

MATHEMATICS II

MRM Term 1 - Fall 2018

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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.

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.

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.

Class schedule

Session 1: Sept 26th (2.30pm-3:45pm)

Introduction to the Tools and Python Data Types (Numbers, Boolean and Strings)

Learning objectives:

- Mathematics and syntax: Using Python as a calculator.
- Basic Python operators and basic data structures (integer, strings)
- Introduction to the Boolean type

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>)
 - 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 2: Oct 4th (2.30pm-3:45pm)

Variables, Containers and Operators

Learning objectives:

- 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:

- Watch “#3 Python Tutorial for Beginners | Getting Started with Python” (<https://www.youtube.com/watch?v=DWgzHbglNIo>)

- 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>)
 - 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=CI7LN3Gr2y4>)
 - **Submit Assignment 1**
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Session 3: Oct 11th (9.30am-10:45am)

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=akcEaEH91gI>)
- 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>)
 - **Submit Assignment 2**
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Session 4: Oct 18th (2.30pm-3:45pm)

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)
 - TBA
 - **Submit Midterm**
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Session 5-6: Oct 31st (9.30am-12:15pm)

Basic data input-output

Learning objectives:

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

Required pre-session assignments:

- TBA
 - **Submit Assignment 3**
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Session 7-8: Nov 15th (9.30am-12:15pm)

Classes and Objects: Introduction to pandas

Learning objectives:

- Introduction to objects
- Using pandas to perform data management and transformations

Required pre-session assignments:

- TBA
 - Submit Assignment 4
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Session 9-10: Dec 3rd (9.30am-12:15pm)

Working with databases

Learning objectives:

- Linking Python to a SQL database
- Introduction to basic SQL commands (SELECT, INSERT, UPDATE, JOIN)

Required pre-session assignments:

- TBA
 - Submit Final Exam
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