

CAS 705
COMPUTABILITY AND COMPLEXITY

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Lectures: Thursday, 9:30 – 12:30, in ITB 222

Course Outline (Tentative):

Languages and Machines: sets of sequences/languages (finite/infinite sequences, closure properties, Nerode equivalence, regular languages, automata, transition systems), defining sets by expressions and equations (regular expressions, fix-point theory), machines, computational models and structures (Turing machines, RAM, PRAM, non-standard automata, etc.).

Rewriting Systems: Grammars, Post systems, Chomsky hierarchy.

Computability: Functions and sets, Primitive recursive functions and sets, recursive functions and sets, recursively enumerable sets, what does computable and decidable mean (Halting problem), limitation of formal systems (Gödel's theorem), Church thesis.

Complexity: definition, independence from a computing platform, time/space hierarchy, P vs NP, NP-completeness, reduction problem.

Text: none

Reference Books:

1. D.C. Kozen, Automata and Computability, Springer 1997.
2. J.E. Hopcroft, R. Motwani, J.D. Ullman, *Introduction to Automata Theory, Languages and Computation*, Addison-Wesley, 2001.
3. M. Sipser, Introduction to the Theory of Computation, 3rd Edition, Cengage Learning, 2012.

Lecture Notes: They will be available on the website, usually before an appropriate class.

Evaluation: 4, rather heavy and labour consuming, assignments.

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Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

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1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
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3. Copying and using unauthorized aids in tests and examinations.