



Faculty of Health, Science and Technology  
Computer Science

# Syllabus

## Theoretical Computer Science

<b>Course Code:</b>	DVGA17
<b>Course Title:</b>	Theoretical Computer Science <i>Teoretisk datalogi</i>
<b>Credits:</b>	7.5
<b>Degree Level:</b>	Undergraduate level
<b>Progressive Specialisation:</b>	First cycle, has less than 60 credits in first-cycle course/s as entry requirements (G1F)

**Major Field of Study:**  
DVA (Computer Science)

### Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2026-01-30, and is valid from the Autumn semester 2026 at Karlstad University.

### Prerequisites

Programming techniques (7.5 credits). Discrete mathematics (7.5 credits), or Software development methodology (7.5 credits). Equivalence assessment may be made.

### Learning Outcomes

Upon completion of the course, students should be able to:

- describe and evaluate formal languages using the pumping lemma, automata, expressions and grammar,
- use central concepts of computability theory,
- construct Turing machines to solve problems, and
- analyse the time complexity of algorithms.

### Content

The course deals with the fundamentals of automata theory, formal languages, computability and complexity theory. The course is central to the understanding of the potentials and limitations of the computer and why some problems are not computable whereas others are difficult or easy. The course comprises the following components:

Automata theory and formal languages:

- Regular languages and expressions and finite automata
- Context-free languages and grammars and pushdown automata
- Pumping lemma

Computability theory:

- Turing machines
- Church-Turing thesis
- Decidability of problems/languages
- Halting problem
- Recursion theorem (linking to computer virus)

Complexity theory:

- Complexity classes
- Time complexity of algorithms
- Cryptography

**Reading List**

See separate document.

**Examination**

Assessment is based on mandatory laboratory and hand-in assignments and a written exam.

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

**Grades**

One of the grades Pass with Distinction (5), Pass with Some Distinction (4), Pass (3), or Fail (U) is awarded in the examination of the course.

**Quality Assurance**

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

**Course Certificate**

A course certificate will be provided upon request.

**Additional information**

The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.