

# Complexity Theory

VU 181.142, WS 2019

## 1. General Information

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08 October, 2019



# Outline

## 1. General Information

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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

# 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 (Logic-based Abduction)
- Parameterized Complexity

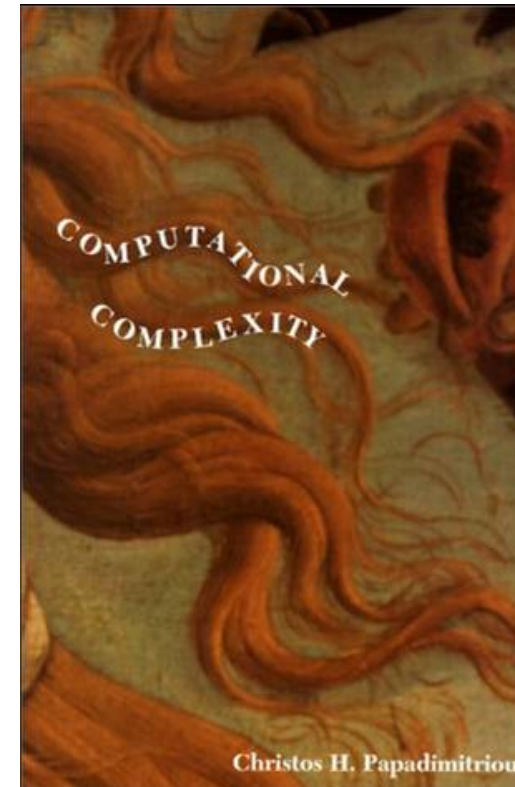
# References

- 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

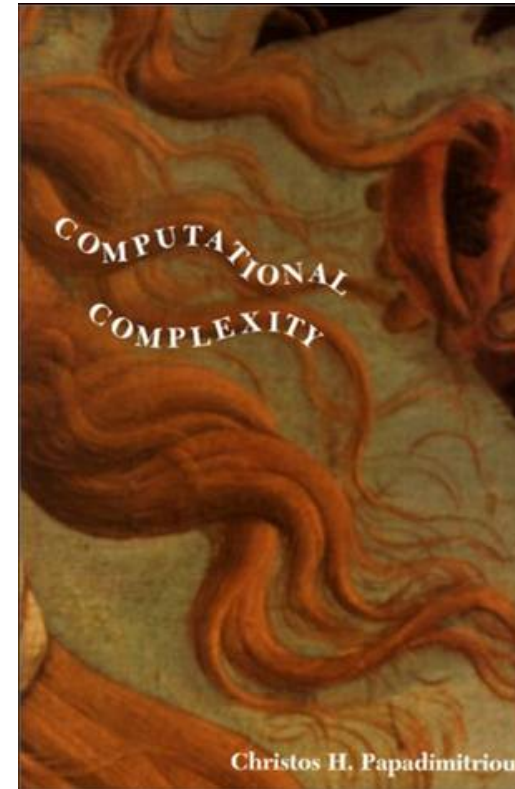
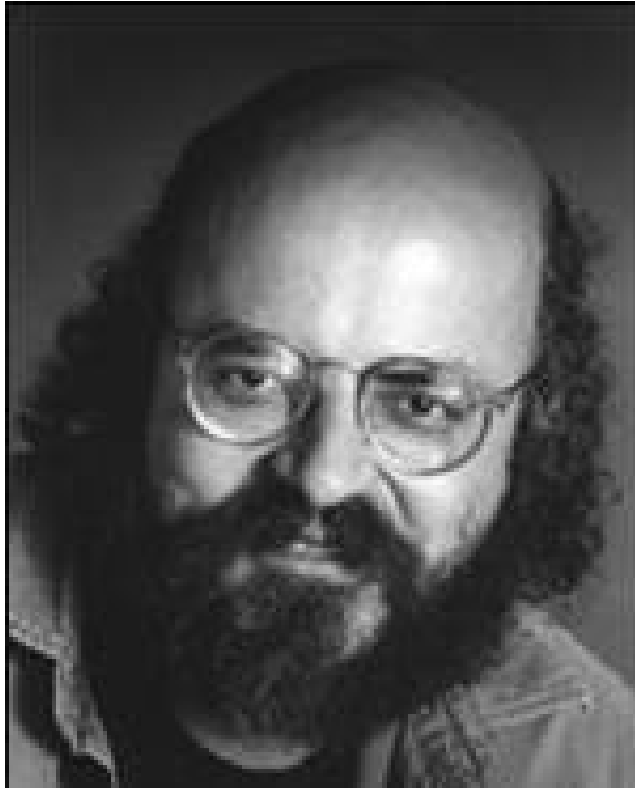


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# References



# 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

- 5 Homework assignments: max. 10 credits each
- maximum in total: **50** credits  
(normally, no excuses are accepted if a student misses a homework).
- 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 week is allotted for each homework)
  - late submission: -2 credits per day of delay

## 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
=====	
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