

# Domain-Specific Languages of Mathematics

Course-memo for the 2017 instance of a 7.5hec BSc course at Chalmers and GU.

Homepage: <https://github.com/DSLsofMath/DSLsofMath/>

Course codes: DAT326 / DIT982

## Course team

- Examiner & main lecturer: Patrik Jansson (patrikj AT)
- Lecturer: Cezar Ionescu (cezar AT)
- Teaching assistants: Daniel Schoepe (schoepe AT), Frederik Hanghøj Iversen (hanghj AT student)

## Objectives

The course presents classical mathematical topics from a computing science perspective: giving specifications of the concepts introduced, paying attention to syntax and types, and ultimately constructing DSLs of some mathematical areas mentioned below.

Learning outcomes as in the course syllabus:

- Knowledge and understanding
  - design and implement a DSL (Domain Specific Language) for a new domain
  - organize areas of mathematics in DSL terms
  - explain main concepts of elementary real and complex analysis, algebra, and linear algebra
- Skills and abilities
  - develop adequate notation for mathematical concepts
  - perform calculational proofs
  - use power series for solving differential equations
  - use Laplace transforms for solving differential equations
- Judgement and approach
  - discuss and compare different software implementations of mathematical concepts

The course is elective for both computer science and mathematics students at both Chalmers and GU.

## Course material

There is no course textbook. References will be provided in the lecture summaries.

## Course setup

- Lectures (Mondays 10-12 in EB, and Mondays 15-17 in EF)
  - Introduction: Haskell, complex numbers, syntax, semantics, evaluation, approximation
  - Basic concepts of analysis: sequences, limits, convergence, ...
  - Types and mathematics: logic, quantifiers, proofs and programs, Curry-Howard, ...
  - Type classes, derivatives, derivation,
  - Domain Specific Languages and algebraic structures, algebras, homomorphisms
  - Polynomials, series, power series
  - Power series and differential equations, exp, sin, log, Taylor series, ...
  - Laplace transform
  - Linear algebra
- Weekly exercises (Wednesdays 13-15 and Fridays 13-15 in EDIT2505)
- Assignments: two compulsory hand-in assignments in groups of three
  - Grading: Pass or fail
- Written exam
  - Grading: Chalmers: U, 3, 4, 5; GU: U, G, VG

## Changes from last year

In 2016 the course was taught for the very first time, and by a different teaching team (Cezar Ionescu, Irene Lobo Valbuena). The main changes for 2017 are

- Re-worked the first four lectures (less logic, more Haskell)
- Re-ordering of lectures
- Replacing two guest lectures by new lectures on Linear Algebra

## Examination

There are two compulsory course elements:

- Assignments (written + oral examination in groups of three students)
  - Deadlines: 2017-01-31 and 2017-02-28
- Exam (individual written exam at the end of the course)
  - Date: 2017-03-14 at 14.00
  - Aids: One textbook of your choice

To pass the course you need to pass both course elements.