
Modulbezeichnung: Algorithms, programming, and data representation (AlgProgDat) 10 ECTS
 (Algorithms, programming, and data representation)

Modulverantwortliche/r: Bernhard Kainz

Lehrende: Mischa Dombrowski, Johanna Müller, Bernhard Kainz

Startsemester: WS 2022/2023

Dauer: 1 Semester

Turnus: jährlich (WS)

Präsenzzeit: 120 Std.

Eigenstudium: 180 Std.

Sprache: Englisch

Lehrveranstaltungen:

Algorithms, programming, and data representation (WS 2022/2023, Vorlesung, 4 SWS, Bernhard Kainz)

Algorithms, programming, and data representation; Exercise (WS 2022/2023, Übung, 2 SWS, Johanna Müller et al.)

Algorithms, programming, and data representation; Tutorial (WS 2022/2023, Übung, 2 SWS, Mischa Dombrowski et al.)

Inhalt:

The lecture Algorithms, programming, and data representation is aimed at students with tech and math background and is one of the basic lectures in the field of computer science. In addition to an introduction to fundamental algorithms, (object-oriented) programming in Python, various data structures such as linked lists, trees and graphs are covered. Algorithms include recursion, sorting methods and graph algorithms, as well as O notation of algorithms.

Lernziele und Kompetenzen:

Topics:

- Programming and computing basics
- Data structures
- Object orientation
- Python basic knowledge
- Computational Complexity
- Basic algorithms

Students will solve object-oriented programming tasks in the Python programming language illustrate program structures with the help of a subset of the Unified Modelling Language compare the efforts of different algorithms in terms of runtime and memory requirements implement basic combinatorial algorithms, especially search and sort algorithms, binary trees and basic graph algorithms understand and use recursion as a link between mathematical problem descriptions and programming implementation translate recursive problem descriptions into iterative ones plan and process programming tasks in such a way that they are completed on time.

Syllabus: (L - lecture, C - coursework, T - tutorial)

L01 Motivation and Logistics L02 Introduction: What does a Computer do

C01 Explore local Anaconda and Google Colab

L03 Data Representation and Boolean Algebra

L04 Floating Point numbers

T01 Organization and Boolean Algebra

C02 Number Representations and Boolean Algebra in Python

L05 Memory Organisation

L06 Branching and Iterations

T02 Number Representations and Boolean Algebra

C03 Branching and Iterations

L07 Decomposition, Abstraction, and Functions, Tuples, Lists, etc.

L08 Recursion and Dictionaries

T03 Memory Organisation

C04 Recursion and Dictionaries

L09 Testing, Debugging, Exceptions, and Assertions
 L10 Object Oriented Programming
 T04 Decomposition, Abstraction, and Functions
 C05 Testing, Debugging, Exceptions, and Assertions
 L11 Classes and Inheritance
 L12 Program efficiency I
 T05 Recursion
 C06 Classes and Inheritance
 L13 Program efficiency II
 L14 Searching and Sorting
 T06 Object Oriented Programming
 C07 Searching and Sorting
 L15 Version management and git
 L16 API and Libraries
 T07 Program efficiency
 C08 APIs and Libraries
 L18 Graphs and graph algorithms
 L19 Bellman-Ford
 T08 Searching and Sorting
 C09 Searching and Sorting
 L20 Dijkstra
 L21 Graphs and Trees
 T09 Graphs and Trees
 C10 Graphs and Trees
 L21 Dynamic Programming
 L22 Hashtables
 T10 Hashtables
 C11 Hashtables
 R01 Revision Q&A
 R02 Revision Q&A

Confidence and social competence:
 The students will

- organize themselves independently into groups and coordinate the organizational and technical process of group work in consultation with each other
- communicate and jointly develop solutions for theoretical questions and practical programming tasks within the framework of group tasks
- plan and apply targeted measures for mutual quality assurance of the submitted solutions (check each other's group submissions)
- are jointly responsible for the result of their group work, the evaluation of which applies equally to both group partners

Studien-/Prüfungsleistungen:

Algorithms, programming, and data representation (Prüfungsnummer: 219172)

(englische Bezeichnung: Algorithms, programming, and data representation)

elektronische Prüfung mit MultipleChoice, Dauer (in Minuten): 120

weitere Erläuterungen:

Students of medical engineering as of FPO 2018 take the exam for the lecture Algorithms, programming, and data representation as a separate exam module. The exercise performance is completed as a separate module.

Prüfungssprache: Englisch

Erstabelleung: WS 2022/2023, 1. Wdh.: SS 2023

1. Prüfer: Bernhard Kainz

