Advanced Programming

Course Presentation

Troels Henriksen

2024

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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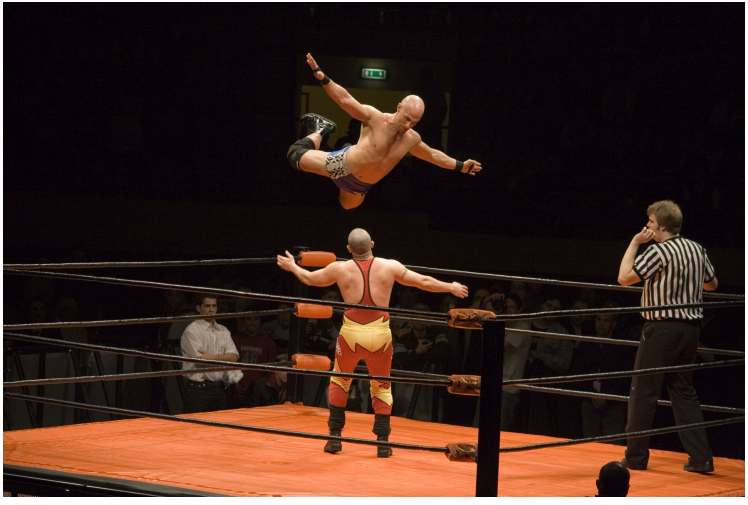
- Allowing principled **reasoning** about program behaviour.
- Performing rigorous **testing**.
- Pushing **separation of concerns** further than you have seen before.
- **This is how I program!**

Advanced Programming and Professional Wrestling



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

Photo by Hugo Fernandes

https://commons.wikimedia.org/wiki/File:Christopher_Daniels_1.jpg

Kayfabe

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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.

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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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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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.

The Course Team

Lecturers

-  Troels: **course responsible**, Haskell, parsing, free monads, concurrency.
-  Mikkel: type classes, monads, property-based testing.

TAs

Robert 

Francisco 

Therese 

Joachim 

Mikkel

Ian 

Rasmus

Thomas 

The didactic architecture of AP

- Each week has **lectures**, **course notes** and **other reading material**…
- …which enable you to solve programming **exercises**…
- …the solutions of which form the basis for the **assignments**.

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2. Attend exam.

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Weekly resource allocation

- **Lectures:** 4 hours
- **Reading:** 4 hours
- **Exercises:** 4 hours
- **Assignment:** 8 hours

Individual course elements

- **Exercises**, weekly, voluntary but *strongly recommended*.
- **Assignments**:
  - Six in total.
  - Solved in groups of up to 3 students.
  - Awarded 0-4 points.
  - **No resubmissions.**
- **Exam**: take-home, similar to assignments but larger. To qualify, you must have:
  - At least twelve points, and
  - at least one point in each assignment.
- **Lectures**, Tuesday and Thursday.
- **Exercise classes**, Thursday.
- **Study café**, Friday.
- **Course website**: `https://github.com/diku-dk/ap-e2024-pub`
- **Absalon**: used for handins, announcements, and discussions.
- **Discord**: `https://discord.gg/dJgTJ7mry7`

Schedule

When

	Monday	Tuesday	Wednesday	Thursday	Friday
10-12		Lecture		Exercises	
13-15				Lecture	Café
15-17				Exercises	

Where

Tuesday lecture: Aud 01, HCØ

Thursday lecture: Store UP1, DIKU

Friday café: Lille UP1, DIKU

Exercise classes: All over, see course webpage.

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No mandated textbook.

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- 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*.
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- We have written *course notes*.
  - `https://github.com/diku-dk/ap-notes`
  - One chapter per week; the idea is that they roughly correspond to lecture content.
    - And things that don't fit anywhere else.
  - Newly written this year, still WIP, please report bugs if you find any.
    - Incomprehensible text is a bug.

Preparing for the course

- Install necessary software.
  - `https://github.com/diku-dk/ap-e2024-pub/blob/main/haskell.md`
- Become a proficient functional programmer.
  - Do basic Haskell exercises, such as the ones from *Programming in Haskell* or *Learn You a Haskell for Great Good* (free online).
  - Or get a head start on the weekly exercises: `https://github.com/diku-dk/ap-e2024-pub/tree/main/week1`

Despite our emphasis on principles, this is a programming-intensive course where you are ultimately evaluated on your ability to produce working programs.

Questions?