

Introduction - Programming

Programming: Everyday Decision-Making Algorithms

Dr. Tobias Vlćek
Kühne Logistics University Hamburg - Winter 2025

About this Course

Teaching Team



Figure 1: Dr. Tobias Vlcek



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

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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](https://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
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 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.

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💡 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!

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Question: Anybody know why?

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- 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

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💡 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

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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

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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!

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💡 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

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💡 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

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💡 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.