



DD2557 Program Semantics and Analysis 7.5 credits

Programsemantik och programanalys

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

Establishment

The official course syllabus is valid from the spring semester 2023 in accordance with Head of School decision: J-2021-2044. Decision date: 14/10/2021

Grading scale

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

Education cycle

Second cycle

Main field of study

Computer Science and Engineering

Specific prerequisites

Knowledge and skills in programming, 5 credits, equivalent to completed course DD1337/DD1310-DD1318/DD1321/DD1331/DD100N/ID1018.

Knowledge in basic computer science, 6 credits, equivalent to completed course DD2325/DD1320/DD1325/DD1327/DD2325/ID1020/ID1021.

Knowledge in discrete mathematics, 6 higher education credits, equivalent to completed course SF1688/SF1610/SF1630/SF1662/SF1679.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After passing the course, the student should be able to

- construct the state space of a program as a basis for program behaviour analysis
- translate programs to abstract machine code and execute it
- compute the denotation of a program
- extend a programming language with new language features, and extend its semantics and abstract machine implementations accordingly
- suggest and justify program transformations supported by an appropriate program analysis
- specify and verify programs in Hoare logic
- generate verification conditions of a given program and specification
- relate different semantic styles formally
- prove language properties such as determinism and termination formally
- prove the correctness of a given program transformation by showing equivalence between the original program and the transformed program formally
- show properties of a given semantics formally.

Course contents

Part I. Operational semantics and language implementation: natural semantics, structural operational semantics, abstract machines, correctness of language implementation.

Part II. Denotational semantics and program analysis: denotational semantics, fixed point theory, abstract interpretation, program analysis and program transformation.

Part III. Axiomatic semantics and program verification: axiomatic semantics, program specification and verification, weakest preconditions, verification condition generation.

Examination

- HEM1 - Home assignments, 2.5 credits, grading scale: P, F
- LAB1 - Laboratory work, 2.5 credits, grading scale: P, F
- TEN1 - Home exam, 2.5 credits, grading scale: A, B, C, D, E, FX, 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.

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.