *Data Structures and Algorithms in Python*. John Wiley & Sons, Incorporated. ISBN: 9781118476734.
-  Jurafsky, Daniel and James H. Martin (2009). *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*. second edition. Pearson Prentice Hall. ISBN: 978-0-13-504196-3.