

SS 2014

Komplexitätstheorie

Ernst W. Mayr

Fakultät für Informatik
TU München

<http://www14.in.tum.de/lehre/2014SS/kt/>

Sommersemester 2014

Chapter 0 Organizational Matters

- Lectures:
 - 4SWS Mon 08:15–10:00 (MI 00.13.009A)
Thu 10:15–12:00 (MI HS3)
Compulsory elective in areas Algorithms and Scientific Computing, Informatics, Bioinformatics
Module No. IN2007
- Exercises/Tutorial:
 - 2SWS Central exercise: Thu 12:30–14:00 (03.11.018)
 - Tutor: Chris Pinkau
- Valuation:
 - 4V+2ZÜ, 8 ECTS Points
- Office hours:
 - Thu 13:00–14:00 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 Mondays on the course webpage
 - must be turned in a week later before class
 - are discussed in the tutorial
- Exam:
 - final exam: Monday, July 21, 2014, 14:30–17:00, room **MI HS2**
 - the final exam is closed book, no auxiliary means are permitted except for one sheet of DIN-A4 paper, handwritten by yourself
 - to pass the final exam, it is necessary to obtain at least **40%** of the point total
 - probably 10 problem sets




- Prerequisites:
 - Fundamentals of Algorithms and Data Structures (GAD)
 - Discrete Probability Theory (DWT)
 - Efficient Algorithms and Data Structures (EA)
 - Randomized Algorithms
- Supplementary courses:
 - Approximation Algorithms
 - Internet Algorithmics
 - Quantum Algorithms
 - ...
- Webpage:

<http://wwwmayr.in.tum.de/lehre/2014SS/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 complexity 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