# IT coding and applications

## Prof. Daniele Tessera; Prof. Emanuele Goldoni

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

Quantitative data analysis of complex systems in economics and social sciences require a multidisciplinary methodological training. Computer science, especially its algorithmic aspects, constitutes one of the fundamental building blocks of such preparation.

This course aims to provide students modern computational capabilities for quantitative data analyses and is organized into two modules: Basic Programming and IT concepts (module A - 30 hours) and Introduction to algorithms and methods for Data Analysis (module B - 30 hours).

In the first module students are introduced to computer programming, starting from the foundations of coding up to basic data structure and algorithm implementations. Programming laboratories based on the Python programming language.

The second module focuses on algorithms for data analysis and visualization by providing hands-on experience on a real dataset. In addition, the lab sessions will give an overview of basic implementation of algorithms for automated data processing and extraction of useful trends and indexes. At the end of the course students will be able to realize simple Python coding using popular toolkits to exploit basic data analysis capabilities.

*Intended learning outcomes*

* Understanding the components of computer programming
* Working knowledge of python programming language
* Familiarity with basic data structures and algorithm implementations
* Working knowledge of the steps involved in the development of an application for data analysis

***COURSE CONTENT***

1. Introduction to computational thinking focused to data analysis applications.
2. Basic Python programming capabilities.
3. Introduction to some very popular programming techniques.
4. Introduction to data management and processing framework.
5. Hands-on experience on plots and data visualization
6. Introduction to linear regression and binary logistic regression
7. Introduction to clustering algorithms for unsupervised machine learning
8. Overview of basic neural network principles and algorithms

***READING LIST***

 Lecture notes and online contents

***TEACHING METHOD***

The course will include lectures and class exercises based on traditional teaching and teach by example principles. It is strongly advised to attend to lectures for working on case studies and examples, and for revising materials.

The course also involves lectures and exercise sessions using personal notebooks/PC-labs.

Active participation, and ongoing personal study are required.

***ASSESSMENT METHOD AND CRITERIA***

The final exam is based on a written test (consisting of both open-ended and close-ended questions) on the topics discussed in module A and B. Students will be also asked to deliver an individual or small team (up to three participants) project or one essay, approved by instructors on course topics.

The test accounts for 26/30 and the project/essay contributes to 4/30 of the final grade.

***NOTES AND PREREQUISITES***

Prof. Daniele Tessera covers the first module while Prof. Emanuele Goldoni the second one.

Very basic knowledge on computer systems is required.

Attendance is strongly recommended.