DD232V Algorithms and Complexity 7.5 credits

Algoritmer och komplexitet

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

The official course syllabus is valid from spring semester 2028 as decided by the Director of First and Second Cycle Education. Decision date: 2026-10-19.

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Computer Science and Engineering

Specific prerequisites

- Knowledge of algorithms and data structures, 6 credits, equivalent to completed course DD1320.
- Knowledge and skills in programming equivalent to completed course DD100N/DD100V.
- Knowledge of linear algebra, 7.5 credits, equivalent to completed course SF1624.
- Knowledge of one-variable analysis, 7.5 credits, equivalent to completed course SF1625.
- Knowledge of discrete mathematics, 7.5 credits, equivalent to completed course SF1698/SF1698.

- Skills in English equivalent to the upper secondary school course English B/English 6.

Intended learning outcomes

After passing the course, the student should be able to

- define and explain central concepts such as P, NP, NP-completeness and undecidability
- compare alternative algorithms considering efficiency
- compare problems with respect to complexity by means of reductions
- develop and implement algorithms and reductions, and analyse them with respect to correctness and efficiency

in order to

- independently be able to design computer programs that use time and memory efficiently and thereby can contribute to economically and environmentally sustainable development
- in professional life identify problems that are unrealistically resource demanding or not possible to solve on a computer.

Course contents

Design principles of algorithms: Divide and conquer, greedy algorithms, dynamic programming. Algorithm analysis. Probabilistic algorithms. Approximation algorithms. Selected applications in sets, graphs, arithmetic and geometry. Implementation of algorithms.

Computability and complexity: Reductions. The complexity classes P (polynomial time), NP (non-deterministic polynomial time), PSPACE (polynomial space) and BPP (probabilistic polynomial time with bounded error). NP completeness and NP hardness reductions. Undecidable problems.

Examination

- MAS1 - Mastery Test, 1.5 credits, grading scale: A, B, C, D, E, FX, F
- MAS2 - Mastery Test, 1.5 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 1.5 credits, grading scale: P, F
- EXA1 - Theory Exam, 3.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability. The examiner may apply another examination format when re-examining individual students. If the course is discontinued, students may request to be examined during the following two academic years.

Labs and mastery tests are examined both orally and in writing. The exam is an oral exam.

Transitional regulations

Students admitted to the course under a previous syllabus that included a written examination (TEN1/TEN2) may take the oral theory examination (EXA1) as a replacement, but have the option to choose the written exam instead up to and including the spring semester of 2028.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.