Department of Mathematics (incl. Math. Statistics)

Stockholm University

Syllabus

for course at first level

Algorithms and Complexity
Algoritmer och komplexitet

7.5 Higher Education Credits
7.5 ECTS credits

Course code:	DA3004
Valid from:	Spring 2009
Date of approval:	2007-08-28
Department	Department of Mathematics (incl. Math. Statistics)
Subject	Informatics/Computer and Systems Sciences
Specialisation:	G1N - First cycle, has only upper-secondary level entry requirements

Decision

This syllabus has been approved by the Board of the Faculty of Science at Stockholm University, August 28, 2007.

Prerequisites and special admittance requirements

For course admission knowledge equivalent to the following is required: Object Oriented Programming, FL, 7.5 HECs (DA3002) and Combinatorics II, SL, 7.5 HECs (MM7007).

Course structure

Examination code	Name	Higher Education Credits
THEO	Theory	3
LABO	Practical Exercises	1.5
IND2	Individual Assignment 2	1.5
IND1	Individual Assignment 1	1.5

Course content

a. The course covers: Principles for construction of algorithms: Decomposition, greedy algorithms, dynamic programming, local and total search. Algorithm analysis. Approximation, algorithms and heuristics. Selected applications to sets, graphs, arithmetic, and geometry. Implementation of algorithms.

Data structures: Repetition of hash tables and heaps; balanced trees and bloom filters. Use and implementation of data structures.

Computability and complexity: Reduction. Complexity classes P (polynomial time) and NP (non-deterministic polynomial time). NP-complete problems. Undecidable problems. Coping with untractable problems.

b. The course includes the following elements:
• Theory, 3 HECs
• Individual Assignment 1, 1.5 HECs
• Individual Assignment 2, 1.5 HECs
• Practical Exercises, 1.5 HECs

Learning outcomes

After taking the course the student shall be able to:
• develop and implement algorithms with data structures and analyze them with respect to correctness and efficiency
• compare alternative algorithms and data structures with respect to efficiency and reliability
• define the concepts P, NP, NP-completeness and undecidability
• compare problems with respect to complexity using reductions,
• explain how problems of high complexity can be handled
• independently construct computer programs that use time and memory efficiently
• in professional life identify and attack problems that are unrealistically resource demanding or not possible to solve on a computer

Education

The education consists of lectures, exercises, and practical exercises.

Participation in the practical exercises and group education associated with this is compulsory. An examiner may rule that a student is not obliged to participate in certain compulsory education, if there are special grounds for this, after consultation with the relevant teacher.

Forms of examination

a. Examination for the course is in the following manner: measurement of knowledge of the element Theory takes place through written and oral examination, and of the elements Individual Assignment 1 and Individual Assignment 2 through witten and oral presentations.

b. Grading is carried out according to a 7-point scale related to learning objectives:
A = Excellent
B = Very Good
C = Good
D = Satisfactory
E = Sufficient
Fx = Fail
F = Fail

c. Grading criteria for the course will be distributed at the start of the course.

d. A minimum grade of E is required to pass the course, together with completion of the element Practical Exercises and all other compulsory education, followed by its presentation and award of a "Sufficient" grade.

e. Students who fail to achieve a pass grade in an ordinary examination have the right to take at least further four examinations, as long as the course is given. The term "examination" here is used to denote also other compulsory elements of the course. Students who have achieved a pass grade on an examination may not retake this examination in order to attempt to achieve a higher grade. Students who have failed to reach a pass grade on two occasions have the right to request that a different teacher be appointed to set the grade of the course. A request for such appointment must be sent to the departmental board.

Interim

Students may request that the examination is carried out in accordance with this syllabus even after it has ceased to apply. This right is limited, however, to a maximum of three occasions during a two-year-period after the end of giving the course. A request for such examination must be sent to the departmental board.

Limitations

The course may not be included in a degree together with the course First Degree Programme in Mathematics-Computer Science, Computer Science Branch, 3rd year (NA8650), Algorithms and Complexity, Advanced Course (NA4110), or the equivalents.

Misc

The course is a component of the Bachelor's Programme in Computer Science, and it can also be taken as an individual course.

Required reading

Course literature is decided by the departmental board and is described in an appendix to the syllabus.