Course Specifications

Valid as from the academic year 2016-2017

Automata Theory (E016020)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0	**Study time 180 h**	**Contact hrs**	60.0 h

Course offerings and teaching methods in academic year 2017-2018

A (semester 2)	seminar	30.0 h
	lecture	30.0 h

Lecturers in academic year 2017-2018

Wittevrongel, Sabine	TW07	lecturer-in-charge

Offered in the following programmes in 2017-2018	crdts	offering
Bachelor of Science in Computer Science Engineering	6	A
Bachelor of Science in Electrical Engineering	6	A

Teaching languages

Dutch

Keywords

Abstract computing structures, finite-state machines, Turing machines, computability, formal languages, grammars, pushdown automata, Petri nets

Position of the course

The course aims at providing insight into the fundamental properties and limitations of various abstract computing structures (such as finite-state machines and Turing machines), various classes of formal languages (such as finite-state, regular, context-free and context-sensitive languages) and models for parallelism (Petri nets), as well as giving basic notions of computability. The course gives a mathematical, theoretical basis for other courses, such as Programming languages and Compilers, although these subjects are not explicitly dealt with during the lectures.

Contents

- Mathematical introduction: Peano's axioms, Proof and definition by induction, Sets and functions, Concepts from graph theory, Equivalence relations, Cardinality of a set
- Finite-state machines: Mealy and Moore machines and their equivalence, Behavior functions, Limitations of finite-state machines w.r.t. the realization of behavior functions, State reduction, Free realization and minimal realization of a behavior function, Nerode equivalence, Composition of state machines
- Turing machines: Definition, Quintuple description, Instantaneous description, Operations on strings and numerical calculations with Turing machines, Modified forms of Turing machines
- Computability: Recursive functions and computability, Church's thesis, Decision problems, Undecidability and the halting problem
- Formal languages: Context-free grammars and languages, Normal forms, Pushdown automata, Ambiguous grammars, Context-sensitive and phrase-structure languages, Chomsky language hierarchy, Finite-state machines and finite-state languages, Nondeterministic state machines, Regular grammars and languages, Theorem of Kleene, Pumping lemma, Operations on languages
- Petri nets: Definition, Petri net graph, Marking, Actions, Modelling with Petri nets, Properties, Analysis techniques

Initial competences

Successfully have followed the course 'Discrete mathematics I' or have obtained the ending objectives of this course by other means

Final competences

1. To understand and to apply properties of finite-state machines and Turing machines w.r.t. the realization of behavior functions and computability.
2. To creatively design state machines, Turing machines and pushdown automata with a given behavior.
3. To understand and to apply methods to specify the syntax of formal languages.
4. To understand and to apply properties of formal languages such as the theorem of Kleene, the pumping lemma and the result of operations on formal languages.
5. To understand, to develop and to analyse Petri net models.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, seminar

Learning materials and price

Dutch syllabus (about 10 euro); additional course material (available via Minerva)

References

Course content-related study coaching

By the lecturer and assistants: contacts are possible during or after the lectures and problem solving sessions, by means of email or after making an appointment

Evaluation methods

end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period

Open book examination

Examination methods in case of periodic evaluation during the second examination period

Open book examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

Written open-book exam (only syllabus)

Calculation of the examination mark