Complexity Theory
VU 181.142, SS 2016

1. General Information

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Outline

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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.**
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. 20 points; passed with $\geq 10$.

■ Time and place.
  • Thursday, 3 March 2016, 16:00 - 18:00: HS 11 Paul Ludwik
  • Thursday, 10 March 2016, 16:00 - 18:00: HS 11 Paul Ludwik
  • 60 min actual working time
Communication

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

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


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References
Assessment

Components

- Quiz
- Homework and Reading assignments
- Exam

Final Mark

- Quiz, Homework, and reading assignments: 50%
- Written exam: 50%
- Requirements for positive assessment:
  - quiz + homework + reading: 40 (out of 80)
  - exam: 40 (out of 80)
- Marks 1 – 4:
  1 [140, 160], 2 [120, 140], 3 [100, 120], 4 [80, 100]
Homework and Reading Assignments

- 5 Homework assignments: max. 10 credits each
- 2 Reading assignments: max. 5 credits each
- maximum in total: 60 credits
  (normally, no excuses are accepted if a student misses a homework or a reading assignment).
- Submission: per mail in electronic form
  (use of Latex is strongly encouraged)
- Submission deadline:
  - will be unambiguously stated on the problem sheet and/or on the course homepage (normally, 1–2 weeks are alloted for each homework and reading assignment)
  - late submission: -2 credits per day of delay
Homework and Reading 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).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
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<tbody>
<tr>
<td>quiz</td>
<td>2h</td>
</tr>
<tr>
<td>12 classes (including preparation)</td>
<td>30h</td>
</tr>
<tr>
<td>reading assignments (2×)</td>
<td>8h</td>
</tr>
<tr>
<td>homework assignments (5×)</td>
<td>20h</td>
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<tr>
<td>exam preparation</td>
<td>15h</td>
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<tr>
<td>--------------------------------</td>
<td>-------</td>
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<tr>
<td>in total</td>
<td>75h</td>
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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
Acknowledgements

- **Prof. Dr. Georg Gottlob** (Oxford, Vienna).
  - for the “Complexity Theory” lecture in SS 1997
  - for ongoing discussions ever since

- **Prof. Dr. Ilkka Niemelä** (Helsinki).
  - for the Latex sources of the slides of his lecture at the Helsinki University of Technology