Scientific Programming

Course introduction

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Università degli Studi di Trento

2022/09/29

Organization

145540 Scientific Programming (12 ECTS, LM QCB)
145685 Scientific Programming (12 ECTS, LM Data Science)

Part A - Programming (Sept-Oct))

Introduction to the Python language and to a collection of
programming libraries for data analysis.

- Mutuated as 145912 Scientific Programming
  (LM Math, 6 credits)

Part B - Algorithms (Nov-Dec)

Design and analysis of algorithmic solutions. Presentation of the
most important classes of algorithms and evaluation of their
performance.

Course syllabus - Part A

- Introduction to Python

- Data types
  - Numbers
  - Strings
  - Lists, tuples, dictionaries

- Input-Output
  - Raw input
  - File system

- Complex statements
  - If
  - For, while
  - Nested statements

- Functions
  - Definition
  - Calls
  - Return values

- Programs
  - Structuring a program
  - Importing external modules

- Libraries
  - Pandas
  - Numpy
  - MatPlotLib

Course syllabus - Part B

- Introduction
  - Recursion
  - Algorithm analysis
  - Asymptotic notations

- Data structures
  - High level overview
  - Sequences, maps (ordered/unordered), sets
  - Data structure implementations in Python

- Trees
  - Data structure definition
  - Visits

- Graphs
  - Data structure definition
  - Visits
  - Algorithms on graphs

- Algorithmic techniques
  - Divide-et-impera
  - Dynamic programming
  - Greedy
  - Backtrack
  - NP class: brief overview

Objectives of the course – Part A

At the end of the module, students are expected to:

- Remember the syntax and semantics of the Python language;
- Understand programs written by others individuals;
- Analyze a simple data analysis task and reformulate it as a programming problem;
- Evaluate which features of the language (and related scientific libraries) can be used to solve the task;
- Construct a Python program that appropriately solves the task;
- Evaluate the results of the program.

Objectives of the course – Part B

At the end of the module, students are expected to:

- evaluate algorithmic choices and select the ones that best suit their problems;
- analyze the complexity of existing algorithms and algorithms created on their own;
- design simple algorithmic solutions to solve basic problems.

What you will learn

Programming expertise

- Content: a brief overview of the main problems in algorithmics and their solution
- Approach: the principles and the techniques that can be used to solve such problems

Content: list of algorithms

- Read their code
- Understand why they work
- Try to implement them

Approach: abstract thinking

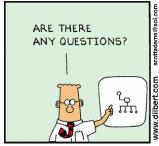- Develop new solutions for unusual problems

About interaction during the lecture

Ask questions!!

- If I'm not clear enough, stop me!
- If you want additional information, ask!

He who asks a question is a fool for a minute; he who does not ask a question remains a fool forever

Chinese proverb

Course material

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http://disi.unitn.it/~passerini/teaching/2022-2023/sci-pro/
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- Slides and notes (in development)
- Links to additional material

Moodle course page

- Communications
- Lecture recordings

Instructors: Part A - Programming

- Instructor: Prof. Andrea Passerini
  - Theory lectures, programming exercises
  - andrea.passerini [AT] unitn.it

- Teaching assistant: Dr. Erik Dassi
  - Python lab sessions (QCB)
  - erik.dassi [AT] unitn.it

- Teaching assistant: Antonio Longa
  - Python lab sessions (data science)
  - antonio.longa [AT] unitn.it

Instructors: Part B - Algorithms

- Instructor: Dr. Alessandro Romanel
  - Theory lectures, algorithmic exercises
  - alessandro.romanel [AT] unitn.it

- Teaching assistant: Dr. Luca Marchetti
  - Lab sessions on algorithms (QCB)
  - luca.marchetti [AT] unitn.it

- Teaching assistant: Dr. Davide Bressan
  - Lab sessions on algorithms (data science)
  - davide.bressan-1 [AT] unitn.it

Schedule

Week day	Time	Room	Description
Monday	14.30-16.30	a107	Lecture
Tuesday	14.30-16.30	a201	QCB Lab
Tuesday	14.30-16.30	b106	DS Lab
Thursday	11.30-13.30	b108	Lecture
Friday	16.30-18.30	a201	QCB Lab
Friday	16.30-18.30	a201	DS Lab

Exam

145540,145685 Scientific Programming (12 credits)

- Lab exam
  - Python programming
  - Simple algorithmic problems
  - Questions about computational complexity

145912 Scientific Programming (6 credits, Math)

- Lab exam
  - Python programming

Dates

Midterms

Midterm 1 (1.5h)	beg of Nov
Midterm 2 (1.5h)	half Dec

Full exams

January (3h)	TBD
February (3h)	TBD
June (3h)	TBD
July (3h)	TBD
September (3h)	TBD

Exam Rules

145540,145685 Scientific Programming (12 credits)

- If you need to pass **both** parts to pass the exam. The mark is computed as the average of the marks of the two parts, rounded up (e.g. $(25+26)/2 = 26$)

- A part is passed if you take at least 18 in the corresponding midterm exam, or the corresponding part of the full exam (which contains both parts)

- You enrol to the full exam by enrolling to the part(s) you want to take (both, if you want to take both). If you enrol to a single part, you have 1.5h. If you enrol to both parts, you have 3h.

- You can take a part in one session (e.g., January/February), and the other in another session (e.g., June/July).

Exam Rules

continued

- If you are not happy with the mark you took in a part, you can enrol for that part in a new session. Note that upon enrolling for a part in a session, you loose the previous mark you had (even if you then fail that part).

- You cannot take an exam if you are not enrolled. If you cannot enrol (e.g., because you don't have a matricola yet), you need to enrol by sending an email to the instructor (this implies loosing the previous mark, as for the formal enrollment)

- Once you successfully passed both parts, you need to enrol to a registration session to have your mark registered.

Exam Rules

145912 Scientific Programming (6 credits)

- If you pass the midterm exam, you can register the mark by enrolling to a regular session. Please write an email to the instructor of the first part to inform him that you want to register the mark.

- If you passed the midterm exam, but you are not happy with the mark you can enrol to a regular session to take the exam again. The result of the regular session exam will be your new mark, you cannot backtrack to the midterm mark.

- After the mark of a regular session have been published, you have a week to refuse it, after which it will be registered (silent assent registration).