Programming Unit 1 & 2

### (12 credits)

# Lecturers

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# Course Objectives

This course intends to provide students a gentle introduction to programming through the Python language, providing basic methodologies for the design and analysis of iterative and recursive algorithms, elementary data structures, and the most basic implementations of simple programs.

At the end of this course, the students will be able to understand and define a problem's requirements, choose how to represent the input and what data structures to use for intermediate computations and output, define the algorithm solving the problem, and code the algorithm as a Python program, splitting the program as small separate functions/methods.

The student, at the end of the course, should be able to autonomously choose how to solve a programming task (analysis, implementation, and testing).

# Course Structure

The course is structured into 32 lectures, each with a duration of 3 hours, for a total of 96 hours.

# Independent Work

The students are expected to review the material to develop a good understanding of the topics covered in each lecture through practical exercises.

# Reading List

**Textbook:**

* Downey, Allen. Think python. " O'Reilly Media, Inc.", Third Edition, 2024. <https://allendowney.github.io/ThinkPython/index.html>

**Other material:**

* <https://allendowney.github.io/ThinkPython/index.html#the-notebooks>
* <https://introtcs.org/public>
* <https://pynative.com/python-exercises-with-solutions>

# Lectures Overview

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| **Lecture** | **Topic** | **Recommended reading** |
| Lecture 1 | Introduction to the course and to Theoretical Computer Science. Algorithms, problems, and models. | <https://introtcs.org/public/lec_01_introduction.html> sec. 0.1 -> 0.5 |
| Lecture 2 | Introduction to the Python language. Interaction with the interpreter. | Textbook chapter 1. |
| Lecture 3 | Variables, expressions, statements, and the print function. | Textbook chapter 2. |
| Lecture 4 | Get acquainted with the Python environment. Simple exercises with the Python interpreter and first scripts. | Textbook chapter 2. |
| Lecture 5 | Functions. | Textbook chapter 3, chapter 6, from section 6.1 to section 6.2. |
| Lecture 6 | Exercises with functions. | Textbook chapter 4.  <https://pynative.com/python-functions-exercise-with-solutions>  <https://pynative.com/python-input-and-output-exercise> |
| Lecture 7 | Conditionals: if/then/else statement, booleans, and operator combinations. | Testbook chapter 5, from section 5.1 to section 5.7, chapter 6, from section 6.3 to section 6.5. |
| Lecture 8 | Exercises with functions and conditionals. | Testbook chapter 5, from section 5.1 to section 5.7, chapter 6, from section 6.3 to section 6.5.  <https://pynative.com/python-if-else-and-for-loop-exercise-with-solutions>  <https://pynative.com/python-functions-exercise-with-solutions> |
| Lecture 9 | Recursion and keyboard input. | Textbook chapter 5, from section 5.8 to section 5.13, chapter 6, from section 6.6 to section 6.10. |
| Lecture 10 | Exercises with functions, conditionals, and simple recursion. | Textbook chapters 5 and 6.  <https://pynative.com/python-functions-exercise-with-solutions> |
| Lecture 11 | Iteration and search: loops, strings, counting. The range function. | Textbook chapter 7. |
| Lecture 12 | Exercises with loops and strings. | Textbook chapter 7.  <https://pynative.com/python-string-exercise>  <https://pynative.com/python-if-else-and-for-loop-exercise-with-solutions> |
| Lecture 13 | Nested loops. Strings and regular expressions. Introduction to files. | Textbook chapter 8. |
| Lecture 14 | Exercises with loops, strings, and files. | Textbook chapter 8.  <https://pynative.com/python-string-exercise>  <https://pynative.com/python-if-else-and-for-loop-exercise-with-solutions>  <https://pynative.com/python-input-and-output-exercise> |
| Lecture 15 | Introduction to lists: creation, modification, and iteration. | Textbook chapter 9, from section 9.1 to section 9.7. |
| Lecture 16 | Practice for the final exam. |  |
| Lecture 17 | Sets. Advanced topics on lists: sorting, aliasing, arguments, and wordlists. | Textbook section 18.1 and chapter 9, from section 9.8 to section 9.12 |
| Lecture 18 | Lists and sets comprehension. Exercises with lists and sets. | Textbook sections 18.1, 18.4, 18.5. |
| Lecture 19 | Introduction to dictionaries: creation, look up, loops. | Textbook chapter 10, from section 10.1 to section 10.5. |
| Lecture 20 | Exercises with dictionaries. | Textbook chapter 10, from section 10.1 to section 10.5.  <https://pynative.com/python-data-structure-exercise-for-beginners> |
| Lecture 21 | Lists and dictionaries. Dictionaries and recursion. | Textbook chapter 10, from section 10.6 to section 10.8. |
| Lecture 22 | Exercises with dictionaries and lists. | Textbook chapter 10, from section 10.6 to section 10.8.  <https://pynative.com/python-list-exercise-with-solutions>  <https://pynative.com/python-data-structure-exercise-for-beginners> |
| Lecture 23 | Advanced sorting. The use of functions for customized sorting. | <https://docs.python.org/3/howto/sorting.html> |
| Lecture 24 | Exercises with advanced sorting. | <https://docs.python.org/3/howto/sorting.html> |
| Lecture 25 | Tuples and lists. Lists of lists (matrices). | Textbook chapter 11. |
| Lecture 26 | Exercises with tuples, lists, and dictionaries. | Textbook chapter 11.  <https://pynative.com/python-tuple-exercise-with-solutions>  <https://pynative.com/python-list-exercise-with-solutions>  <https://pynative.com/python-data-structure-exercise-for-beginners> |
| Lecture 27 | Text analysis and generation. | Textbook chapter 12. |
| Lecture 28 | Text analysis and generation. | Textbook chapter 12. |
| Lecture 29 | Files and folders. | Textbook chapter 13. |
| Lecture 30 | Exercises with files and folders. | Textbook chapter 13.  [https://pynative.com/python-file-handling-exercises](https://pynative.com/python-file-handling-exercises/) |
| Lecture 31 | Practice for the final exam. |  |
| Lecture 32 | Practice for the final exam. |  |