



Training: Python

Python is the core language of ROS (Robot Operating System). Robot's motion planning, manipulation, navigation, localization, image processing, physics simulation, etc are research programmed commonly using Python.

We encourage you to refer material apart from the stuff given below as well to expand your understanding. We have tried to curate a list of resources we found would utilize your time the best way.

Please read the entire document before beginning with anything

Introduction:

I recommend you to go through this course in Coursera if you are completely new or not at all confident with programming especially with C++.

<https://www.coursera.org/specializations/python-3-programming#courses>

Watch only the videos, Don't get deviated with the Reading and Project parts in the course

- In the first course:

Do only week 1 and week 2 and basic if-else loops in week 3

- In the 2nd course:

Do only Dictionary basics in week 2

Do week 3 and week 4 only

- In the 4th Course:

Do week 1 and week 2 only.

You should skip course no.3 in this specialization i.e Data Collection and Preprocessing and course no. 5.

Note: For accessing a single course from a specialization course, you can select a single course and click on enrol and then click on "audit the single course".

You can follow this youtube tutorial https://www.youtube.com/watch?v=_uQrJ0TkZlc if you are already familiar with little Python or confident in basic programming, follow this video at your comfortable speed ($\geq 1x$) asap and complete it in a day. He uses Python 3xx version. Make sure you are well versed with classes if you are following this.



Also after you complete this go through this short lecture series for reference for OOP concepts **assuming** you haven't understood it properly (no need if you have done the coursera course), <https://www.youtube.com/watch?v=ZDa-Z5JzLYM&list=PL-osiE80TeTsghluOqKhwlXsIBldSeYtc> This is very important make sure you pay good attention as you will come across this very much frequently.

Installation:

For windows: You can install python as shown in the video above(recommended) or can do it from here <https://www.python.org/downloads/windows/>

Note: In ubuntu you already have a python version so you could just go into terminal and type python and enter. But you will be needing an editor for sure.

Visual Studio Code : Text Editor

I recommend you use Visual Studio Code as your Primary code editor instead of PyCharm as shown in the videos. You can watch short videos like

https://www.youtube.com/watch?v=h0HbFnb8bC8&ab_channel=CodingGeek to run python in vscode. Also Visual Studio Code is very flexible when it comes to dealing with GitHub Repositories. *(Never heard of git? No worries, we'll catch on it once you finish python)*

Note (tips):

1) **Practice** - Completing a course, book wouldn't make you a good programmer, instead it gives an idea of how things can be used . So i would recommend you to keep practicing and solve even basic problems using this. Also to learn you will be doing lot of searches in the internet and refer docs (<https://docs.python.org/3/>) or <https://www.w3schools.com/python/default.asp> or **ask us** whenever you have doubts.

2) **Modules**- Also you would be extensively working on modules like numpy,os etc . I'll attach a few references below.

PIP

Follow the short tutorial in this website

https://www.w3schools.com/python/python_pip.asp

The commands would be same even for Ubuntu



Important modules in python-

1) Numpy

Tutorial video - <https://youtu.be/GB9ByFAIAH4>

You can download the doc <https://numpy.org/doc/> as a reference for any further doubts.

2)Pandas

Tutorial video- <https://www.geeksforgeeks.org/pandas-tutorial/?ref=leftbar-rightbar>

See the “Working with CSV and Excel files” part only

3)Scikit Image

Tutorial video-<https://www.youtube.com/watch?v=xPrTHRbT1vY> -13 mins tut

4) Os(optional for now)

Tutorial video -<https://www.youtube.com/watch?v=tJxcKyFMTGo>



Assignment

You will be expected to solve these given set of problems(1-4) and submit the solutions for them

Q1) A pair of prime numbers are called twin primes if they differ by 2, for example (5,7), (11, 13) are twin primes. Find and report all twin primes having d decimal digits. You are expected to report the results in myFirstFile.txt file using your code. You can refer to the internet on how to write to a txt file.

Ex:

Input:

1

Output:

A myFirstFile.txt file with first line 3 5 and the second line 5 7.

Q2) Given a palindrome number, find the next smallest palindrome in an efficient way.Ex:

Input: 999

Input: 121

Output: 1001

Output: 131

Q3) Implement the class of Complex numbers,It should have methods like addition, subtraction, modulus (magnitude), multiplication, conjugate, display and inverse.

Ex:

a = Complex(1,2) #### a would refer to 1+2*i

a .display() #### prints out "1 + 2i"

b = Complex(2,-3)

c = b.add(a)

c.display() #### prints out "3 - 1i"

c.conjugate().display() ### prints "3+1i"

Q4) Write a NumPy program to calculate theta(matrix) using the normal equation

Normal equation

$$\theta = (X^T X)^{-1} X^T y$$

Where X is any random normalized numpy matrix of shape(20 x 20), y is a numpy array of length 20 and data type "int32". Look for np.random.normal, np.dtype for reference.



Q5) (Optional)

You are given prices for a particular stock for the next n days, say p_1, p_2, \dots, p_n . You want to buy one stock on one of the upcoming days and sell it on a later day. Both buying and selling should be done within the next n days. You want to find out which buying and selling days will maximize your profit. If multiple of these options are possible print with the earliest buying date.

Can you think of a very much efficient solution for this?

Ex:

The first line of input contains no. of days and the second line contains prices separated by space.

For the output, The first line prints maximum profit possible. The second line prints the earliest buy date possible such that profit is maximised.

Input:

5

100 10 1110 5000 4000

Output:

4990

2