IS407E - Introduction to Programming with Python

Paul Schuhmacher
Coordinator: Mr. Amine LAHIANI
Duration : 24h (8 x 3h sessions)

About me

- 2011: Bachelor’s Degree in **Physics**
- 2012: **Master’s Degree in "Modeling of Complex Systems" (Physics specialization)**: Scientific programming, numerical simulations of sand dune dynamics and collective animal behavior (fish schooling)
- 2016: **Ph.D. in Mechanical and Civil Engineering (Physics/Computational Mechanics)**: Modeling and numerical simulations of granular material flows
- 2018: **Postdoctoral Researcher**: Academic research, team codebase maintenance and development, teaching
- 2020: Transition to Software Developer (CDA - Application Developer certification at ENI, Nantes)
- 2021: **Web Developer** in a web agency in Nantes
- *Today*: Web developer/**Software/web development teacher** since 4 years

How to contact me

By email:

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> Feel free to ask me any questions about programming or software projects you may have!

Objectives

- Understand the **basic concepts** of **computer programming**
- Be able to write **simple programs** in **Python**
- Be able to write and use **libraries** (packages) in Python
- Be able to use basic functions of NumPy (scientific computing), Matplotlib (data vizualisation), and pandas (data analysis) libraries, for different practical purposes: **data manipulation and visualization**
- *(DAIS only) Write programs using **Object-Oriented Programming** paradigm (OOP)*

After this course

You will:

- know *how to program* (or get better at programming)
- have *fundamental knowledge* of Python programming language (and many others indirectly!)
- be able to *prepare* and *translate raw data* into *usable datasets* and *interpretable outputs* to support fact-based **decision-making**

Grades and assessments

- **3 grades**
  - Quiz (20%)
  - Final Exam (individual) (60%)
  - Participation and **task completion on DataCamp** (20%). See required assignments.

> Last session

Practice on DataCamp

Datacamp platform:

- Interactive lessons
- Problem solving (Quick daily challenges)

> Access given by Rennes School of Business

Module plan sessions

Session 01 (today)

Introduction to Computers, Python, and your first program:

- **From machine to code: how a computer executes a Python program**
- Setting up and writing code
- Core concepts: variables, data types (strings, numbers, booleans), basic arithmetic and operators
- Data structures: lists and dictionaries
- Control flow basics: loops and conditions (introductory overview)
- **DataCamp assignment**

Session 02

Data Structures and Debugging Fundamentals:

- Deeper practice with data structures: lists and dictionaries (indexing, nesting, common operations)
- Introduction to debugging: reading error messages, common bugs, step-by-step troubleshooting
- Best practices for responsible use of GenAI tools when debugging code
- **DataCamp assignment**

Session 03

Control Flow: Conditions and Loops:

- Conditional structures: if / elif / else
- Loops: for and while, break/continue
- Combining loops with conditions to solve structured problems
- **DataCamp assignment**

Session 04

Functions, Code Reuse:

- Defining and calling functions
- Parameters and return values
- Why code reuse matters: writing maintainable, modular code
- Debugging functions
- **DataCamp assignment**

> Basics should be acquired here.

Session 05

Data Preparation with NumPy:

- Introduction to NumPy arrays: creation, shape, indexing, slicing
- Vectorized operations and basic math on arrays
- **DataCamp assignment**

Session 06

Data Visualization with Matplotlib:

- Basic plot types: line, bar, scatter
- Customizing titles, labels, legends
- **DataCamp assignment**

Session 07

Data Analysis with Pandas: Series and DataFrames:

- Pandas Series and DataFrames: structure and purpose
- Lab Session for discovering pandas
- Loading CSV files, inspecting data
- Selecting columns, filtering rows
- Combining NumPy with Pandas for numerical data preparation
- Plotting directly from DataFrames
- **DataCamp assignment**

Session 08 (Last session, exams)

Assessments:

- Quiz: 1:30 hours. 20 questions (on Moodle).
- Final exam (individual): 1:30 hours. You will have to solve programming exercises on your local machine. During the exam, you are not allowed to access Internet and/or use any AI/LLM. However, **you are allowed to access all your local documents on your computer** (course materials, notes, programs you wrote, etc.) or paper notes.

> **Before the exam, ensure your local dev environment is fully WORKING** (PyCharm + numpy/matplotlib packages installed)! If you have any problems with your machine please come see during class.

Next Module

Go to next module

Resources to go further

- Course's Repository (GitHub): sources (exercises, commented corrections), bibliography and useful references. Always *up-to-date*!
- Problem sheet, solve some problems to practice each concept, step by step.