UNIVERSITY OF GOTHENBURG

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DIT322 Finite automata and formal languages, 7.5 credits

Ändliga automater och formella språk, 7,5 högskolepoäng

First Cycle

Confirmation

This course syllabus was confirmed by Department of Computer Science and Engineering on 2019-02-07 to be valid from 2020-01-20, spring semester of 2020.

Field of education: Science 100%
Department: Department of Computer Science and Engineering

Position in the educational system

The course is compulsory within the N1COS Computer Science Bachelor's Programme. It is offered within the framwork of several programmes. The course also a single subject course at the University of Gothenburg.

The course can be part of the following programmes: 1) Mathematical Sciences, Master's Programme (N2MAT), 2) Computer Science, Master's Programme (N2COS), 3) Computer Science, Bachelor's Programme (N1COS) and 4) Bachelor's Programme in Mathematics (N1MAT)

Main field of studies	*Specialization*
Computer Science	G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

Entry requirements

To be eligible for this course, students must have successfully completed 45 credits in computer science or mathematics, including the following courses:
- 7.5 credits in discrete mathematics (for example DIT980, MMG200 or equivalent)
- 7.5 credits in programming (for example DIT440, DIT143, DIT012, DIT948, DIT953, MVG200 or equivalent)

Learning outcomes

On successful completion of the course the student will be able to:

Knowledge and understanding

- Define different concepts in automata theory and the theory of formal languages, such as (non-) deterministic automaton, regular expression, regular language, context-free grammar, context-free language, and Turing machine.

Competence and skills

- Prove properties of (some) languages, grammars and automata using rigorous mathematical methods.
- Construct finite automata, regular expressions and context-free grammars accepting or generating certain languages.
- Describe the language accepted by a finite automaton or generated by a regular expression or context-free grammar.
- Convert descriptions of regular languages between the following formalisms: deterministic and non-deterministic finite automata as well as regular expressions.
- Simplify automata and context-free grammars.
- Determine if a word belongs to a certain (regular or context-free) language.
- Construct Turing machines for simple tasks.

Judgement and approach

- Manipulate formal descriptions of (some) languages, grammars and automata.

Course content

The course's main topics are finite automata, regular expressions and context-free grammars. It also contains a short introduction to Turing machines.

Finite automata and regular expressions are simple models of computation. They are for instance used to control traffic lights, to search for patterns, and for lexical analysis. Furthermore their theory can illustrate basic concepts in set theory and the theory of discrete structures.

Context-free grammars are used to parse and analyse both artificial languages (for instance programming languages) and natural languages. Turing machines provide a more expressive model of computation. They help computer scientists understand the limits of mechanical computation by providing a precise definition of the concept of "algorithm". More detailed contents: Proofs. Finite automata, regular expressions, and related algorithms. Context-free grammars. Properties of regular and context-free languages. A short introduction to Turing machines.

Sub-courses

1. **Written examination** *(Skriftlig tentamen),* 6 credits
   Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)
2. **Assignments** *(Inlämningsuppgifter),* 1.5 credits
   Grading scale: Pass (G) and Fail (U)

Form of teaching

Lectures, exercise sessions.

Language of instruction: English

Assessment

The course is examined by individual assignments and an individual written exam given in an examination hall.

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

In cases where a course has been discontinued or has undergone major changes, the student shall normally be guaranteed at least three examination occasions (including the ordinary examination) during a period of at least one year from the last time the course was given.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).
To be awarded the grade Pass (G) for the whole course, the student must get the grade Pass on both the sub-courses. To be awarded the grade Pass with Distinction, the student must get the grade Pass with Distinction on the sub-course Written examination and the grade Pass on the sub-course Assignments.

Course evaluation

The course is evaluated through meeting after the course between teachers and student representatives. Further, an anonymous questionnaire is used to ensure written information. The outcome of the evaluations serves to improve the course by indicating which parts could be added, improved, changed or removed.

Additional information

The course is a joint course together with Chalmers.

Course literature to be announced the latest 8 weeks prior to the start of the course.

The course replaces the course DIT321 *Finite automata theory and formal languages*, 7.5 credits. The course cannot be included in a degree which contains DIT321. Neither can the course be included in a degree which is based on another degree in which the course DIT321 is included.