

# Programming and Mathematics Bootcamp

UCLA Anderson School of Management (Summer 2022)

July 22, 2022

## 1 Introduction

Hi MFE Class of 2023!

Welcome to the programming and mathematics bootcamp. Tobias and I (Anand) will be your instructors for this bootcamp. We will discuss some topics in programming and mathematics that will help you prepare for the MFE program and job interviews. This document will walk you through the workshop structure and the required software. This will involve downloading and installing just one software (Anaconda), which comes with the Python programming language and multiple environments (Jupyter, Spyder, etc.) to write and compile your code.

## 2 Bootcamp Structure

### 2.1 Outline

The bootcamp will be 6 weeks long. We will have 18 classes in total and meet 3 times each week. A list of topics that we will cover are (not exhaustive) -

- **Week 1:** Python programming (data types, NumPy, Pandas, functions, loops, Matplotlib)
- **Week 2:** Probability theory (elements of probability, bayes theorem, densities, distributions)
- **Week 3:** Statistics (expectation, higher order moments, correlation, causation, CLT, LoLN)
- **Week 4:** Linear algebra (matrix algebra, projection, principal components, regression)
- **Week 5:** Portfolio theory (asset allocation, mean-variance frontier)
- **Week 6:** Time-series econometrics (autoregressive, moving average models) and numerical methods (lagrange multipliers, constrained optimization)

### 2.2 Assignments

We will have assignments distributed at the end of each class and due start of next class. You will be divided into groups of 4 and are highly encouraged to discuss these assignments with your group members.

Please **email** all your assignments to Tobias at [tobias.ingebrigtsen.phd@anderson.ucla.edu](mailto:tobias.ingebrigtsen.phd@anderson.ucla.edu) **before** the start of the next class. If it is a programming based assignment, you are encouraged to do it in Python. If the assignment involves solving problems, you can use LaTeX or scan your handwritten work and email the PDF. *Suggestion* : Overleaf is a great platform for collaborating with your colleagues. We will not be having any final or midterm exams.

### 2.3 Other Admin Points

The bootcamp will be help remotely. The zoom link for the meeting and the detailed class timings will be shared in the email. Codes and other class material will be shared via Github and email.

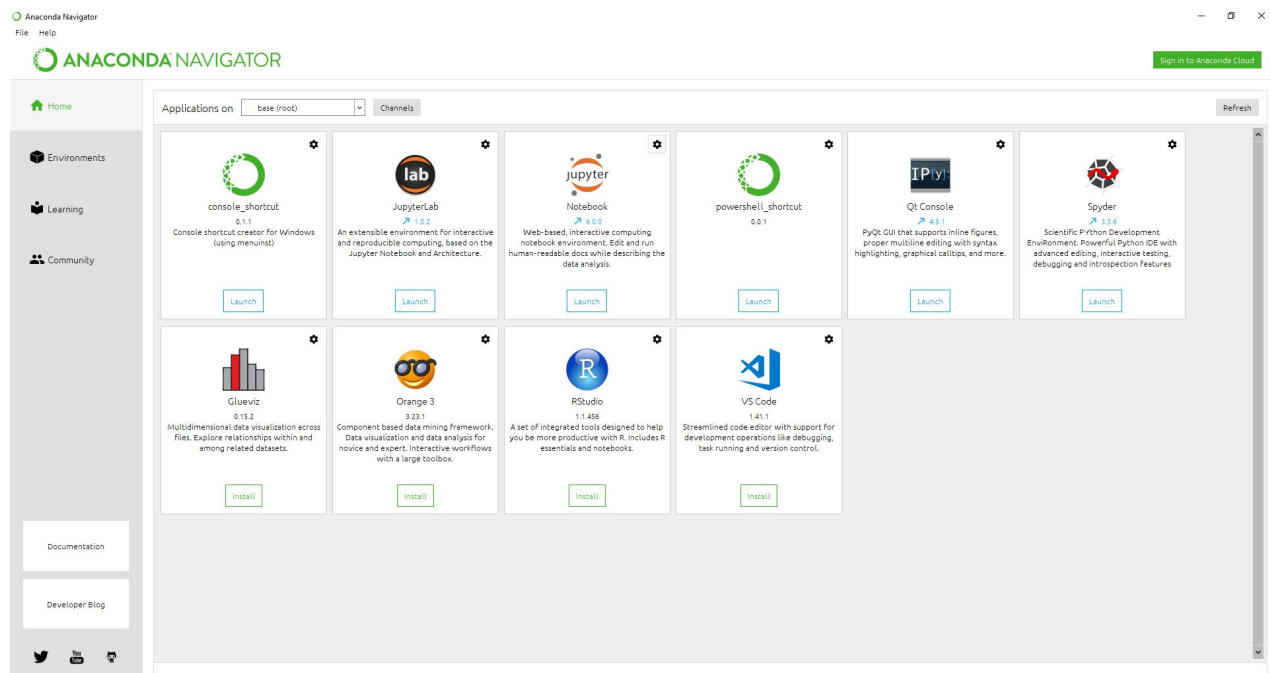
## 3 Python

This section will walk you through the steps in downloading and installing Python programming software on your system.

Python was originally designed for readability and flexibility. It is a language that displays complexity through simplicity. The applications range from software development to database management and from web applications to analyzing big data. Compared to R, which is geared specifically towards data analysis, Python is more versatile. Compared to MATLAB, which is not open source, Python is free. And finally, compared to lower-level programming languages like C++ & Java, Python is relatively easy to learn and program in!

### 3.1 Installing Anaconda

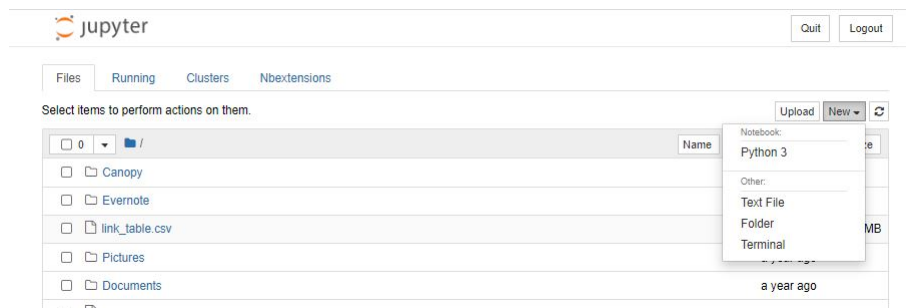
The most recent version of Python is Python3. The interpreter we will be installing for Python3 is Anaconda. The link to download and install is <https://www.anaconda.com/distribution/#download-section>. Click, download and install **Python3.9** for your operating system (Windows, Linux, or macOS). After successfully installing Anaconda on your system and opening it, you will see the following screen



For the purpose of this workshop, we will be using Jupyter notebooks. However, you are encouraged to explore other Python environments like Spyder and PyCharm etc.

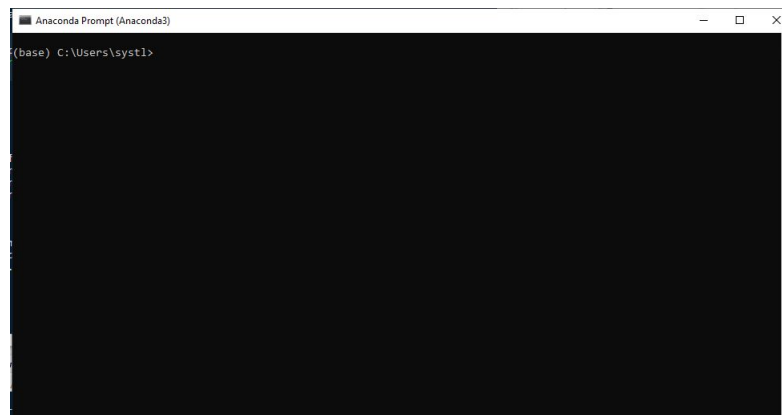
### 3.2 Jupyter Notebook

For the next step, launch the Jupyter notebook. Your Jupyter notebook will open in a web browser. Jupyter Notebook is a web based interactive environment. The extension under which a Jupyter Notebook is saved is ".ipynb". The Jupyter Notebook can support multiple programming languages (**J**ulia, **P**ython, and **R**, etc.) and can be converted to number of open standard output formats (HTML, PDF, .py etc.). You will get familiar with this interface over the next few days.



### 3.3 Anaconda Prompt

The command prompt (CMD) allows you to communicate with your computer. Post installation, a new command prompt (specifically for Anaconda) is also installed. Anaconda command prompt is just like command prompt, but it makes sure that you are able to use anaconda and conda commands directly from the prompt, without having to change directories or your path (which can be quite painful!).



We will be using only the **Anaconda Prompt** and not your system's command prompt for installing and updating packages. Once you open Anaconda Prompt you will see the following black screen. Mac users open launchpad and click on the terminal icon.

## 4 Resources

With growing number of books and online resources, we have tried to list some of the resources that will be helpful to continue your education in Python and mathematics beyond this bootcamp. This list is not exhaustive by any means and you are encouraged to look further -

- **Python programming books**

1. Python For Finance by Yves Hilpisch, O'Reilly 2014 (Intermediate Level)
2. Python For Data Analysis by Wes McKinney, O'Reilly 2013 (Intermediate Level)
3. Other mentions: Pro Python by Marty Alchin, Python Cookbook by David Beazly

- **Websites (queries and competitions)**

1. Hacker Rank (competitive programming challenges platform)
2. Kaggle (Data science & quant finance competitions)
3. QuantConnect (quant trading and back testing platform)
4. Stack Overflow is every programmers go-to website for queries and bugs. There is a good chance someone else had the same problem as you and an expert has provided a solution to the problem on this website. You'll be visiting this website .. a lot!

- **Mathematics text books and MOOCs**

1. Statistical Inference by Casella and Berger
2. Introduction to Linear Algebra by Gilbert Strang (check out his MIT OCW youtube videos!)
3. Monte-Carlo Methods in Financial Engineering by Glasserman
4. Elements of Statistical Learning by Friedman, Tibshirani & Hastie

If any questions arise, do not hesitate to contact us. We look forward to meeting you all soon!

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