

COMPUTATIONAL SOCIAL SCIENCE

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Introduction to Computational Social Science

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Introduction

The ever increasing availability of data represents an opportunity and also a challenge for contemporary social scientists. Such trend is opening new research pathways - either by allowing scholars to study phenomena that were previously precluded, or by offering stronger empirical evidence for already established theories. However, collecting, cleaning, processing, handling and storing large bodies of data require a skill-set that used to be solely part of the domain of computer scientists.

This class will serve as an entry path to such competences as it will focus on learning the basics of Python programming. Python is a very readable, easy to use, yet powerful high-level programming language that is becoming one of the more popular programming languages for scientific research. The other big application for Python is the WWW; some of the biggest web sites (youtube.com, reddit.com...) are written in Python. One of the main advantages of Python is that it is designed to facilitate usability rather than minimizing computing time. Python thus is not the fastest computer language, but it allows moving from idea to actual implementation very easily.

Objectives

This course will have a strong practical orientation. The objective is for you to learn the basics of Python programming, through which we will learn how to handle and process large bodies of data. While you will NOT master Python by the end of this class, you will be in the position of continuing to build your competences on the strong foundations provided. Also, you will be able to better evaluate the feasibility and the skills required for any of your research projects in the future.

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At the end of this module, you will be able to write simple programs in Python, and be able to use effectively different types of data structures, control flows, handling data input and output, call functions and instantiate objects.

Learning outcomes

- Utilize Python as a calculator
- Develop a simple Python program
- Devise strategies to handle large quantities of data using computational techniques

General competences

- Basic programming
- Basic data management
- Basic database design

Specific competences

- Dominance of Python syntax
- Input and output of basic data files
- Using pandas for data management
- Querying and updating MySQL databases

Content

The class will cover the following topics:

1. Python data types
2. Containers and iterations
3. Control flows and generators
4. Functions and code organization
5. Text files input/output
6. Classes and objects
7. Introduction to pandas
8. Introduction to MySQL

Methodology

The class will use a flipped classroom design. Students will be required to watch a series of videos before coming to class, and complete/submit an assignment. We will use class time to review exercises, introduce more advanced topics and practice in teams.

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Evaluation

This class will require a set of deliverables. A number of weekly homework assignments will be required to build familiarity with Python. There will also be a mid-term and a final exam, both of which will be administered as a take home exam.

Grading schema	
In-class participation	10%
Homework assignments	30%
Mid-term exam	30%
Final exam	30%

Course Material

Students will be provided with class material written by the instructors. The class will also be based on videos from various online courses.

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Course Outline:

Session 1-2: Sept 14th (9.30am-12:15pm)

Introduction to the Tools and Python Essentials: Data Types, Variables, Containers, and Operators

Learning objectives:

- Mathematics and syntax: Using Python as a calculator.
- Basic Python operators and basic data structures (integer, strings)
- Introduction to the Boolean type
- Introduction and applications of lists, dictionaries, and sets
- Examples of using lists, dictionaries, and sets for data processing: it's all about Iterating.

Required pre-session assignments:

- Download and install Anaconda and Pycharm (instructions will be sent by email)
- Watch “#0 Python Tutorial | Python Programming Tutorial for Beginners | Course Introduction” (<https://www.youtube.com/watch?v=QXeEoD0pB3E>)
- Watch “#1 Python Tutorial for Beginners | Introduction to Python” (<https://www.youtube.com/watch?v=hEgO047GxaQ>)
- Watch “#3 Python Tutorial for Beginners | Getting Started with Python” (<https://www.youtube.com/watch?v=DWgzHbglNlo>)
- Watch “#4 Python Tutorial for Beginners | Variables in Python” (<https://www.youtube.com/watch?v=TqPzwenhMj0>)
- Watch “Python Tutorial for Absolute Beginners #1 - What Are Variables?” (from 7:50) (<http://www.youtube.com/watch?v=Z1Yd7upQsXY&t=7m50s>)
- Watch “#5 Python Tutorial for Beginners | List in Python” (<https://www.youtube.com/watch?v=Eaz5e6M8tL4>)
- Watch “Introduction To Lists In Python (Python Tutorial #4)” (<https://www.youtube.com/watch?v=tw7ror9x32s>)
- Watch “#6 Python Tutorial for Beginners | Tuple | Set in Python” (<https://www.youtube.com/watch?v=Mf7eFtbVxFM>)
- Watch “How To Use Dictionaries In Python (Python Tutorial #8)” (<https://www.youtube.com/watch?v=ZEZdys-fHDw>)
- Watch “Learn Python Programming - 16 - Dictionaries” (<https://www.youtube.com/watch?v=l46sJnu51GY>)
- Watch “#9 Python Tutorial for Beginners | Data Types in Python” (<https://www.youtube.com/watch?v=gCCVsvgR2KU>)

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- Watch “#10 Python Tutorial for Beginners | Operators in Python” (<https://www.youtube.com/watch?v=v5MR5JnKcZI>)
 - Watch “Python Tutorial: Boolean Operators In Python #39” (<https://www.youtube.com/watch?v=C17LN3Gr2y4>)
 - Skim the following articles:
 - Srivastava, S. B., Goldberg, A., Manian, V. G., & Potts, C. 2017. Enculturation Trajectories: Language, Cultural Adaptation, and Individual Outcomes in Organizations. Management Science.
 - Kaplan, S., & Vakili, K. 2015. The double-edged sword of recombination in breakthrough innovation. Strategic Management Journal, 36(10): 1435-1457.
 - Aral, S., & Walker, D. 2011. Creating social contagion through viral product design: A randomized trial of peer influence in networks. Management Science, 57(9): 1623-1639.
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Session 3-4: Oct 16th (9.30am-12:15pm)

Conditional Execution and Iteration

Learning objectives:

- Control flows (if statements): Instruct Python to do what you really want.
- Iterations: Looping the loop

Required pre-session assignments:

- Watch “#15 Python Tutorial for Beginners | Working with PyCharm | Run | Debug | Trace | py file” (<https://www.youtube.com/watch?v=akcEaEH91gl>)
 - Watch “#17 Python Tutorial for Beginners | If Elif Else Statement in Python” (<https://www.youtube.com/watch?v=PqFKRqpHrjw>)
 - Watch “#18 Python Tutorial for Beginners | While Loop in Python” (<https://www.youtube.com/watch?v=HZARImviDxg>)
 - Watch “#19 Python Tutorial for Beginners | For Loop in Python” (<https://www.youtube.com/watch?v=0ZvaDa8eT5s>)
 - Watch “Introduction to For Loops in Python (Python Tutorial #5)” (<https://www.youtube.com/watch?v=OnDr4J2UXSA>)
 - Watch “List Comprehension || Python Tutorial || Learn Python Programming” (<https://www.youtube.com/watch?v=AhSvKGT8Q>)
 - Watch “Dictionary Comprehensions in Python” (https://www.youtube.com/watch?v=J_R2nxy1nQY)
 - **Submit Assignment 1**
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Session 5-6: Sep 20th (9.30am-12:15pm)

First Exam + Debrief

The exam will cover the contents of the first 4 sessions and will take place during the first session (from 9:30am to 10:45am). We'll use the second session (from 11:00am to 12:15pm) to go over the exam solution in detail.

Session 7-8: Sep 23th (9.30am-12:15pm)

Code organization: Functions, modules and scripts

Learning objectives:

- Introduction to Python functions
- Using the Python standard library

Required pre-session assignments:

- Watch “#28 Python Tutorial for Beginners | Functions in Python” (<https://www.youtube.com/watch?v=BVfCWuca9nw>)
 - Watch “#29 Python Tutorial for Beginners | Function Arguments in Python” (<https://www.youtube.com/watch?v=ijXMGpoMkhQ>)
 - Watch “#30 Python Tutorial for Beginners | Types of Arguments in Python” (https://www.youtube.com/watch?v=eci9iU_s6Ag)
 - Watch “#39 Python Tutorial for Beginners | Modules in Python” (<https://www.youtube.com/watch?v=1RuMJ53CKds>)
 - Watch “#55 Python Tutorial for Beginners | Exception Handling in Python” (<https://www.youtube.com/watch?v=6SPDvPK38tw>)
 - Watch “Python Tutorial: if __name__ == '__main__'” (<https://www.youtube.com/watch?v=sugvnHA7ELY>)
 - Submit Assignment 2
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Session 9-10: Sep 27th (9.30am-12:15pm)

Basic data input-output

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Learning objectives:

- Data input/output from csv
- Handling errors and exceptions
- Managing missing values

Required pre-session assignments:

- Watch “Text Files in Python” (<https://www.youtube.com/watch?v=4mX0uPQFLDU>)
- Watch “File Objects - Reading and Writing to Files” (<https://www.youtube.com/watch?v=Uh2ebFW8OYM>)
- Watch “CSV Files in Python” (<https://www.youtube.com/watch?v=Xi52tx6phRU>)
- Watch “CSV Module - How to Read, Parse, and Write CSV Files” (<https://www.youtube.com/watch?v=q5uM4VKywbA>)
- Watch “OS Module - Use Underlying Operating System Functionality” (<https://www.youtube.com/watch?v=tJxcKyFMTGo>)
- **Submit Assignment 3**

Session 11-12: Sep 30th (9.30am-12:15pm)

Second Exam

The exam will cover the contents of sessions 6 through 10 and will take place during the first session (from 9:30am to 10:45am). We’ll use the second session (from 11:00am to 12:15pm) to go over the exam solution in detail.

Session 13-14: Oct 4th (9.30am-12:15pm)

Classes and Objects: Working with Pandas Series and DataFrames

Learning objectives:

- Introduction to Classes and Objects
- Using pandas to perform data management and transformations
- Pandas Series and Pandas DataFrames
- Selecting, ranking, and sorting data.
- Summary statistics on Series and DataFrames.
- Merging, concatenating, and combining DataFrames.

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Required pre-session assignments:

- You have to enroll in the Udemy course: “Learning Python for Data Analysis and Visualization ” at: <https://www.udemy.com/learning-python-for-data-analysis-and-visualization/>. It costs 10 € but you will be reimbursed.
 - Watch the following videos:
 - From the section **Intro to Pandas: Series, DataFrames, Index objects, Selecting Entries, Rank and Sort, Summary Statistics, and Missing Data.**
 - From the section **Working with Data: Part 1: Merge, Concatenate, Combining DataFrames.**
 - From the section **Working with Data: Part 2: GroupBy on DataFrames, GroupBy on Dict and Series, and Aggregation.**
 - Submit Assignment 4
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Session 15-16: Oct 7th (9.30am-12:15pm)

Introduction to SQL

Learning objectives:

- Introduction to SQL
- Creating and describing Tables
- Basic Operations on Tables: SELECT, UPDATE, and DELETE rows.

Required pre-session assignments:

- TBA
 - Submit Assignment 5
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Session 17-18: Oct 14th (9.30am-12:15pm)

SQL Applications

Learning objectives:

- Managing data with MySQL: loading and dumping databases.
- Complex Queries: grouping, ordering, and limiting.
- Operations on Tables: INNER JOIN, OUTER JOIN and UNION
- Storing complex queries: Database VIEWS

Required pre-session assignments:

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- TBA
- Submit Assignment 6

Session 19-20: Oct 18th (9.30am-12:15pm)

Exam on SQL and Introduction to Python applications for quantitative research

The exam will cover the contents of sessions 12 through 18 and will take place during the first session (from 9:30am to 10:45am). We'll go through cool applications of Python programming and packages for quantitative research: Social Network Analysis, Natural Language Processing, and Web scrapping.
