Course syllabus
Third-cycle courses and study programmes

This is a translation of a Swedish document. In the event of a discrepancy, the Swedish-language version shall prevail.

Topics in Contemporary Computer Science, 7.5 credits

Datavetenskaplig orientering, 7.5 hp

Course Code/Codes	50DT058
Subject Area	Datavetenskap
School/equivalent	School of Science and Technology
Valid from	2019-10-01
Approved	2019-12-19
Revised	
Approved by	Peter Johansson
Translation to English, date and signature	N/A

1   Course content

The aim of this course is to provide all doctoral students with a common layer of knowledge and understanding about the fundamental concepts, principles and methods of contemporary computer science. The course is meant to be accessible to students with different backgrounds and possibly with limited previous exposure to computer science. It will bring these students to the level at which they can profitably follow the more advanced courses of the computer science curriculum.

To achieve this aim, the course will consist of two complementary parts. The first part will provide the basic notions and vocabulary of computer science. This part will cover the following topics:
- Classical models of computation
- Formal languages and grammars
- Decidability
- Recursion, reflection and self-reference
- Computational complexity
- Computing architectures
- Distributed computation

The second part will part will use the above notions and vocabulary to explore some advanced topics that characterize modern developments of computer science. Examples of these topics are:
- Massively distributed systems, including ubiquitous computing, the Internet of Things, cyber-physical systems
- Unconventional models of computation, including spatial computing, amorphous computing, dynamic system models, quantum computing
- Formal models of computation, including modal, temporal and dynamic logics
- Self-*(self-star) properties, including autonomic computing and aware computing

The selection of the specific advanced topics to be addressed in the course will be made on a year-by-year basis, depending on the background, the educational needs and the research interests of the participating students.

2 Outcomes

2.1 The course in relation to the doctoral programme

The course shall primarily refer to the following intended learning outcomes for third-cycle courses and study programmes as described in the Higher Education Ordinance, i.e. the doctoral student shall demonstrate:

Knowledge and understanding
- broad knowledge and systematic understanding of the research field (part of outcome 1)
- familiarity with the methods of the specific field of research in particular (part of outcome 2)

Competence and skills
- the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively (part of outcome 4)
- the capacity to support the learning of others (part of outcome 8)
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The intended learning outcomes are listed in the same order as in the general syllabus for the programme.

2.2 Intended course learning outcomes

To obtain a passing grade, the doctoral student shall demonstrate:

- A clear understanding of the basic concepts and principles of computer science, including: computation and computability, algorithms, complexity, formal languages, grammars, programing languages, computing architectures and distributed computation. (Relates to outcome 1)

- Knowledge of how those concepts and principles have evolved in the history of computer science. (relates of outcomes 1 and 2)

- The ability to encode a given problem in terms of data and algorithms that operate of those data. (Relates to outcome 4)

- Familiarity with the main formal languages and grammars. (Relates to outcome 2)

- Familiarity with the main classes of formalisms used to model computational problems and solutions, including finite state automata, push-down automata and Turing machines. (Relates to outcome 2)

- The ability to critically convey the main concepts of an advanced topic to the other students. (Relates to outcome 8)

3 Reading list and other teaching material

The following course readings and teaching material will be used on the course:

- Peter Van Roy and Seif Haridi. Concepts, Techniques, and Models of Computer Programming. MIT press, 2004.
- Elaine Rich. Automata, Computability and Complexity: Theory and Applications. Prentice-Hall, 2008.
- Lecture notes by the teacher.
- Selected books and papers about specific advanced topics. These will be decided year-by-year depending on the background and interests of the students.

4 Teaching formats

Teaching on the course takes the following format:

- Lectures delivered by the teacher;
- guided self-study on specific advanced topics;
- seminars delivered by the students on these specific topics;

5 Examination

The course is assessed through an examination consisting of the components listed below. The individual components are not graded separately but together they provide the basis for assessment and grading.

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- A oral examination on the general contents of the course, as delivered during the lectures;
- A guided self-study about a specific topic agreed with the teacher, leading to the student giving a seminar on that topic; the student must show understanding of the topic, of its relation to the main issues of Computer Science, and of its strong and weak points; the student must also show the ability to critically discuss the topic with the other students in a question-answering session.

6 Grades

Examinations on third-cycle courses and study programmes are to be assessed according to a two-grade scale with either of the grades 'fail' or 'pass' (local regulations).

The grade shall be determined by a teacher specifically nominated by the higher education institution (the examiner) (Higher Education Ordinance).

To obtain a passing grade on examinations included in the course, the doctoral student is required to demonstrate that he/she attains the intended course learning outcomes as described in section 2.2. Alternatively, if the course consists of multiple examinations generating credit, the doctoral

student is required to demonstrate that he/she attains the outcomes that the examination in question refers to in accordance with section 5.

A student who has failed an examination is entitled to a retake.

If an examination consists of several examination components, and a student fails an examination component, the examiner may, as an alternative to a retake, set a make-up assignment with regard to the examination component in question.

A doctoral student who has failed an examination twice for a specific course or course element is entitled, upon his/her request, to have another examiner appointed to determine the grade.

7   Admission to the course

7.1   Admission requirements

To gain access to the course and complete the examinations included in the course, the applicant must be admitted to a doctoral programme at Örebro University.

7.2   Selection

Selection between applicants who have been admitted to doctoral programmes at Örebro University and who otherwise meet the admission requirements as listed above is made according to the following order of precedence:

If no other selection criteria are specified in this section, priority shall be given to applicants with a lower number of course credits left before the award of their degree over applicants with a higher number of remaining course credits. Should two or more students have equal number of credits, selection will be done through the drawing of lots. This also applies within any selection groups listed unless otherwise stated.

7.3   Other applicants than doctoral students admitted at Örebro University

Other applicants than doctoral students admitted at Örebro University may be given access to the course on the grounds of provisions for and/or agreements regarding contracted courses, joint degrees, national graduate schools or cooperation in other respects with other universities.

Any decisions on what such other applicants may be given access to the course are made separately and on the basis of the provisions and/or agreements that occasion the student to apply for the course.

For participation in the course in other respects, the same provisions shall apply as for doctoral students admitted to Örebro University.

8   Transfer of credits for courses, study programmes and other experience

Provisions on the transfer of credits can be found in the Higher Education Ordinance and on the university's webpage.

9   Other information

The course is taught in English.
Attendance to the lectures and to the seminars is compulsory

Transitional provisions

N/A