

SS 2013

Komplexitätstheorie

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<http://www14.in.tum.de/lehre/2013SS/kt/>

Sommersemester 2013

Chapter 0 Organizational Matters

- Lectures:
 - 4SWS Tue 08:25–09:55 (MI HS2)
Fri 08:25–09:55 (MI 00.13.009A)
Compulsory elective in areas Algorithms and Scientific Computing, Informatics, Bioinformatics
Module no. IN2007
- Exercises/Tutorial:
 - 2SWS Central exercise: Thu 12:15–13:45 (03.11.018)
 - Tutor: Chris Pinkau
- Valuation:
 - 4V+2ZÜ, 8 ECTS Points
- Office hours:
 - Fri 11:00–12:00 and by appointment

- Tutorials:
 - Chris Pinkau, MI 03.09.057 (pinkau@in.tum.de)
Office hours: Tue 13:00–14:00
- Secretariat:
 - Mrs. Lissner, MI 03.09.052 (lissner@in.tum.de)

- Problem sets and final exam:
 - problem sets are made available on Tuesdays in class and/or on the course webpage
 - must be turned in a week later before class
 - are discussed in the tutorial
- Exam:
 - written exam, date: August 1, 2013, 11:30–14:00, room **Interims Hörsaal 101**
 - the final exam is closed book, no auxiliary means are permitted except for one sheet of DIN-A4 paper, handwritten by yourself
 - probably 12 problem sets




- Prerequisites:
 - Grundlagen: Algorithmen und Datenstrukturen (GAD)
 - Diskrete Wahrscheinlichkeitstheorie (DWT)
 - Effiziente Algorithmen und Datenstrukturen
 - Randomisierte Algorithmen
- Supplementary courses:
 - Approximationsalgorithmen
 - Internetalgorithmik
 - Quantenalgorithmen
 - ...
- Webpage:

<http://www.mayr.in.tum.de/lehre/2013SS/kt/>


1. Planned topics for the course

- 1 The computational model
- 2 \mathcal{NP} and \mathcal{NP} -completeness
- 3 Diagonalization
- 4 Space complexity
- 5 The polynomial hierarchy and alternation
- 6 Boolean circuits
- 7 (Randomized computation)
- 8 Interactive proofs
- 9 Cryptography
- 10 ...

2. Literature

-  Sanjeev Arora, Boaz Barak:
Computational Complexity — A Modern Approach,
Cambridge University Press: Cambridge-New York-Melbourne, 2009
-  Giorgio Ausiello, Pierluigi Crescenzi, Giorgio Gambosi, Viggo Kann, Alberto Marchetti-Spaccamela, Marco Protasi:
Complexity and approximation — Combinatorial optimization problems and their approximability properties,
Springer-Verlag: Berlin-Heidelberg, 1999
-  José L. Balcázar, Josep Díaz, Joaquim Gabarró:
Structural Complexity I (and II),
EATCS Monographs on Theoretical Computer Science, Springer-Verlag:
Berlin-Heidelberg, 1995

-  **Christos H. Papadimitriou:**
Computational Complexity,
Addison-Wesley Publishing Company: London-Amsterdam-New York, 1994
-  **Christos H. Papadimitriou, Kenneth Steiglitz:**
Combinatorial optimization: Algorithms and complexity,
Prentice-Hall, Englewood Cliffs, NJ, 1982
-  **Karl Rüdiger Reischuk:**
Komplexitätstheorie — Band I: Grundlagen,
B.G. Teubner: Stuttgart-Leipzig, 1999
-  **Michael Sipser:**
Introduction to the Theory of Computation,
International Edition, Thomson Course Technology:
Australia-Canada-Mexico-Singapore-Spain-United Kingdom-United States, 2006

 Ingo Wegener:
The coomplexity of Boolean functions,
Wiley-Teubner Series in Computer Science: Stuttgart-Chichester-New York, 1987,
http://eccc.hpi-web.de/static/books/The_Complexity_of_Boolean_Functions/

Further relevant research papers will be made available during the course.

3. Notational conventions

We use standard notation and basic concepts, as detailed e.g., in the introductory course on

Discrete Structures, IN0015

<http://wwwmayr.in.tum.de/lehre/2012WS/ds/index.html.en>

Chapter I The Computational Model

1. Some basic concepts

See



Sanjeev Arora, Boaz Barak:

Computational Complexity — A Modern Approach,

p. 9–12, Cambridge University Press: Cambridge-New York-Melbourne, 2009