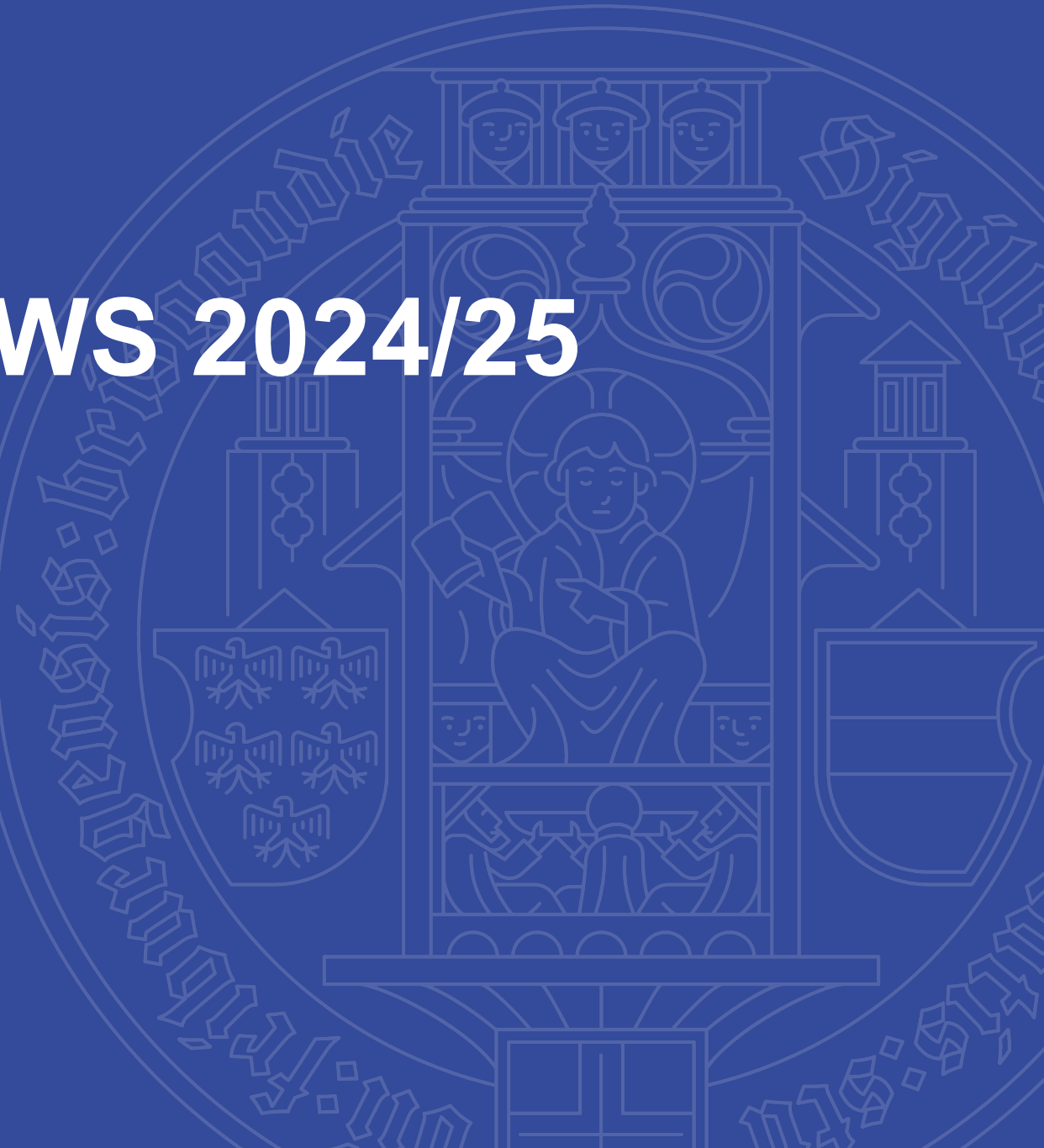


universität freiburg

# Algorithm Theory – WS 2024/25

Introduction

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Algorithms and Complexity



# About the Course

## Design and analysis techniques for algorithms

### *Tentative list of topics:*

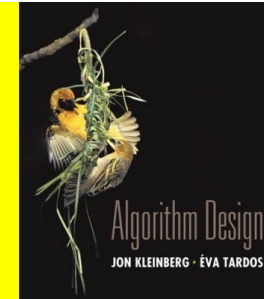
- divide and conquer
- greedy algorithms
- dynamic programming
- advanced data structures
- amortized analysis
- graph algorithms
- randomization
- approximation algorithms
- online algorithms
- parallel algorithms

# Requirements

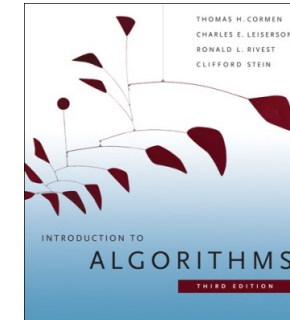
- We assume that you have basic algorithms and data structures knowledge as well as some mathematical maturity
  - E.g., from the BSc course *Algorithmen & Datenstrukturen* and basic math courses
- In particular, you should be (at least partly) familiar with
  - math. induction, basic combinatorics & (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

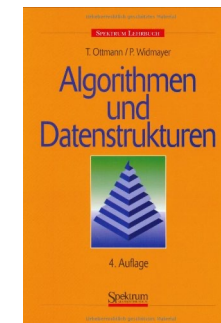
- J. Kleinberg, E. Tardos  
Algorithm Design  
Addison Wesley, 2005



- 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 Organization

## Lectures: Tuesdays 16:15 – 18:00 (101-00-026)

- The physical lectures will be recorded
  - *Note: We optimize the lectures for physical participation and not for online watching*

## Exercise Tutorials: Fridays 10:15 – 12:00 (101-00-026)

- We will have weekly exercises and exercise tutorials
  - The tutorials will be used to discuss the exercise sheets and whenever we have time also to discuss additional examples/exercises for which there is no time in the lectures
  - *Note: The exam will be based on the content of the lectures and the exercises.*

## Video Lectures

- We also have video lectures from an earlier version of this course
  - *Note: Content is mostly, but not exactly the same...*

**General Remark:** theory lecture (i.e., there will be math)

# Web Page

<http://ac.informatik.uni-freiburg.de>

→ Teaching → Winter Term 2024/25 → Algorithm Theory

- We will publish all important information there!
- Check the web page regularly!
- Lecture recordings, exercises, sample solutions, old lecture videos, ... will be available on the course web page

# Zulip for Discussions

- In addition to the web page, we use **Zulip** as an **online forum** for questions, online discussions, further information, etc.
  - Zulip is a group chat / forum (<https://zulip.com>).
  - Use Zulip to discuss questions regarding the lecture / exercises.
  - Also check Zulip for additional announcements.
- Information on how to sign up, see later slide...
- If you have a question about the lecture or the exercises, **use Zulip instead of writing an email!**
  - In this way, all of us and also your colleagues see the question and can answer/discuss it
  - We can directly answer a question for everybody
  - Of course feel free to also use Zulip to discuss anything else related to the topics and organization of the lecture

# Zulip Organization

## Zulip has a 2-Level Hierarchy

- 1<sup>st</sup> level: streams
  - They are predefined by us (see below)
- 2<sup>nd</sup> level: topics
  - Every message is assigned to a topic. Messages of the same topic can be grouped. Please use short, but meaningful topic names when creating new topics.

## Zulip Streams for Algorithm Theory:

- *AC-announcements*: [read-only](#), general info for all lectures
- *algtheory2024/exercises*: questions related to exercise sheets
- *algtheory2024/lecture*: questions related to the lectures



# Exercises

## General Information

- There will be (theoretical) exercises to practice the material
  - We will try to provide **sample solutions** (not always guaranteed)
- 1 exercise sheet per week
- You need to do the exercises alone or in groups of 2 or 3 students.
  - We encourage you to team up and do the excercises in groups
  - Each of you should hand in a solution, if you work in a group, please hand in the same solution!
  - When you hand in an exercise, clearly write on your solution with whom you worked on it. (We don't want to grade the same solution twice. 😊)
  - If you want to work in a group, but don't have a partner, you can try to find somebody through Zulip. We will try to set up something on Zulip that should simplify this.

**50% of all exercise points needed to pass the “Studienleistung”**

# Exercises Online Organization

## Daphne

- We use the Daphne system to
  - Electronically hand in exercises and give feedback on exercises
  - Manage your exercise points
- Information on how to sign up, see next slide...

## Exercise Schedule

- Exercise sheet will be published at the latest on Friday
- Exercises are due in the following week on Friday at 10:00
- Exercise tutorials: Fridays, 10:15 – 12:00 (101-00-026)

## Subversion (SVN)

- When signing up to Daphne, you get access to an SVN repository.
- You need to upload your solution to your repository
  - Up to the deadline, you can update your solution as often as you like

# Signing Up to Zulip & Daphne

- Links to sign up are available on the course website
  - You need to separately sign up for both systems!

## Zulip

- Sign-up link is on a separate page on the website
  - Only accessible from within the university network (e.g., by VPN)
- If you already signed up to our Zulip for another lecture:
  - In this case, the link does not work
  - Follow instructions given on AC-announcements stream on Zulip
    - Send private Zulip msg. to Marc Fuchs or Salwa Faour

## Daphne

- Sign-up link is on main course website
- Use your RZ account to sign up!

# Final Exam

- Final exam will take place after the semester
  - It will be a written 120 min exam.
  - As soon as we know the date, we will publish it on the web page
- You will be allowed to bring **6 A4 pages of handwritten notes** to the exam.
  - No other material will be allowed
  - 6 A4 pages  $\hat{=}$  6 singly-sided A4 sheets
  - You are also not allowed to use any electronic devices during the exam
    - incl. your phone, smartwatch, pocket calculator, laptop, etc.

# Cheating, Using LLMs, etc.

We recently had some issues with cheating in exams. We therefore want to emphasize that

**Cheating is not allowed in the exam and in the exercises.  
If you nevertheless do it, it will have consequences.**

Cheating includes

- Copying solutions from others
- Using resources that are not allowed
  - e.g., using electronic devices or any means of communication during the exam

Use of LLMs, other resources

- You can of course use such resources as a help when solving the exercises. You are of course also allowed to (and in fact encouraged to) talk about the exercises with colleagues
- You however have to formulate your solutions by yourself (or in your exercise group)