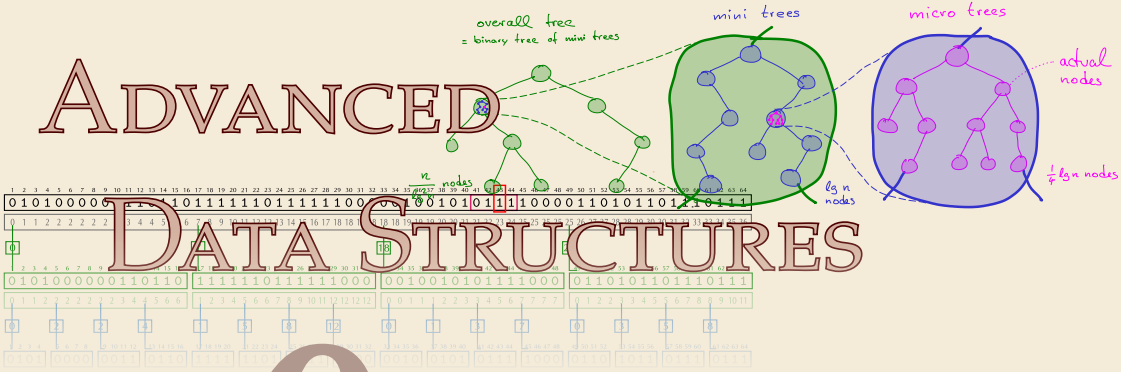

Advanced Data Structures

0 Administrativa

Advanced Data Structures · Summer 2026

Prof. Dr. Sebastian Wild

CS650 (Summer 2026)
Philipps-Universität Marburg
version 2026-04-12 21:43

Welcome to CS 650 – Advanced Data Structures

- Lectures: Prof. Dr. Sebastian Wild
  Mehrzweckgebäude, Raum 05 D 16
  wild@informatik.uni-marburg.de

Tutorials: Tamio Nakajima nakajima@informatik.uni-marburg.de

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- Module website: www.wild-inter.net/teaching/advds
  → your first address for module info

- *Campuswire:* collaborative Q&A (more on this later)
  also used for announcements
  → please register via link from the ILIAS announcement or:
  https://campuswire.com/p/GC35274D2 PIN 6013

- *Slido:* student response system for formative feedback → bring a smart device to class!

- Final mark: 100% final examination
  Admission to exam: 50% of points from exercise sheets

Goals for Today

- give you some detail on **what** this module covers
- ⇝ so that you can decide whether to keep it

if it is an elective module for you

Advanced Data Structures

- inform you about **how** AdvDS is run
- inform you about how AdvDS is **assessed**

Audience Response System: *Slido*

- Slido has 2 useful features:

1. Quick Polls

2. Audience Questions

- Goal: Collect immediate, formative feedback
  - Stay focused and engaged! ("active learning")
  - Quick feedback (for you individually) if you are on track.
  - Quick feedback (for me) whether (most of) you are on track.

Clicker Question

Which of the following online systems have you used before?
Select all that apply.

("used" means more than "tried it out once", but you need not be a professional user)

- **A** ILIAS
- **B** Slido
- **C** Campuswire
- **D** ChatGPT
- **E** Gemini
- **F** Claude
- **G** GitHub Copilot
- **H** Some other LLM-based chat assistant
- **I** None of these

→ *sli.do/cs650*

Overview of the module

Goals:

1. Learn about clever data structure designs
2. Apply design and analysis techniques to new data structuring problems
3. Become equipped to do academic research in data structures

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Units: (preliminary plan) ⇝ `www.wild-inter.net/teaching/advds/#units`

0. **Administrativa**
1. Randomized Trees
2. Adaptive Trees
3. Efficient Priority Queues
4. Persistence
5. Integer Data Structures
6. Bitvectors
7. Succinct Data Structures
8. Beyond Succinct
9. External Memory
10. Cache oblivious
11. Modern hashing

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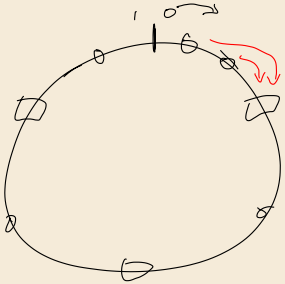
Note: *We'll focus on theoretically/asymptotically optimal results (with occasional remarks on implementation concerns).*

Clever Data Structures Save the Day

In data structures, the leap from theory to practice can be short and swift.

Startups founded on a data structure

- *Akamai* CDN
  founded around Consistent Hashing for distributed load balancing



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- Genome-Wide Read Mapping
  based on FM-index and other compressed text indexes

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Many more examples out there . . . maybe you will add one, too!

Assessments

- **Module mark** = mark in final exam
- **Final exam**
  - written or oral examination
- **Exam Material:** everything covered in lectures (except marked "$\notin$ exam")
  everything covered in **tutorials** and exercise sheets
- **Admission requirements to final exam**
  - ≤ 2 exercise sheets with 0 points in your group
    (not handing in implies 0 points)
  - $\geq 50\,\%$ of available points in sum over all exercise sheets

stay tuned . . .

Tutorials

- *Exercise Sheet* (Übungsblatt)
  - released on module website
  - to be **handed in**
    - handin on ILIAS
    - in **groups** of 2–4 students
  - practice problems
  - enhancement problems
- in *tutorials*
  - discussion of selected solutions

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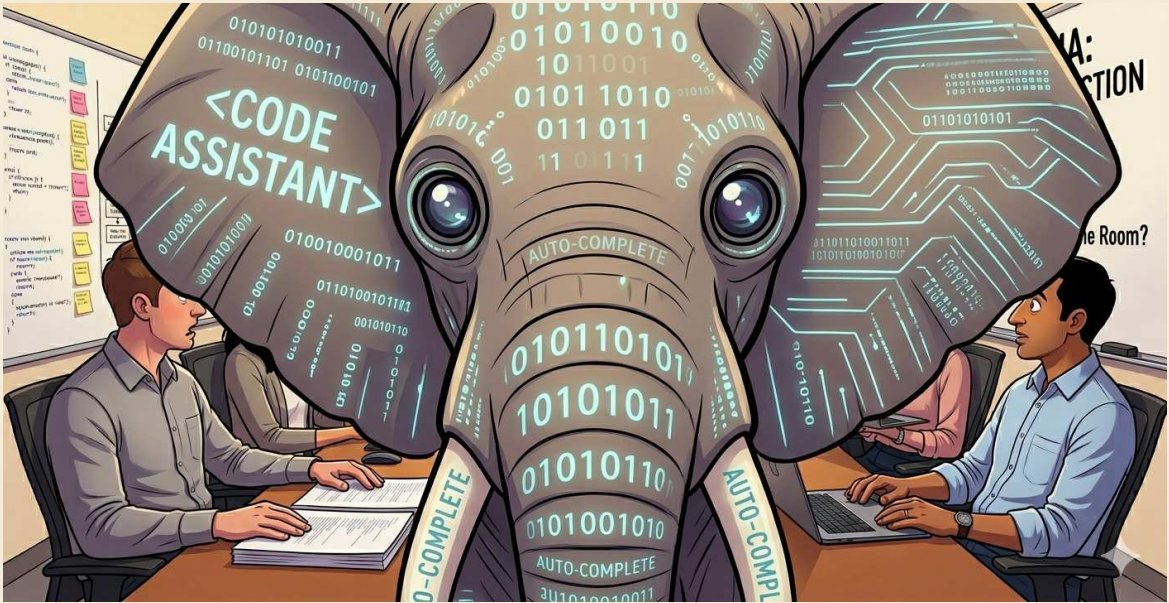
  - discussion of selected solutions
- **Marking**
  - Mainly for your feedback
  - Serious attempts will yield partial credit even if unsuccessful

*Use the tutorials to **practice** your thinking!* = Don't cheat yourself!

The Elephant in the Room



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We live in exciting times!

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  - Can do many things . . .
  - . . . some even well 😉
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Acceptable use:

- preparatory research (≈ Wikipedia)
- proof reading (spelling, grammar)

Unacceptable use: (not exhaustive!)

- use generated parts w/o acknowledgment & citation
- tools to paraphrase others' work to pass as own
- generated parts with inappropriate prompt, e. g., "write me a conclusion for this essay"

A ~~Disney~~ Pixar Vision

A Disney Vision

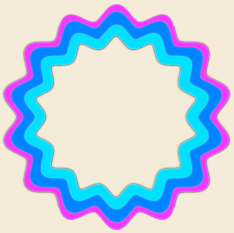
A Disney Vision

AI for Tutorials?

What is Campuswire?

Campuswire is an online space for lectures

1. ***Class Feed:*** questions on material
2. ***Chatrooms:*** structured social space
   similar to Slack or Discord



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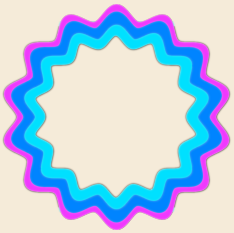

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We use Class Feed for **collaborative Q&A**

- Ask *public* questions
  - *"Why is* $\lg(n^3) = \Theta(\log n)$*?"*
  - *"Will there be classes on regional holiday X?"*
- ***Answer*** **your peers' questions!**
  - Know the answer? → put it in!
  - Know a partial answer? → Post it, others can build on it, instructors can endorse it!
  - Found a helpful answer (or question)? → Vote it up!
- Ask *private* questions
  - if your question might contain "spoilers" for assessments
  - if you feel the answer is only relevant for you personally

ILIAS

- Official announcements
- Hand-in of exercise sheets
- Announcement of marks

. . . what can be on the public module website goes to the public module website!

Exam Question Gallery

- We jointly collect a **pool of exemplary exam questions**.
  (just a shared Google Doc, link on module website)
- ***You** add **your** questions to it.*
- I will give feedback which questions are realistic.
- *. . . and we will pick one if there's sufficiently many good ones!*

⇝ great resource for exam preparation

⇝ We will answer selected questions in recap session (last week of classes)

- Engage in this early and pose great questions!