

Complexity Theory

VU 181.142, SS 2018

1. General Information

Reinhard Pichler

Institut für Informationssysteme
Arbeitsbereich DBAI
Technische Universität Wien

06 March, 2018



Classes

- **Language.** This lecture will probably be held in English.
- **Time.** Throughout the term: **Tuesdays, 11:00 – 13:00.**
- **Place.**
 - Classes will be held in the **Seminarraum 188/2** (Favoritenstraße 9-11, 4th floor).
 - The quiz at the beginning of the semester will be in the **main building, HS 11 Paul Ludwik.**

Outline

1. General Information

- 1.1 Classes
- 1.2 Prerequisites and Admission
- 1.3 Quiz
- 1.4 Communication
- 1.5 Course Overview
- 1.6 Assessment
- 1.7 ECTS Breakdown
- 1.8 Related Lectures

Prerequisites and Admission

- **Prerequisites.**
 - This course is designed for **master's students.**
 - It is highly recommended to attend this course **after** the course **Formale Methoden der Informatik (185.291).**
- **Knowledge and skills required.**
 - basic knowledge in mathematical logic
 - introduction to complexity theory
 - in particular, the central concept of **“problem reduction”**
- **Admission.**
 - primarily for **master's students!**
 - **positive assessment in a quiz is required**
 - each student has at most two attempts

Quiz

- **Goal.**
 - ensure that students have the required knowledge and skills
 - basic knowledge in mathematical logic and complexity theory;
 - in particular, the central concept of “**problem reduction**”.
- **Organization.**
 - **Student's card required!!**
 - **closed book** (no material allowed)
 - Being able to solve all questions of the exercise sheet of block 1 (complexity theory part) of the course “Formale Methoden der Informatik” clearly suffices for the quiz.
 - max. 10 credits; passed with ≥ 5 .
- **Time and place.**
 - Thursday, 8 March, 16:00 - 18:00: HS 11 Paul Ludwik
 - Thursday, 15 March, 16:00 - 18:00: HS 11 Paul Ludwik
 - 60 min actual working time

Course Overview

Further details on topics from “Formale Methoden”

- Logarithmic Space
- Boolean Logic, proof of the Cook-Levin Theorem
- More NP-Completeness

Further topics

- The polynomial hierarchy
- The class PSPACE
- Applications (Database Theory, Abduction, ...)
- Fixed-Parameter Tractability

Communication

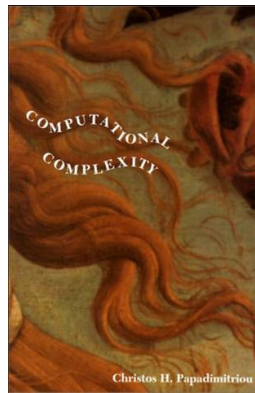
- (during, after) classes
- Course Homepage:
<http://www.dbai.tuwien.ac.at/staff/pichler/complexity>
- TISS: please check your mail address in TISS

References

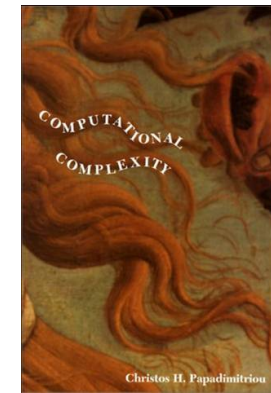
- Christos H. Papadimitriou:
Computational Complexity.
Addison Wesley, 1994.
- M. R. Garey, D. S. Johnson:
Computer and Intractability:
A Guide to NP-Completeness.
W. H. Freeman 1979.
- Further references (articles from journals, conferences, ...): see course homepage

References

- **Christos H. Papadimitriou: Computational Complexity.** Addison Wesley, 1994.
- M. R. Garey, D. S. Johnson: Computer and Intractability: A Guide to NP-Completeness. W. H. Freeman 1979.
- Further references (articles from journals, conferences, ...): see course homepage



References



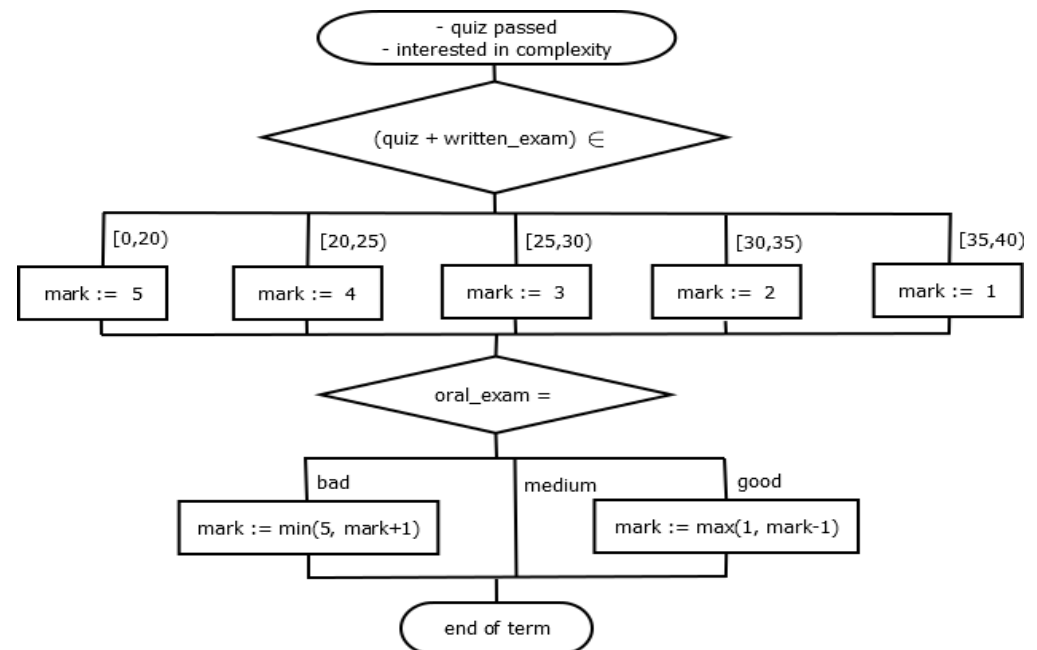
Assessment

Components

- Quiz: max. 10 credits
- Written Exam: max. 30 credits
- Oral Exam

Final Mark

- Quiz + written exam: $\text{mark} \in \{1, 2, 3, 4, 5\}$
- Mark after quiz + written exam (max. 40 credits): 1 [35, 40], 2 [30, 35), 3 [25, 30), 4 [20, 25)
- Oral exam: change mark by $\{-1, 0, +1\}$
- Assessment of oral exam: good, medium, bad



ECTS Breakdown

3 ECTS corresponds to 75h of work for “standard students” fulfilling the prerequisites (i.e., VU Formale Methoden der Informatik - 185.291).

| | |
|-------------------------------------|-------|
| quiz: | 2h |
| 12 classes (including preparation): | 30h |
| exam preparation: | 40h |
| exams: | 3h |
| ===== | ===== |
| in total: | 75h |

Some Related Lectures

- **Complexity Analysis**
184.215 – 2.0 VU – Komplexitätsanalyse
Thomas Eiter
- **Database Theory**
181.140 – 2.0 VU – Datenbanktheorie
Tuesdays, 9:00 - 11:00, Seminarraum 188/2
Reinhard Pichler