Complexity Theory
VU 181.142, WS 2019

1. General Information

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Outline

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Classes

- **Time and Place.** Regular classes:
  - Mondays, 11:00 - 13:00, Seminarraum FAV 01 B (Sem 187/2); no Monday classes in the first two weeks.
  - Tuesdays, 11:00 - 13:00, Seminarraum FAV EG C (Sem Gödel)
  - No classes on 28/29 October and 11/12 November
  - Quiz at the beginning of the semester: EI 5, Hochenegg HS.
  - Course ends before the Christmas holidays

- Please check the course homepage:
  https://www.dbai.tuwien.ac.at/staff/pichler/complexity

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 $\geq 5$.

**Time and place.**
- Thursday, 10 October, 09:00 - 11:00: EI 5, Hochenegg HS
- Thursday, 17 October, 09:00 - 11:00: EI 5, Hochenegg HS
- 60 min actual working time

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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 (Logic-based Abduction)
- Parameterized Complexity

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Communication

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

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References

- Further references (articles from journals, conferences, ...) see course homepage
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Assessment

Components

- Quiz
- Homework
- Exam

Final Mark

- Quiz and homework: 50%
- Written exam: 50%
  (in the week before the Christmas holidays)
- Requirements for positive assessment:
  - quiz + homework: 30 (out of 60)
  - exam: 30 (out of 60)
- Marks 1–4:
  1 [105, 120], 2 [90, 105], 3 [75, 90], 4 [60, 75]
Homework Assignments (cont’d)

- **good practice.**
  - discuss the problems with other students
  - team up to solve the problems
  - write down the solutions in your own words

- **bad practice.**
  - copy other students’ solutions
  - search for solutions on the web and copy them

**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
- 15 classes: 30h
- homework assignments (5×): 30h
- exam preparation: 13h

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in total: 75h

**Some Related Lectures**

- **Complexity Analysis**
  184.215 – 2.0 VU – Komplexitätsanalyse
  Thomas Eiter (in the summer semester)

- **Numerous courses by the Algorithms and Complexity Group**
  e.g., 186.855 Fixed-Parameter Algorithms and Complexity
  Robert Ganian

- **Database Theory**
  181.140 – 2.0 VU – Datenbanktheorie
  Mondays and Tuesdays, 9:00 - 11:00
  Reinhard Pichler