

Advanced Programming

Course Introduction

Troels Henriksen

Course perspective

Course organisation

Programming in Haskell

Why I think this course is worthwhile

The purpose of this course is to provide practical experience with sophisticated programming techniques and paradigms from a language-based perspective. The focus is on high-level programming and systematic construction of well-behaved programs.

- from course description

- Solving complex problems in a **maintainable** and **reusable** way.
- Allowing principled **reasoning** about program behaviour.
- Performing rigorous **testing**.

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- Solving complex problems in a **maintainable** and **reusable** way.
- Allowing principled **reasoning** about program behaviour.
- Performing rigorous **testing**.
- Pushing **separation of concerns** further than you have seen before.
- **This is how I program!**

Advanced Programming and Professional Wrestling



Christopher Daniels performing a *flying crossbody* on Jonny Storm.

Kayfabe

The fact or convention of presenting staged performances as genuine or authentic.

¹By my standards.

²In week 3.

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The Kayfabe of AP

- Principled design works better the larger your system is and the longer it has to be maintained.
- For practical reasons we look at small systems that are not maintained over time and that would probably work if implemented any reasonable way.
- We pretend the systems we study are a lot bigger than they actually are.

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I promise you will get to write real¹ programs in this course!²

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Which languages and tools you will use

- All programming is in **Haskell**.
 - ▶ Purely functional.
 - ▶ Somewhat similar to F#.
 - ▶ Lazy.
- We use standard compilers and build tools.
 - ▶ Feel free to use fancy editor integration, but it is not required.
 - ▶ Tool expertise not part of learning goals; we try to streamline as much as possible.
 - ▶ Windows users will (probably) have to use WSL2.
- We assume programming proficiency, roughly corresponding to an undergraduate degree in computer science.

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3. Taking generalisation and abstraction further.

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1. Reasoning about computation as a mathematical construct.
2. Clean separation and modularisation.
3. Taking generalisation and abstraction further.
4. How to parse input data in a principled and convenient manner.

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1. Reasoning about computation as a mathematical construct.
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5. How to structure (potentially large) concurrent systems in a robust manner.

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5. How to structure (potentially large) concurrent systems in a robust manner.
6. How to effectively test complex systems without writing a million unit tests.

Course perspective

Course organisation

Programming in Haskell

Lecturers

Troels (**Course responsible**)



Fritz



TAs

William



Tudor



Mikkel



Alex

Hongyang

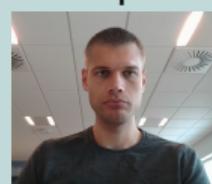
Matan



Victor



Casper



Mark



Course structure

Recommended reading

- AP Course Notes.
- *Programming in Haskell* by Graham Hutton.
- Various papers.

Assignments

- **Six** weekly group assignments.
- Preferably **three students per group**.
- **Graded** with 0-4 points.
- **No resubmissions**.
- Exam qualification: at least 12 points and **at least one point** per assignment.
- **First one handed out today**.

Assignments and exercises

The AP Student Algorithm

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2. Attend exam.

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2. Attend exam.
3. **Optional:** Attend re-exam.

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1. Repeat for every week:
 - 1.1 Consume learning material:
 - ▶ Attend lectures.
 - ▶ Read texts.
 - 1.2 Solve programming exercises.
 - 1.3 Solve programming assignment.
 - 1.4 Hand in assignment with your group.
2. Attend exam.
3. **Optional:** Attend re-exam.
4. **Optional:** Return to 1.

The assignments build *directly* on the code you see in the exercises.

Physical teaching activities

What and where

Lecture: Tuesday 10-12 at Store UP-1.

Exercises: Thursday 10-12 in NBB.

Lecture: Thursday 13-15 at Store UP-1.

Exercises: Thursday 15-17 in HCØ.

- Work on the exercises by yourself after Tuesday lecture.
- Continue (with TA help) on Thursday.
- See course website for classrooms.

Course resources

- **Course website:** <https://github.com/diku-dk/ap-e2025-pub>
- **Absalon:** used for handins, announcements, and discussions.
 - ▶ **Action item:** Add yourself to an *Assignment Group*.
- **Discord:** <https://discord.gg/DBzmDyxt82>
 - ▶ Not mandatory, but many students seem to prefer it over the Absalon forum.
 - ▶ Use your Absalon name, not your sweet hacker nick.

Classrooms

Each Thursday will have a minimum of **four TA-staffed classrooms**:

- NBB 1.01.B.080
- NBB 1.01.B.082
- NBB 1.01.F.64
- NBB 1.01.F.70

The following room **may be staffed** as needed (will be the first week):

- NBB 1.1.E.015

Go where you wish, but do try to perform some manual load balancing.

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No mandated textbook.

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But...

- We recommended chapters from *Programming in Haskell* by Graham Hutton.
 - ▶ If you don't like its style, feel free to read equivalent chapters from books such as *Learn You a Haskell for Great Good* or *Real World Haskell*, or any other that the Internet recommends.

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- We will provide some classic *research papers*.
 - ▶ You can make do without reading these, but they often provide very good background material to help your understanding.
- We have written *course notes*.
 - ▶ <https://diku-dk.github.io/ap-notes/>
 - ▶ One chapter per week; the idea is that they roughly correspond to lecture content.
 - ▶ And things that don't fit anywhere else.
 - ▶ Still adding material, still WIP, please report bugs if you find any.
 - ▶ Incomprehensible text is a bug.

Questions?

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Course organisation

Programming in Haskell

Rest of the lecture takes place in Emacs.