Scientific Programming

Course introduction

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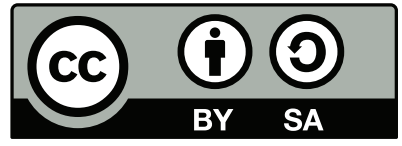


Organization

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

Part A - Programming (23/9-31/10)

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 (4/11-12/12)

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

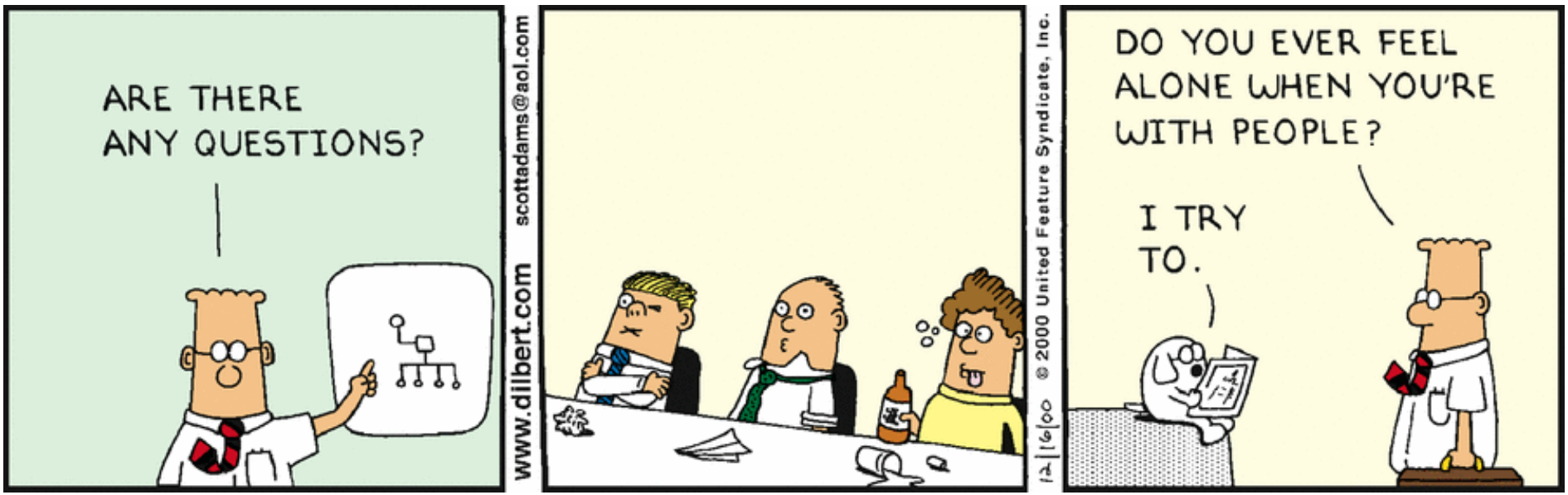
About interaction during the lecture

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 website

`http://disi.unitn.it/~passerini/teaching/2019-2020/sci-pro/`

- Slides and notes (in development)
- Links to additional material

Instructors: Part A - Programming

- Instructor: Prof. Andrea Passerini
  - Theory lectures, programming exercises
  - andrea.passerini [AT] unitn.it
- Teaching assistant: Dr. Luca Bianco
  - Python lab sessions (QCB)
  - luca.bianco [AT] fmach.it
- Teaching assistant: Dr. David Leoni
  - Python lab sessions (data science)
  - david.leoni [AT] unitn.it

Instructors: Part B - Algorithms

- Instructor: Dr. Luca Bianco
  - Theory lectures, algorithmic exercises
  - luca.bianco [AT] fmach.it
- Teaching assistant: Dr. Massimiliano Luca
  - Lab sessions on algorithms (QCB)
  - massimiliano.luca [AT] unitn.it
- Teaching assistant: Dr. David Leoni
  - Lab sessions on algorithms (data science)
  - david.leoni [AT] unitn.it

Schedule

Week day	**Time**	**Room**	**Description**
Monday	14.30-16.30	A107	Lecture
Tuesday	15.30-17.30	A107	Lab. QCB
Tuesday	15.30-17.30	A103	Lab. Data Science
Wednesday	11.30-13.30	A107	Lecture
Thursday	15.30-17.30	A107	Lab. QCB
Thursday	15.30-17.30	A208	Lab. Data Science

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)	Beginning of November?
Midterm 2 (1.5h)	Week before XMas?

Full exams

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

Tell us something of yourselves

Non-anonymous survey about you

`https://docs.google.com/forms/d/18iGAsOV8NGHus4Y34mpOC7fhPijb`