

Only the german version of the module description as part of the study regulations is legally binding.

Module name	Complexity Theory
Module number	INF-25-Ma-FTK-CT
Responsible lecturer	Prof. Dr. Markus Krötzsch markus.kroetzsch@tu-dresden.de
Qualification objectives	Students have in-depth knowledge of complexity theory. They are familiar with important complexity classes and the relationships between them. They have detailed knowledge of diverse calculation models and can derive corresponding language classes from them. They also have an in-depth understanding of relevant proof and analysis methods. Furthermore, they have an in-depth understanding of relevant proof and analysis methods.
Content	Contents of the module are Turing machines, oracles and computability, basic complexity classes such as L, NL, P, NP, PSpace, Exp and NExp as well as their complements and relations, the theorem by Savitch, the theorem by Immermann and Szelepcsényi, hierarchy theorems, the gap theorem, the theorem by Ladner as well as the theorem by Baker, Gill and Solovay, alternation and the polynomial hierarchy, circuit complexity with P/poly, NC and AC0, probabilistic complexity with PP and BPP, Adleman's theorem and the theorem of Sipser, Gács and Lautemann, quantum complexity, interactive proof systems such as IP, AM and MA as well as parameterized complexity.
Teaching and learning methods	The module comprises lectures of 4 SWS, exercises of 2 SWS and the self-study. The language of instruction for the lectures and exercises is English.
Prerequisites for participation	The Diploma degree course in Computer Science requires the skills acquired in the modules INF-25-Ba-AuD Algorithms and Data Structures, INF-25-Ba-AuB Automata and Computability Theory, INF-25-Ba-LuK Logic and Complexity, INF-25-Ba-Ma1 Linear Algebra and Analysis, INF-25-Ba-Ma2 Discrete Structures, INF-25-Ba-Ma3 Algebra and INF-25-Ba-Ma4 Probability Theory and Statistics. The Master's degree course in Computer Science requires knowledge of the fundamentals of algorithm design, formal languages, theoretical computer science and propositional and predicate logic as well as knowledge of mathematics at Bachelor's level
Applicability	The module is a compulsory elective module in the Diploma program in Computer Science in the main course in the subject area Theoretical Computer Science and Symbolic Artificial Intelligence, which must be selected in accordance with Annex 2 to the examination regulations. In the Master's degree program in Computer Science, the module is a compulsory elective module in the open track in the subject area of Theoretical Computer Science and Symbolic Artificial Intelligence as well as the supplement, which must be selected in accordance with Annex 2 to the Examination Regulations. The module can only be chosen once in the Master's degree course in Computer Science. The module cannot be

	selected in the Master's degree program in Computer Science if the student has already completed a module with essentially the same content from a degree program with which the admission requirements according to § 3 of the study regulations were fulfilled or has already been completed. The module creates the prerequisites for the modules listed under prerequisites for participation.
Requirements for earning credit points	The credit points are earned if the module examination is passed. The module examination consists of a non-public oral examination as an individual examination lasting 25 minutes. The examination language may be German or English and will be specified by the lecturer at the beginning of each semester and announced in the usual manner.
Credit points and grades	9 credit points can be earned through the module. The module grade corresponds to the grade of the examination.
Module frequency	The module is offered every winter semester.
Workload	The total workload is 270 hours.
Module duration	The module comprises one semester.