



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DIT181 Data Structures and Algorithms, 7.5 credits

Datastrukturer och Algoritmer, 7,5 högskolepoäng

First Cycle

Confirmation

This course syllabus was confirmed by Department of Computer Science and Engineering on 2017-01-05 and was last revised on 2020-11-06 to be valid from 2022-01-17, spring semester of 2022.

Field of education: Science 100%

Department: Department of Computer Science and Engineering

Position in the educational system

The course is a compulsory course in the N1SOF Software Engineering and Management Bachelor's Programme. The course is also a single subject course at the University of Gothenburg.

The course can be part of the following programmes: 1) Mathematical Sciences, Master's Programme (N2MAT), 2) Applied Data Science Master's Programme (N2ADS), 3) Bachelor's Programme in Mathematics (N1MAT), 4) Software Engineering and Management Bachelor's Programme (N1SOF) and 5) Software Engineering and Management, Bachelor's Programme (N1SEM)

Main field of studies

Software Engineering

Specialization

G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

Entry requirements

To be eligible for this course, students must have successfully completed 7.5 higher education credits in object oriented programming (for example DIT042 Object-Oriented Programming, 7.5 hec) and successfully completed 7.5 hec on basic mathematical concepts such as sets, functions, relations, graphs, logarithms and proof by induction (for example DIT022 Mathematical Foundations for Software Engineering, 7.5 hec).

Applicants must prove knowledge of English: English 6/English B or the equivalent level of an internationally recognized test, for example TOEFL, IELTS.

Learning outcomes

On successful completion of the course the student will be able to:

Knowledge and understanding

- explain basic abstract data types and data structures, including lists, queues, hash tables, trees, and graphs
- explain some of the algorithms used to manipulate and query these data structures in an efficient way, and explain why they are correct

Competence and skills

- apply basic abstract data types and data structures, and algorithms related to these
- implement and use abstract data types as interfaces, and data structures as classes, in an object-oriented programming language
- use a standard library of data structures and algorithms
- read, specify, and describe algorithms, at a higher level of abstraction than code

Judgement and approach

- analyse the efficiency of basic algorithms and data structures
- make informed choices between different data structures and algorithms for different applications

Course content

Data structures and algorithms are fundamental building blocks in almost all software products. Knowledge and skills in data abstraction, data structures, and algorithms are important in the construction, use, and maintenance of adaptable, reusable, correct, and efficient program components.

The course gives knowledge and skills in the construction and use of algorithms and data structures, an introduction to various techniques for the analysis of algorithms, and insights in the advantages of using data abstraction in program development.

The following topics are covered by the course:

- abstract data types
- common data structures such as arrays, linked lists, unbalanced and balanced trees, heaps, and hash tables

- how these can be used to implement abstract data types such as stacks, queues, priority queues, maps, sets, and graphs
- standard algorithms for these data structures, including their resource demands
- searching and sorting algorithms
- standard libraries for data structures and algorithms
- asymptotic efficiency and simple complexity analysis of data structures and algorithms

Sub-courses

1. **Written hall examination** (*Skriftlig salstentamen*), 4.5 credits
Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)
2. **Assignments** (*Inlämningsuppgifter*), 3 credits
Grading scale: Pass (G) and Fail (U)

Form of teaching

The teaching consists of lectures, group work, exercises, as well as supervision in connection to the exercises.

Language of instruction: English

Assessment

The course is examined by an individual written exam carried out in an examination hall, and assignments normally carried out in smaller groups.

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

In cases where a course has been discontinued or has undergone major changes, the student shall normally be guaranteed at least three examination occasions (including the ordinary examination) during a period of at least one year from the last time the course was given.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U). A Pass grade (G) for the entire course requires at least a Pass grade for all sub-courses. To be awarded Pass with Distinction (VG) for a full course, the student must, in addition, receive a VG on the sub-course written exam.

Course evaluation

The course is evaluated through a meeting after the course between teachers and student representatives. Further, an anonymous questionnaire is used to ensure written information. The outcome of the evaluations serves to improve the course by indicating which parts could be added, improved, changed or removed.

Additional information

Course literature to be announced 8 weeks prior to the start of the course.