inf451 - Complexity Theory

Module label Complexity Theory
Module code inf451
Credit points 6.0 KP
Workload 180 h
Used in course of study Master's Programme Computing Science > Theoretische Informatik
Contact person

Module responsibility
- Eike Best
- Die im Modul Lehrenden

Authorized examiners
- Eike Best
- Die im Modul Lehrenden

Entry requirements

Skills to be acquired in this module
This module covers the computational complexity of algorithms. Complexity considerations are concerned with the time, the memory, and the parallelism required or allowed, for solving an algorithmic problem. In particular, one is interested in lower and/or upper time and space bounds, and in approximative investigations providing information about entire classes of algorithms. For any concrete problem, complexity theory aims at being able to find out which class it belongs to, and thus estimating the cost of the most efficient methods of solving it. Methods taught in this module are general, not depending on any particular algorithmic model or chosen programming language.

Professional competence
The students:

- use Turing machines and variants thereof
- define time, memory, and processor requirements of algorithmic problems
- specify the most relevant complexity classes
- estimate the computational complexity of the most important problems

Methodological competence
The students:

- analyse the complexity of algorithms
- apply techniques of simulation, reduction, and diagonalisation
- compare new problems in terms of complexity

Social competence
The students:

- present proof sketches, proofs, and algorithmic solutions in front of an audience

Module contents

- Mathematical foundations
- Turing machines and register machines
- Space and time hierarchies, equivalence and hierarchy theorems
- Complexity classes: P, NP, NPC, PSPACE, and others
- Alternating automata and polynomial time hierarchy
- Circuit complexity

Reader's advisory

- Eike Best: Skript zur Vorlesung (2015)

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| Lern-/Lehrform / Type of program | Je nach Studiengang Pflicht oder Wahlpflicht |

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Total time of attendance for the module: 56 h