Algorithms and Complexity, 7,5 HE credits
Algoritmer och komplexitet, 7,5 hp

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Established: 2024-02-15
Established by: Department of Engineering Science
Applies from: H24

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Learning outcomes
After completing the course, the student should be able to:
Knowledge and understanding
- identify the complex data structures needed in order to implement efficient algorithms.
- describe algorithms and their properties so that others can understand how they work and are able to implement them.
- prove the correctness and analyze the efficiency of an algorithm.
- define and explain central concepts such as P, NP, NP-completeness and undecidability.
- compare problems with respect to complexity using reductions.

Competence and skills

- develop and implement algorithms by applying standard algorithm design techniques, such as greedy algorithms, dynamic programming, divide-and-conquer.
- design algorithms to solve specific problems.
- perform simple reductions between problems.

Judgement and approach

- critically assess proposed algorithms, with respect to correctness and efficiency, and recognize common pitfalls.

Entry requirements
Bachelor of Science in Computer Science, Computer Engineering, or Software Engineering. Additionally, the Bachelor of Science degree must include 15 HE credits in programming, 15 HE credits in mathematics, and one course in algorithms and data structures. Verified knowledge of English corresponding to the course English B/English 6 in the Swedish Upper Secondary School (high school) or equivalent.

The forms of assessment of student performance
Individual hand-in assignment. Individual quiz. Individual oral exam.

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Course contents
The overall goal of the course is to provide the students with tools to help them develop efficient algorithms for new problems. The first step is to formulate and analyze the computational problem. The next step is to select and modify data structures and techniques in order to formulate an algorithm. Once the algorithm is analyzed for correctness and efficiency, it can be implemented.

The course deals with the concepts complexity on a deeper level than previous courses, with respect to time as well as space. It presents techniques to evaluate the complexities for a given algorithm. The students learn about asymptotic functions and the complexity classes P, NP and NP-complete.

The choice of appropriate data structures is essential for the design of efficient algorithms. The course introduces complex data structures, such as heaps and graphs, as well as operations on them.

A few standard design techniques, including greedy algorithms, dynamic programming and divide-and-conquer, are presented.

Other regulations
Course grading: F/Fx/E/D/C/B/A - Insufficient, Insufficient- more work required before the credit can be awarded, Sufficient, Satisfactory, Good, Very Good, Excellent
Course language: The teaching is conducted in English.

General rules pertaining to examination at University West are available at www.hv.se.

If the student has a decision/recommendation on special support due to disability, the examiner has the right to examine the student in a customized examination form.

Cycle
Second cycle

Progressive specialization
A1N - second cycle, has only first-cycle course/s as entry requirements

Main field of study
Computer Engineering

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