

Introduction - Programming

Programming: Everyday Decision-Making Algorithms

Dr. Tobias Vlček

Kühne Logistics University Hamburg - Winter 2025

About this Course

Teaching Team



Figure 1: Dr. Tobias Vlček



Figure 2: Dr. Nils Roemer

About me

- Field: Optimizing and simulating complex systems
- Languages: of choice: Julia, Python and Rust
- Interest: Modelling, Simulations, Machine Learning
- Teaching: OR, Algorithms, and Programming
- Contact: vlcek@beyondsimulations.com

...



Tip

We really appreciate active participation and interaction!

Agenda

- About the course, team, and expectations
- How to learn programming (mindset and resources)
- Setting up Python with uv and VS Code

- Using notebooks with uv
- Q&A and next steps

Course Outline

- I: Optimal Stopping
- II: Explore & Exploit
- III: Caching
- IV: Scheduling
- V: Randomness
- VI: Computational Kindness

Participation

- Try actively participating in this course
- You will find it much (!) easier and more fun
- Lecture based on the book Algorithms to live by¹
- Material and slides are hosted online: beyondsimulations.github.io/Programming-Everyday-Decisions

Teaching

- Lecture: Presentation and discussion of algorithms related to everyday decision-making
 - Tutorial: Step-by-step assignments to be solved and discussed together in groups
 - Difficulty: Strongly depends on your background and programming experience
- ...

Tip

No worries, we will help you out if you have any questions!

Passing the Course

- Pass/fail course without exams
- 75% attendance required for passing the course
- Hand in the assignments of at least two lectures
- Short presentation and discussion at the end
- You work together in groups of three students

Handing in Assignments

- Each student group submits one solution
- Provide us all working notebooks of the lecture
- Hand in is due at the beginning of the next lecture
- At least 50 % have to be correct to pass
- You have to pass at least twice

¹Christian, B., & Griffiths, T. (2016). Algorithms to live by: the computer science of human decisions. First international edition. New York, Henry Holt and Company.

...

Tip

This is just in order to provide you with working solutions after each deadline.

Learning Python

We will mostly not cover Python during the lectures!

...

Question: Anybody know why?

...

- In our experience, the best way to learn is by doing!
- Here, we will focus on decision-making algorithms
- You will learn Python by doing the tutorials

...

Tip

Don't worry, we will help you out if you have any questions!

Difficulty of the Course

- At first it might be a little bit overwhelming
- Programming is similar to learning a new language
- First, you have to get used to it and learn words
- Later, you'll be able to apply it and see results
- Important: Practice, practice, practice!

Goals of the Course

- Learn the basics of programming
- Learn about algorithmic thinking
- Be able to apply methods and concepts
- Solve practical problems with algorithms

Tip

We are convinced that this course will be quite interesting and teach you more for your daily life than most other courses!

Why Python?

- Origins: Conceived in late 1980s as a teaching and scripting language
- Simple Syntax: Python's syntax is mostly straightforward and very easy to learn
- Versatility: Used in web development, data analysis, artificial intelligence, and more

- Community Support: A large community of users worldwide and extensive documentation

Help from AI

- You are allowed to use AI in the course, we use it as well (e.g., Claude, ChatGPT, Llama3 ...)
- These tools are great for learning Python!
- Can help you a lot to get started with programming

...

Warning

But you should not simply use them to replace your learning.

How to learn programming

Our Recommendation

1. Be present: Attend the lecture and solve the tutorials
2. Put in some work: Repeat code and try to understand it
3. Do coding: Run code, play around, modify, and solve

...

Tip

Great resources to start are books and small challenges. You can find a list of book recommendations at the end of the lecture. Small challenges to solve can for example be found on [Codewars](#).

Don't give up!

- Programming is problem solving, don't get frustrated!
- Expect to stretch your comfort zone

Setting up Python

Install VS Code

- Download and install from the [website](#)
- Built for Windows, Linux and Mac
- Install the [Python](#) and [Jupyter](#) extension
- Now you are ready to go!

...

Tip

Unsure on how to work with VS Code and notebooks? Ask us! We are happy to help you out!

What is an IDE?

- Integrated Development Environment = application
- It allows you to write, run and debug code scripts
- Other IDEs include for example:
 - [PyCharm](#) from JetBrains
 - [Zed](#)

Installation of Python with `uv`

- We will use `uv` to install and manage Python versions
- It works on Windows, Mac and Linux
- It helps us to manage packages and virtual environments
- Now, we all [go here](#) and install `uv` and Python

...

Tip

If the installation does not work, let us know!

Using Notebooks with `uv`

Quick Check

- Have you installed `uv` and initialized the project?
- Great! Before we continue, check the following:
 - ☐ You have a folder for the course
 - ☐ You have initialized `uv` with `uv init` inside the folder
 - ☐ You can see a file called `pyproject.toml` in the folder

...

Tip

Something not working yet? Ask us!

Using Notebooks

- Now we need to add a kernel to our project
- Run `uv add --dev ipykernel` from your terminal
- Now run `uv add jupyter` in the terminal
- This allows us to use `uv` Python in notebooks

- Done? Perfect. Now we can start!

Working with Notebooks

- Now you can download the files from the website
- Just click on one of the sessions and open it
- Select **Jupyter** on the right side
- Download and save the files to your course folder
- Open them and select “Open with Jupyter Notebook”

...

Tip

That was the hardest part today!

Any questions

so far?

After the break — Optimal Stopping

- The “Secretary Problem” and the 37% rule
- When to stop searching and make a decision
- How to translate the idea into code and experiments

Note

That’s it for our introduction!
Let’s have a short break and then continue with our first topic.

Literature

Interesting literature to start

- Christian, B., & Griffiths, T. (2016). Algorithms to live by: the computer science of human decisions. First international edition. New York, Henry Holt and Company.²
- Ferguson, T.S. (1989) ‘Who solved the secretary problem?’, Statistical Science, 4(3). doi:10.1214/ss/1177012493.

Books on Programming

- Downey, A. B. (2024). Think Python: How to think like a computer scientist (Third edition). O’Reilly. [Here](#)
- Elter, S. (2021). Schrödinger programmiert Python: Das etwas andere Fachbuch (1. Auflage). Rheinwerk Verlag.

...

²The main inspiration for this lecture. Nils and I have read it and discussed it in depth, always wanting to translate it into a course.

Note

Think Python is a great book to start with. It's available online for free. Schrödinger Programmiert Python is a great alternative for German students, as it is a very playful introduction to programming with lots of examples.

More Literature

For more interesting literature, take a look at the [literature list](#) of this course.