



## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

### **DIT856 Applied Mathematical Thinking, Master course, 7.5 credits**

Tillämpat matematiskt tänkande, masterkurs, 7,5 högskolepoäng

*Second Cycle*

---

#### **Confirmation**

This course syllabus was confirmed by Department of Computer Science and Engineering on 2018-02-02 and was last revised on 2019-04-23 to be valid from 2019-09-02, autumn semester of 2019.

*Field of education:* Science 100%

*Department:* Department of Computer Science and Engineering

#### **Position in the educational system**

The course is compulsory within the Applied Data Science Master's Programme.

The course can be part of the following programme: 1) Applied Data Science Master's Programme (N2ADS)

#### *Main field of studies*

Data Science

#### *Specialization*

A1N, Second cycle, has only first-cycle course/s as entry requirements

#### **Entry requirements**

To be eligible to the course, the student should have a Bachelor's degree in any subject. Specifically, at least 15 credits of successfully completed courses in programming are required.

#### **Learning outcomes**

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

*Knowledge and understanding*

- Explain different aspects of mathematical thinking: mathematical reasoning, problem solving, modelling.
- Explain how mathematical thinking can be applied in different areas.
- Explain common mathematical knowledge and how it can be used (including functions, equations, derivatives and integrals, probability, sets, graphs).

#### *Competence and skills*

- Show familiarity with mathematical concepts such as definitions, theorems, as well as different kinds of mathematical reasoning and proofs (mathematical reasoning).
- Solve complex and unknown problems with a structured and investigative approach (mathematical problem solving).
- Investigate real problems, determine if they can be seen from a mathematical perspective and translate to mathematical problems, and adapt mathematical conclusions to the real problem (mathematical modelling).
- Communicate about and with the help of mathematics.
- Use different computational tools and independently write computer programs as a natural part of working mathematically.

#### *Judgement and approach*

- A good ability to reflect on the nature of mathematical thinking and how it is used in different areas.
- Identify how own thinking can be used to solve a problem, and to what extent previous knowledge can be used.
- Show a reflective attitude to the course contents and to their own thinking.
- Show precision, quality and maturity in all work.

### **Course content**

The course is mainly intended to strengthen the students' mathematical thinking, and their ability to apply such thinking in applications, and in their continued studies. The focus is not on mathematical knowledge in the traditional sense, but on the often implied abilities needed to effectively be able to apply the mathematics you already know, and efficiently be able to learn new mathematics. The most important parts are mathematical reasoning, problem solving and modelling. Important aspects such as using the computer as a part of your mathematical thinking, and to be able to communicate with and about mathematics are also integrated in the course.

The course also in a natural way introduces basic mathematical knowledge useful in computer science and other areas, including a selection of Swedish upper secondary courses Mathematics 4 and 5.

By developing the ability to think mathematically, the course complements other more traditional courses in mathematics, and by providing the student with experience of

different areas of application, the gap between mathematical theory and relevant applications is bridged.

The core of the course is a number of carefully selected problems, used as starting points for the student's own learning, where student by working in an investigative way develop their own abilities. We also have lectures which provide a broader understanding, follow-up and perspective. The problems illustrate many different areas of application, and their level of difficulty is adapted to efficiently practice the abilities to think and work mathematically in different situations.

In connection with the exercises, we also discuss different problem solving strategies, reflect on solutions, and compare different ways to solve the same problem. We also give an orientation about the role of mathematics in various applications and demonstrate the importance of mathematical computer models.

Every module includes an extended reflective part where the students reflect and reason about their problem solving in each problem, in order to improve their ability to reflect and evaluate, as well as their problem solving skills.

The course also includes independent programming tasks.

### **Form of teaching**

The course is mainly organized in modules. For every module there is an introductory lecture and a compulsory follow-up lecture providing feedback on the problems of the module.

The learning is supported by an interactive way of teaching with a lot of contact between students and teachers. This occurs during supervision hours where students work with the problems and regularly discuss with the supervisors. They will then receive individual feedback and guidance in their own problem solving, and develop their independent abilities.

*Language of instruction:* English

### **Assessment**

The course is examined through written assignments and with a final report, where the students are encouraged to summarize and reflect over the course in a personal way. The assignments and the final report are normally written in groups of two persons. In addition, each group reads reports from other groups, and discusses them in a final seminar.

To pass the course, attendance of selected lectures is also required.

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 pass the course, the assignments and the final report must pass. To get the grade Pass with distinction (VG), this grade is required both for the assignments and for the final report.

To pass the final report, the student needs to show a good understanding of the course contents, and the presentation and the content of the report must be correct and well written. To get the grade Pass with distinction (VG) on the report, the student must show a very good understanding of the subject, describing own insights and showing particular attention to quality.

To pass the assignments the reasoning must be correct, and of good quality. To get the grade Pass with distinction (VG) on the assignments, the student must show a very good understanding of the subject, describing own insights and showing particular attention to quality.

### **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**

As the exercises are the most important in the course, there is no course literature in the traditional sense. For handouts and further reading, see the course's website.

The course replaces the course DIT855, 7.5 credits. The course cannot be included in a degree which contains DIT855. Neither can the course be included in a degree which is based on another degree in which the course DIT855 is included.

The course cannot be included in a degree which contains DIT991 or DIT025. Neither can the course be included in a degree which is based on another degree in which the course DIT991 or DIT025 is included.