

Module title		Abbreviation
Algorithms, AI and Data Science 1		10-I-AKIDS1-222-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
<p>Introduction to algorithms and algorithmic thinking, introduction to artificial intelligence and data science; basics of algorithms (building blocks, determinism, functional vs. imperative paradigm); Core data structures (lists, sets, stack, queue, heap), together with basics of programming (in Python); Algorithmic complexity: time and memory complexity, growth of functions, asymptotic notation and "Big-O"; Sorting (bubble, insert, heap, merge and quick sort) and algorithms of order statistics; Advanced data structures with associated algorithms: Hash tables (and hash functions), trees (binary search trees, red-black trees) and graphs (connected components, shortest path, minimum spanning tree); algorithm design and recursion; dynamic programming; state space search: Uninformed (depth/width first search), heuristic (A* algorithm), adversarial (MiniMax, alpha-beta pruning) and metaheuristic search (genetic algorithm, ant colony optimization); Function optimization (convex vs. non-convex optimization, numerical optimization, numerical optimization with gradient descent) and constrained optimization algorithms (linear and quadratic programming, branch-and-bound algorithm); learning from data: light introduction to machine learning (parametric and non-parametric classification models, clustering).</p>		
Intended learning outcomes		
<p>Students will acquire fundamental knowledge of algorithms and data structures used throughout computer science, with a particular focus on the fundamentals of artificial intelligence algorithms and data science (e.g. state space search or optimization). They will acquire both theoretical and practical knowledge (as they will have to implement most of the algorithms covered). They will be able to analyze practical problems from an algorithmic perspective, identify the nature of the problem and choose an optimal algorithmic approach to solve the problem. In this course, students will acquire basic algorithmic knowledge, which they will extend and develop in the further course of their studies.</p>		
Courses (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
Method of assessment (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)		
<p>written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). creditable for bonus</p>		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in

Bachelor' degree (1 major) Mathematical Data Science (2022)
Bachelor' degree (1 major) Artificial Intelligence and Data Science (2022)
Bachelor' degree (1 major) Artificial Intelligence and Data Science (2023)
Bachelor' degree (1 major) Artificial Intelligence and Data Science (2024)