# Python Programming Language

#### Prepared by: Mohamed Ayman

Algorithm Engineer at Valeo
Deep Learning Researcher and Teaching Assistant
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spring 2020







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github.com/cs-MohamedAyman



codeforces.com/profile/Mohamed\_Ayman



#### **Mohamed Ayman**

#### **Experience**



- Valeo
  - Deep Learning Researcher
  - Algorithm Software Engineer



- The American University in Cairo (AUC)
  - Research Assistant
  - Teaching Assistant
- BBI Consultancy
  - Research and Development Engineer (R&D Engineer)
  - Data Engineer



#### **Education**

- MSc in Deep Learning, Cairo University
- BSc in Computer Science, Cairo University

# Python Programming Language Training

# Lecture Agenda

We will discuss in this lecture the following topics

- 1- Python Features
- 2- Python Content
- 3- Practice on Online Judges
- 4- Tutorials and References
- 5- Online Courses
- 6- Python Installation

4



### What you will learn

python

- This course introduces the basics of Python 3, including conditional execution and iteration as control structures, and strings and lists as data structures. The course is for you if you're a newcomer to Python programming, if you need a refresher on Python basics, or if you may have had some exposure to Python programming but want a more in-depth exposition and vocabulary for describing and reasoning about programs.
- This course teaches you to fetch and process data using Python list comprehensions and provides opportunities to practice extracting from and processing deeply nested data. The course is well-suited for you if you have already taken the Python Basics and Functions, Files, and Dictionaries topics.

- This course introduces the dictionary data structure and user-defined functions. You'll learn about local and global variables, optional and keyword parameter-passing, named functions and lambda expressions. You'll also learn about Python's sorted function and how to control the order in which it sorts by passing in another function as an input. You'll read data from a file, and write out CSV files.
- This course introduces classes, instances, and inheritance. You will learn how to use classes to represent data in concise and natural ways. You'll also learn how to override built-in methods and how to create "inherited" classes that reuse functionality. You'll also learn about how to design classes. Finally, you will be introduced to the good programming habit of writing automated tests for their own code.

# Lecture Agenda



#### ✓ Section 1: Python Features

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**Section 5: Online Courses** 

Section 6: Python Installation





A simple language which is easier to learn

Python has a very simple and elegant syntax. It's much easier to read and write Python programs compared to other languages like: C++, Java, C#. Python makes programming fun and allows you to focus on the solution rather than syntax. If you are a newbie, it's a great choice to start your journey with Python.

You can freely use and distribute Python, even for commercial use. Not only can you use and distribute softwares written in it, you can even make changes to the Python's source code.

Python has a large community constantly improving it in each iteration.

3 Portability

You can move Python programs from one platform to another, and run it without any changes.

It runs seamlessly on almost all platforms including Windows, Mac OS X and Linux.

level operations.



A high-level, interpreted language

Unlike C/C++, you don't have to worry about daunting tasks like memory management, garbage collection and so on.

Likewise, when you run Python code, it automatically converts your code to the language your computer understands. You don't need to worry about any lower-

5 Large standard libraries to solve common tasks

Python has a number of standard libraries which makes life of a programmer

much easier since you don't have to write all the code yourself. For example: Need to connect MySQL database on a Web server? You can use MySQLdb library using import MySQLdb.

Standard libraries in Python are well tested and used by hundreds of people. So you can be sure that it won't break your application.

Object-oriented

Everything in Python is an object. Object oriented programming (OOP) helps you solve a complex problem intuitively.

With OOP, you are able to divide these complex problems into smaller sets by creating objects.



Simple & Easy to Learn



```
public class HelloWorld {
    public static void main(String[] args) {
        System.out.println("Hello, world");
    }
}

Python

print("Hello, world")
```



• Portable & Extensible





#### • Testing Frameworks

- > Python supports testing with cross-platform & cross-browser
- Built in testing framework which covers debugging time and fastest workflows

pytest





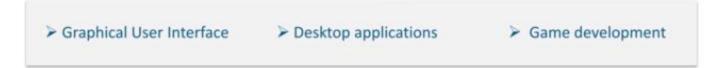


• Web Development





Computer Graphics















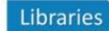






#### Data Science











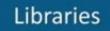




#### Big Data

- Python handles BIG DATA!
- Python supports parallel computing
- > You can write MapReduce codes in Python









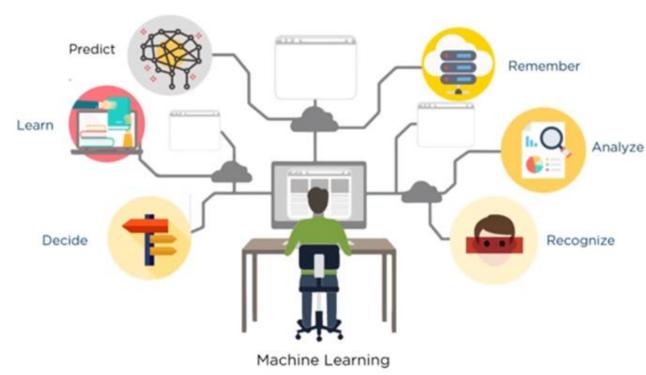






Artificial Intelligence





# Lecture Agenda



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### **Python Content**



Part 1: Python Basics and Functions Part 2: Python Collections and Strings

Lecture 1: Python Overview Lecture 7: Strings

Lecture 2: Variable Types Lecture 8: Lists

Lecture 3: Basic Operations Lecture 9: Tuples

Lecture 4: Conditions Lecture 10: Dictionaries

Lecture 5: Loops Lecture 11: Sets

Lecture 6: Functions Lecture 12: Numbers

### **Python Content**



Part 3: Python Object Oriented

Lecture 13: Object Oriented Overview

Lecture 14: Data Encapsulation

Lecture 15: Operator Overloading

**Function Overloading** 

Lecture 16: Inheritance

**Function Overriding** 

Lecture 17: Polymorphism

**Abstract Class** 

Part 4: Python Files and Standard Libraries

**Lecture 18: Modules** 

**Standard Libraries** 

Lecture 19: File Handling

Lecture 20: Exception Handling

#### Hands-on Projects & Practices



#### Python Basics Projects (4 Projects)

Project 1: Tic-Tac-Toe Game (python basics application)

Project 2: Connect Four Game (python basics application)

Project 3: Sudoku Game (python basics application)

Project 4: 2048 Game (python basics application)

#### Python Object Oriented Projects (4 Projects)

Project 1: Advanced Mathematical Calculator (python object oriented application)

Project 2: Library Management System (python object oriented application)

Project 3: Bank Management System (python object oriented application)

Project 4: Project Management System (python object oriented application)

Python Practices (30+ Practice Problems) on each Lecture

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#### Practice on Online Judges







codeforces.com

hackerearth.com





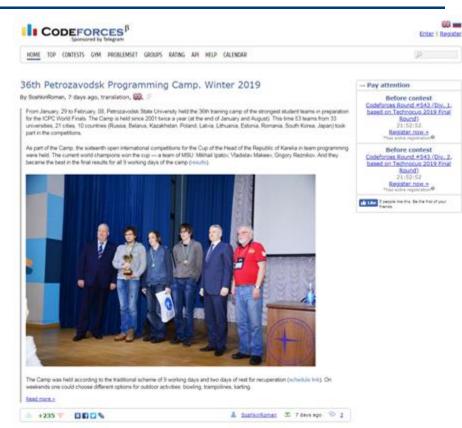
hackerrank.com

atcoder.jp

#### **Codeforces Online Judge**



Codeforces is a website that hosts competitive programming contests. It is maintained by a group of competitive programmers from ITMO University led by Mikhail Mirzayanov.





#### **Codeforces Online Judge**





Mohamed Ayman | Logout

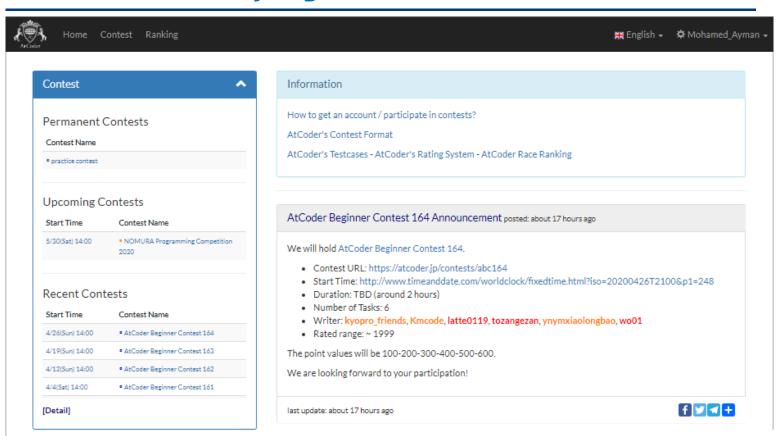
0 CONTESTS PROBLEMSET HELP CALENDAR ACMSGURU PROBLEMS SUBMIT STATUS STANDINGS CUSTOM TEST Problems :■ → Pay attention # Name **∮** ♦ Before contest **⋞**\* • Educational Codeforces Round 81 (Rated for Div. 2) 1294F Three Paths on a Tree dfs and similar, dp, trees 2100 x1488 3 days 1294E Obtain a Permutation greedy, implementation, math 2000 x1886 137 people like this. Be the first of your MEX maximizing data structures, math 1600 x4272 Product of Three Numbers greedy, math, number theory 1300 → Filter Problems x8603 Collecting Packages implementation, sortings 1200 Difficulty: x9042 1294A Collecting Coins 900 x12769 Apply 1293B JOE is on TV! combinatorics, greedy, math 1000 x9324 ConneR and the A.R.C. Markland-N 1293A binary search, brute force, implementation 1100 x8075 → Settings 1292F Nora's Toy Boxes bitmasks, combinatorics, do 3400 ₹ x24





#### AtCoder - Online Judge

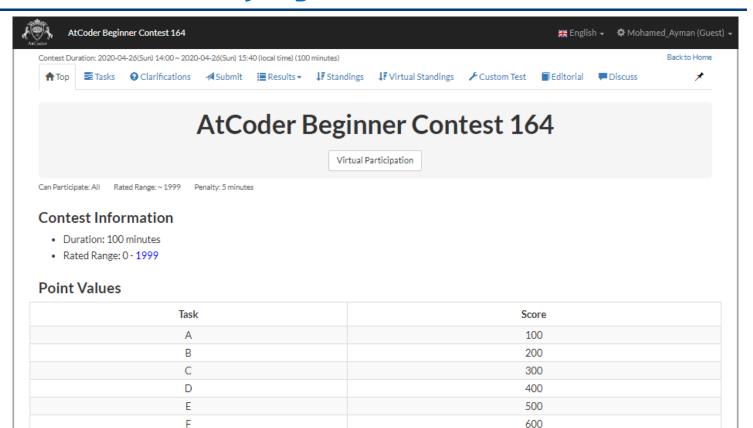






#### AtCoder - Online Judge







#### HackerRank - Online Judge



Virtual Event | 11/08 | Learn how to master the art and science of skill assessments | Live streamed from San Francisco

HackerRank

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Join over 5 million developers.

Practice coding, prepare for interviews, and get hired.















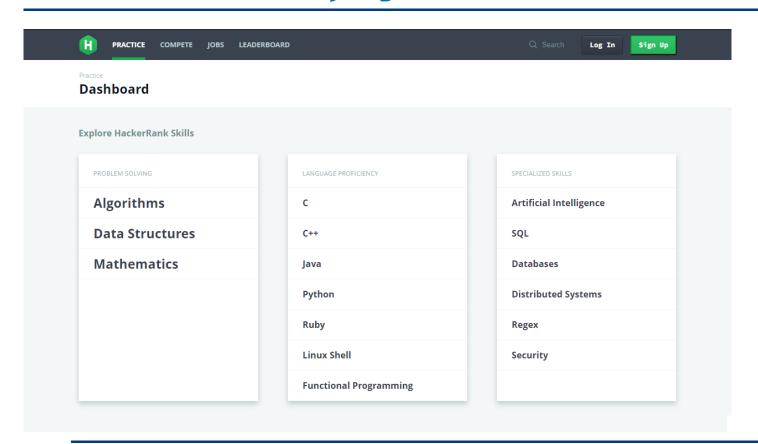






### HackerRank - Online Judge

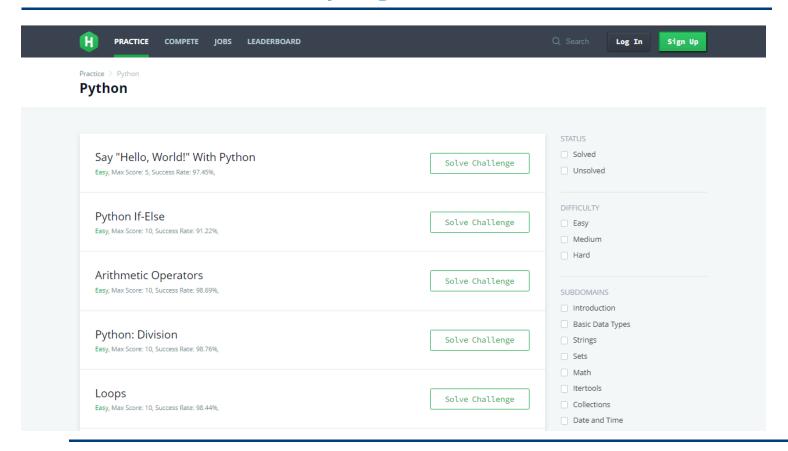






#### HackerRank - Online Judge



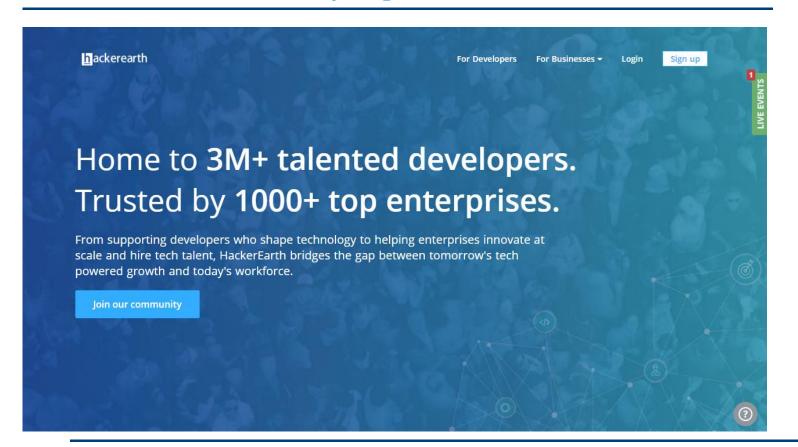




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#### HackerEarth - Online Judge

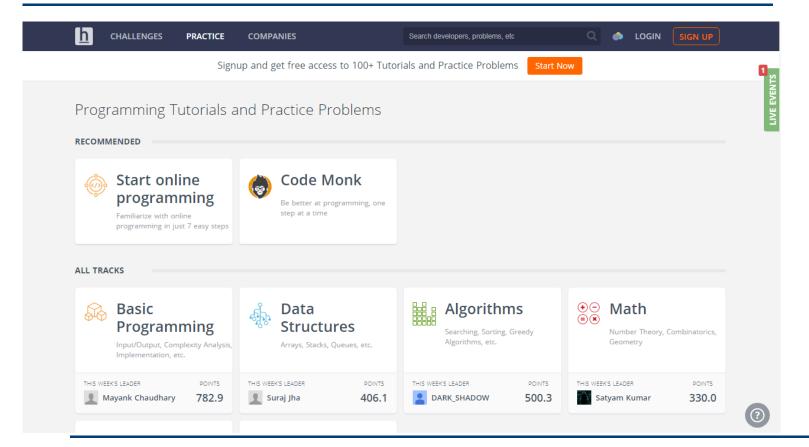






#### HackerEarth - Online Judge

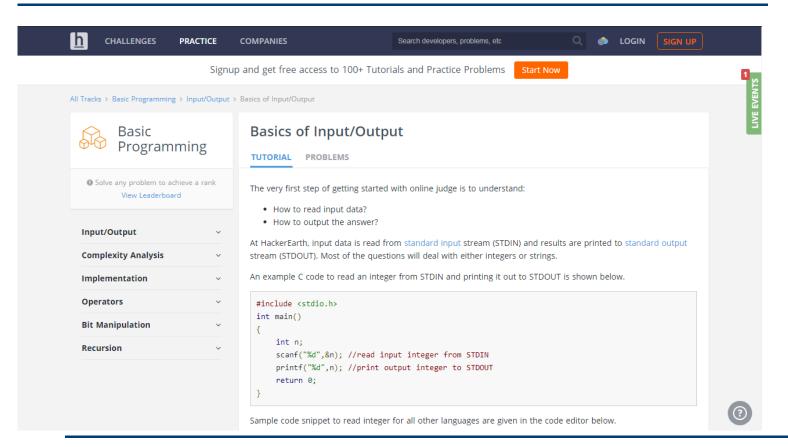






### HackerEarth - Online Judge







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#### **Python Tutorials**





programiz.com/python-programming



docs.python.org/3



geeksforgeeks.org/python-programming-language



tutorialspoint.com/python3

#### Python 3 TutorialsPoint



#### PYTHON 3 - BASIC TUTORIAL

[001 - 330]

- Python 3 - What is New?

- Overview

- Environment Setup

- Basic Syntax

- Variable Types

- Basic Operators

- Decision Making

- Loops

- Numbers

- Strings

- Lists

- Tuples

- Dictionary

- Date & Time

- Functions

- Modules

- Files I/O

- Exceptions Handling

#### PYTHON 3 - ADVANCED TUTORIAL

[330 - 500]

- Object Oriented

- Regular Expressions

- CGI Programming

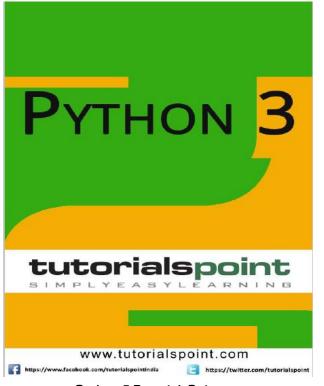
- MySQL Database Access

- Multithreaded Programming

- XML Processing

- GUI Programming

- Extension Programming with C



Python 3 TutorialsPoint

# Python Tutorial, Guido van Rossum



•	Using the Python Interpreter	[005 - 010]
•	An Informal Introduction to Python	[010 - 020]
•	More Control Flow Tools	[020 - 030]
•	Data Structures	[030 - 040]
•	Modules	[040 - 050]
•	Input and Output	[050 - 055]
•	Errors and Exceptions	[060 - 065]
•	Classes	[065 - 080]
•	Brief Tour of the Standard Library	[080 - 095]
•	Virtual Environments and Packages	[095 - 100]

Python Tutorial Release 3.6.4
Guido van Rossum and the Python development team
January 23, 2018
Python Software Foundation Email: docs@python.org

Python Tutorial, Guido van Rossum

### Python for Everybody, Charles R. Severance



•	Why should you learn to write programs?	[001 - 015]
•	Variables, expressions, and statements	[020 - 030]
•	Conditional execution	[030 - 040]
•	Functions	[040 - 055]
•	Iteration	[055 - 065]
•	Strings	[065 - 075]
•	Files	[080 - 090]
•	Lists	[090 - 105]
•	Dictionaries	[105 - 115]
•	Tuples	[115 - 125]
•	Regular expressions	[125 - 140]
•	Object-oriented programming	[170 - 185]
•	Using Databases and SQL	[185 - 210]

Python for Everybody

Exploring Data Using Python 3

Charles R. Severance

Python for Everybody, Charles R. Severance

### Learning to Program Using Python, Cody Jackson



•	Introduction	[010 - 015]
•	How is Python Different?	[015 - 020]
•	Comparison of Programming Languages	[020 - 030]
•	The Python Interpreter	[030 - 035]
•	Types and Operators	[035 - 040]
•	Strings	[040 - 050]
•	Lists	[050 - 055]
•	Dictionaries	[055 - 060]
•	Tuples	[060 - 070]
•	Files	[070 - 075]
•	Statements	[075 - 090]
•	Making a Program	[100 - 105]
•	Exceptions	[105 - 110]
•	Object Oriented Programming	[110 - 125]
•	Databases	[125 - 135]

Learning to Program Using Python

Cody Jackson

Learning to Program Using Python, Cody Jackson

### Think Python, Allen B. Downey



•	The way of the program	[001 - 010]
•	Variables, expressions and statements	[010 - 015]
•	Functions	[015 - 025]
•	Conditionals and recursion	[040 - 050]
•	Fruitful functions	[050 - 060]
•	Iteration	[060 - 070]
•	Strings	[070 - 080]
•	Lists	[090 - 100]
•	Dictionaries	[100 - 110]
•	Tuples	[110 - 120]
•	Files	[135 - 145]
•	Classes and objects	[145 - 155]
•	Classes and functions	[155 - 160]
•	Classes and methods	[160 - 170]
•	Inheritance	[170 - 180]

#### Think Python

How to Think Like a Computer Scientist

2nd Edition, Version 2.2.23

Think Python, Allen B. Downey

### Effective Python, Brett Slatkin



<ul> <li>Pythonic Thinking [001</li> </ul>	- 025]
--	--------

• Functions [025 - 050]

• Classes and Inheritance [050 - 075]

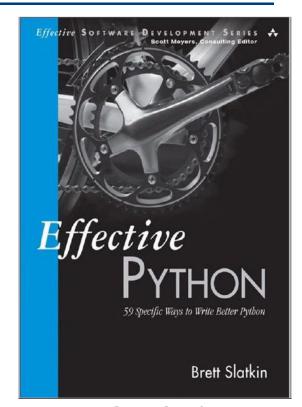
Metaclasses and Attributes [075 - 100]

• Concurrency and Parallelism [100 - 125]

• Built-in Modules [125 - 150]

• Collaboration [150 - 175]

• Production [175 - 200]

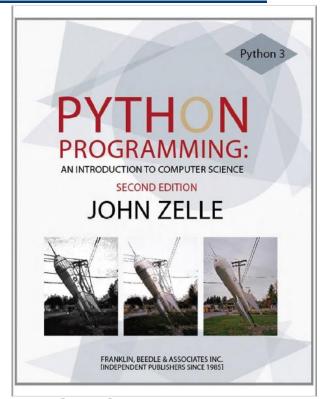


Effective Python, Brett Slatkin

# Python Programming, John Zelle



•	Computers and Programs	[001 - 020]
•	Writing Simple Programs	[020 - 045]
•	Computing with Numbers	[045 - 065]
•	Objects and Graphics	[065 - 100]
•	Sequences: Strings, Lists, and Files	[100 - 140]
•	Defining Functions	[140 - 165]
•	Decision Structures	[165 - 200]
•	Loop Structures and Booleans	[200 - 225]
•	Simulation and Design	[225 - 245]
•	Defining Classes	[245 - 280]
•	Data Collections	[280 - 325]
•	Object-Oriented Design	[325 - 360]
•	Algorithm Design and Recursion	[360 - 385]



Python Programming, John Zelle

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• Introduction to Scripting in Python Specialization (4 Courses) by Rice University coursera.org/specializations/introduction-scripting-in-python



#### **Course:** Python Programming Essentials

Week 1: Python as a Calculator

Week 2: Functions

Week 3: Logic and Conditionals

Week 4: Python Modules



Week 1: Strings

Week 2: Basics of Lists

Week 3: List Manipulation

Week 4: File Access







• Introduction to Scripting in Python Specialization (4 Courses) by Rice University coursera.org/specializations/introduction-scripting-in-python



#### Course: Python Data Analysis

Week 1: Dictionaries

Week 2: Tabular Data and Nested Data Structures

Week 3: Tabular Data and CSV Files

Week 4: Organizing Data



#### Course: Python Data Visualization

Week 1: Python Documentation

Week 2: Python Packages and Modules

Week 3: Python Sets

Week 4: Plotting GDP Data





Python 3 Programming Specialization (5 Courses) by University of Michigan

coursera.org/specializations/python-3-programming



#### Course: Python Basics

Week 1: General Introduction

Week 2: Sequences and Iteration

Week 3: Booleans and Conditionals

Week 4: Sequence Mutation and Accumulation Patterns



#### Course: Python Functions, Files, and Dictionaries

Week 1: Files and CSV Output

Week 2: Dictionaries and Dictionary Accumulation

Week 3: Functions and Tuples

Week 4: More Iteration and Advanced Functions

Week 5: Sorting







Python 3 Programming Specialization (5 Courses) by University of Michigan

coursera.org/specializations/python-3-programming



#### Course: Data Collection and Processing with Python

Week 1: Nested Data and Nested Iteration

Week 2: Map, Filter, and List Comprehensions

Week 3: Internet APIs



#### Course: Python Classes and Inheritance

Week 1: Classes

Week 2: Inheritance

Week 3: Unit Testing and Exceptions



#### Course: Python Project: pillow, tesseract, and opency

Week 1: The Python Imaging Library

Week 2: Tesseract and Optical Character Recognition

Week 3: Computer Vision with OpenCV





• Fundamentals of Computing Specialization (7 Courses) by Rice University coursera.org/specializations/computer-fundamentals



# Course: An Introduction to Interactive Programming in Python (Part 1)

Week 1: Statements, expressions, variables

Week 2: Functions, logic, conditionals

Week 3: Event-driven programming, local/global variables

Week 4: Canvas, drawing, timers

Week 5: Lists, keyboard input, the basics of modeling motion



# Course: An Introduction to Interactive Programming in Python (Part 2)

Week 1: Mouse input, list methods, dictionaries

Week 2: Classes and object-oriented programming

Week 3: Basic game physics, sprites

Week 4: Sets and animation





• Fundamentals of Computing Specialization (7 Courses) by Rice University coursera.org/specializations/computer-fundamentals



#### Course: Principles of Computing (Part 1)

Week 1: Required Python knowledge, coding standards, and machine grading

Week 2: Testing, plotting, and grids

Week 3: Probability, randomness, and objects/references

Week 4: Combinatorics, generators, and debugging

Week 5: Counting, growth of functions, higher-order functions



#### Course: Principles of Computing (Part 2)

Week 1: Searching and Data Structures

Week 2: Recursion

Week 3: Trees

Week 4: Modeling, Assertions, and Invariants





Fundamentals of Computing Specialization (7 Courses) by Rice University

<u>coursera.org/specializations/computer-fundamentals</u>





Week 1: Core Materials

Week 2: Project and Application

Week 3: Core Materials

Week 4: Project and Application



Week 1: Core Materials

Week 2: Project and Application

Week 3: Core Materials

Week 4: Project and Application



Course: The Fundamentals of Computing Capstone Exam

Week 1: Fundamentals of Computing Capstone Exam

# Python YouTube Playlists





<ul> <li>Playlist: Python Tutorial Videos   Simplilearn</li> </ul>	[40 videos] [20 H]	Channel: Simplilearn
<pre>youtube.com/playlist?list=PLEiEAq2VkUUKoW1o-A-VEmkoGKSC26i_I</pre>		
<ul> <li>Playlist: Python Tutorial For Beginners   Edureka</li> </ul>	[180 videos] [45 H]	Channel: edureka!
youtube.com/playlist?list=PL9ooVrP1hQOHY-BeYrKHDrHKphsJOyRyu		
<ul> <li>Playlist: Python Tutorial for Beginners</li> </ul>	[200 videos] [40 H]	Channel: ProgrammingKnowledge
<pre>youtube.com/playlist?list=PLS1QulWo1RlaJECMeUT4LFwJ-ghgoSH6n</pre>		
<ul> <li>Playlist: Python 3 Programming Tutorial</li> </ul>	[40 videos] [10 H]	Channel: codebasics
<pre>youtube.com/playlist?list=PLeo1K3hjS3usILfyvQlvUBokXkHPSve6S</pre>		
<ul> <li>Playlist: Learning to program with Python 3 (py 3.7)</li> </ul>	[15 videos] [3 H]	Channel: sentdex
<pre>youtube.com/playlist?list=PLQVvvaa0QuDeAams7fkdcw0GBpGdHpXIn</pre>		
<ul> <li>Playlist: Python 3 Tutorial for Beginners</li> </ul>	[160 videos] [30 H]	Channel: ProgrammingKnowledge
<pre>youtube.com/playlist?list=PLS1QulWo1RlYt4e0WnBp-ZjCNq8X0FX0J</pre>		
<ul> <li>Playlist: Complete Python Training Course</li> </ul>	[40 videos] [3 H]	Channel: Python Programmer
<pre>youtube.com/playlist?list=PLtb2Lf-cj_AWhtjE6Rb5oWf02RC2qVU-j</pre>		
<ul> <li>Playlist: Python Tutorial for Beginners</li> </ul>	[110 videos] [20 H]	Channel: Telusko
<pre>youtube.com/playlist?list=PLsyeobzWxl7poL9JTVyndKe62ieoN-MZ3</pre>		
<ul> <li>Playlist: Complete Python tutorial in Hindi (2020)</li> </ul>	[240 videos] [20 H]	Channel: Harshit vashisth
<pre>youtube.com/playlist?list=PLwgFb6VsUj_IOTpQKDtLXKXEIQychT_2j</pre>		

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### Python Interpreters Installation





python.org





anaconda.com/distribution





- Go to Download Python page on the official site and click **Download Python** 3.6.0 (You may see different version name).
- When the download is completed, double-click the file and follow the instructions to install it.

  When Python is installed, a program called IDLE is also installed along with it. It provides graphical user interface to work with Python.
- Open IDLE, copy the following code below and press enter.

  print("Hello, World!")
- To create a file in IDLE, go to File > New Window (Shortcut: Ctrl+N).
- Write Python code (you can copy the code below for now) and save (Shortcut: Ctrl+S) with .py file extension like: hello.py or your-first-program.py

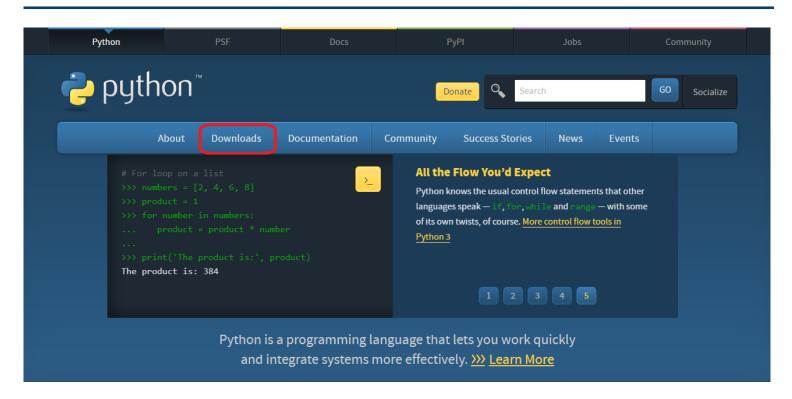
```
1 print("Hello, World!")
```

Go to Run > Run module (Shortcut: F5) and you can see the output. Congratulations, you've successfully run your first Python program.

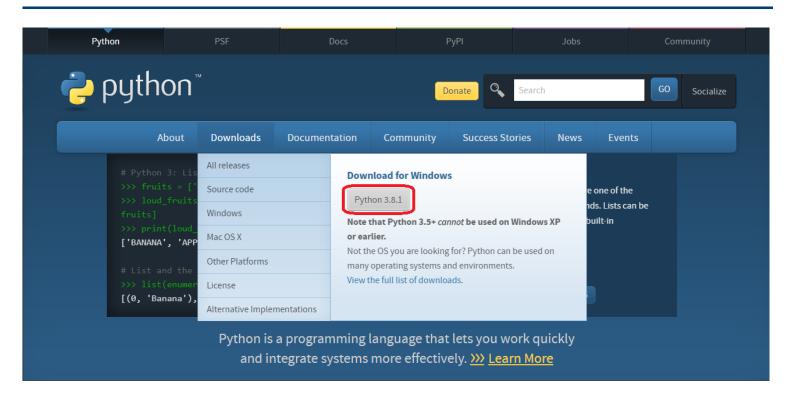


python.org

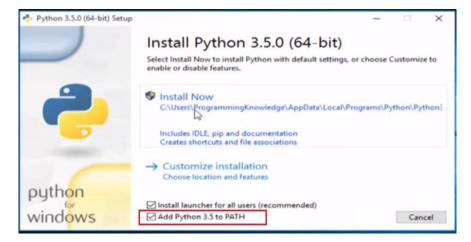


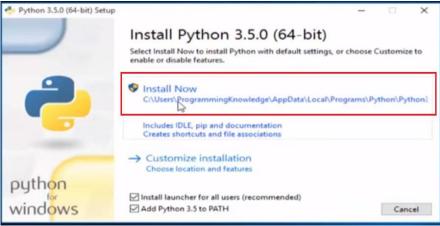




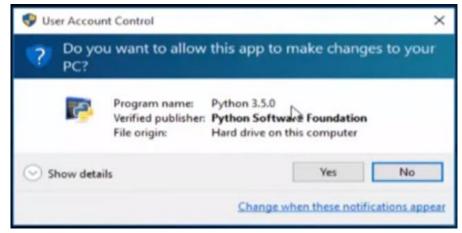


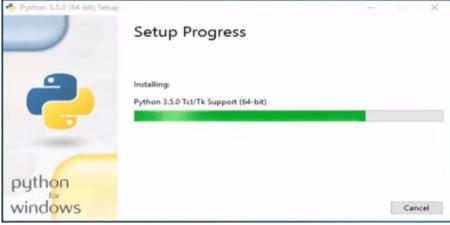




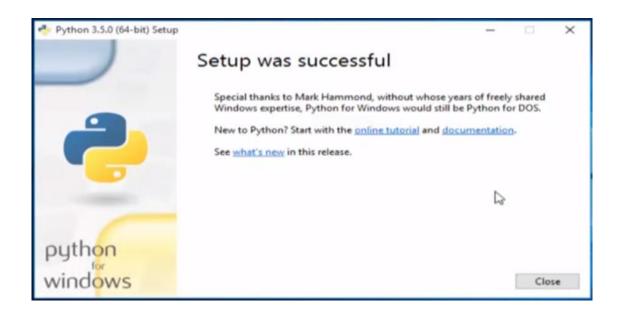




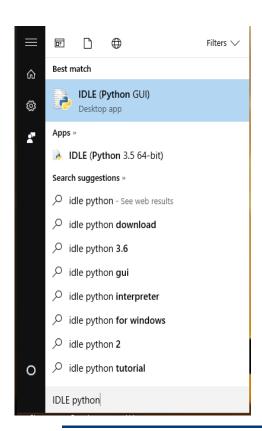


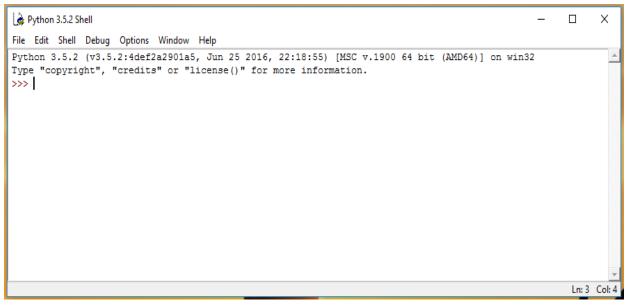




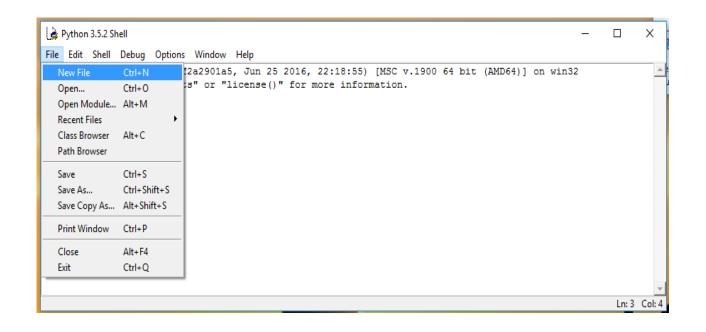




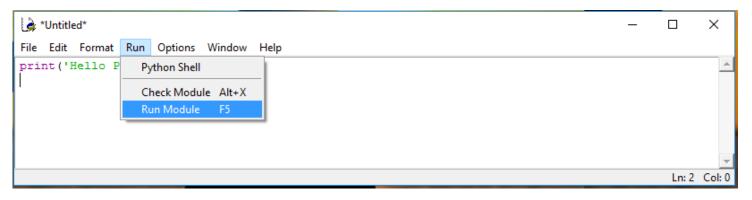


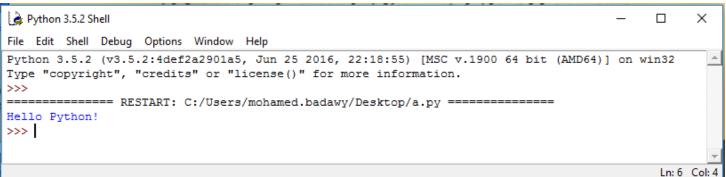








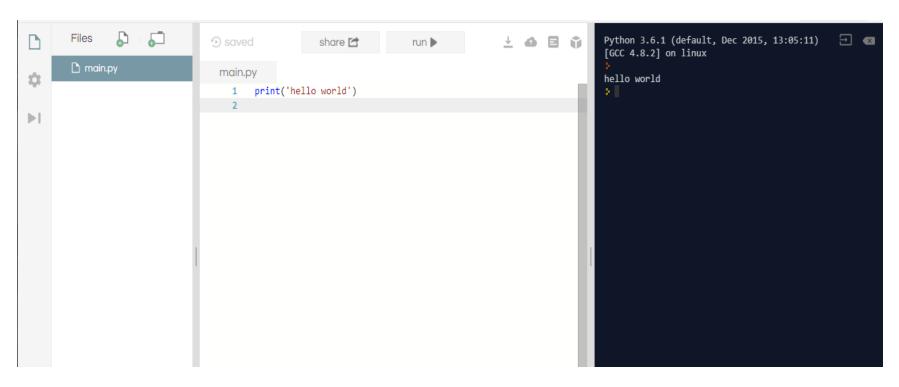




### Python Online Interpreters



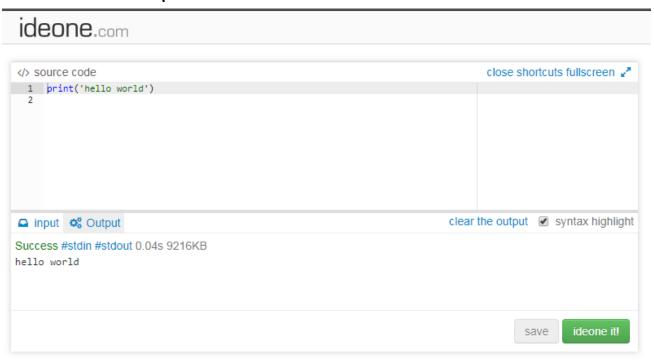
#### repl.it online interpreter: repl.it/languages/python3



### Python Online Interpreters



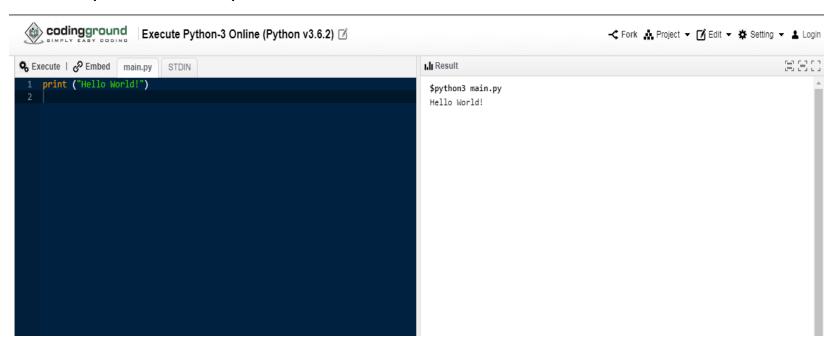
#### ideone online interpreter: <u>ideone.com</u>



### Python Online Interpreters

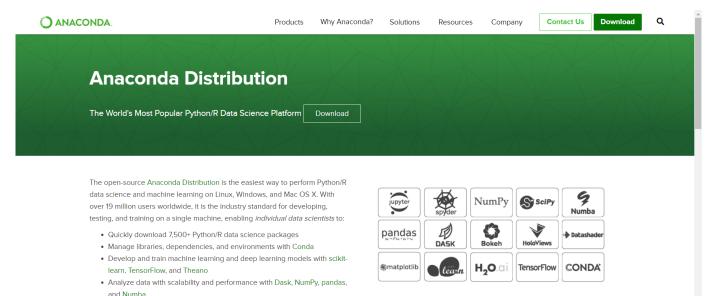


#### Tutorials point online interpreter: tutorialspoint.com/execute python3 online.php



· Visualize results with Matplotlib, Bokeh, Datashader, and Holoviews

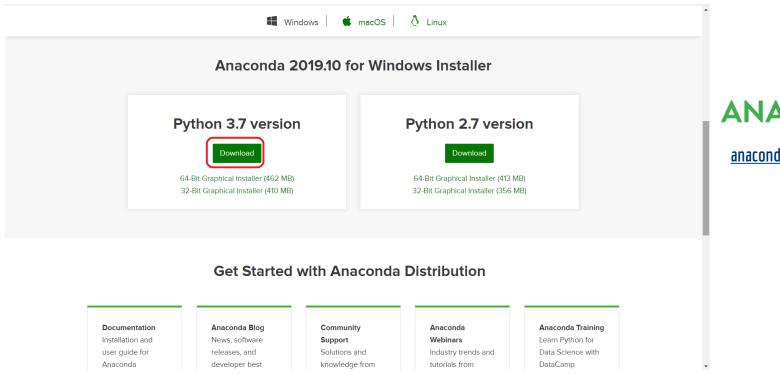






anaconda.com/distribution

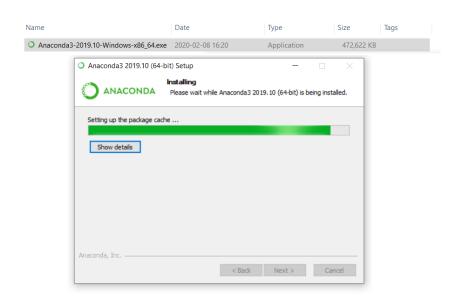


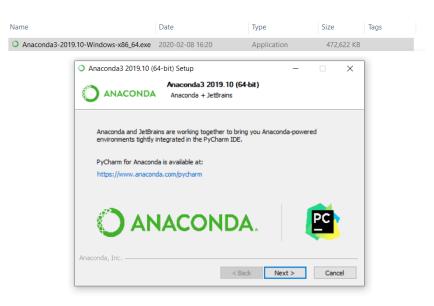




anaconda.com/distribution

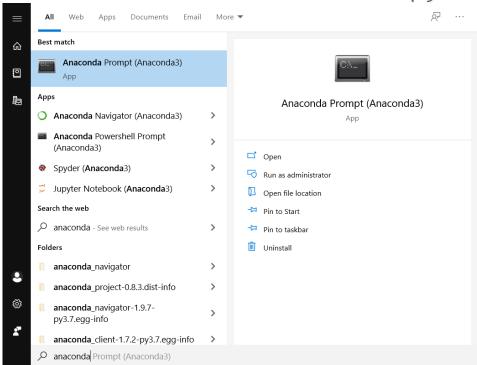














#### Ensure that all steps done successfully, you should run the following command lines:

```
Anaconda Prompt (Anaconda3)
(base) C:\Users\LenovoY540>conda list
 packages in environment at C:\Users\LenovoY540\Anaconda3:
                         Version
                                                   Build Channel
# Name
ipyw jlab nb ext conf
                         0.1.0
                                                  py37 0
alabaster
                         0.7.12
                                                  py37 0
anaconda
                         2019.10
                                                  py37 0
anaconda-client
                         1.7.2
                                                  py37 0
anaconda-navigator
                         1.9.7
                                                  py37 0
anaconda-project
                         0.8.3
                                                    py_0
asn1crypto
                         1.0.1
                                                  py37 0
astroid
                         2.3.1
                                                  py37 0
astropy
                          3.2.1
                                          py37he774522 0
atomicwrites
                         1.3.0
                                                   py37 1
(base) C:\Users\LenovoY540>python --version
Python 3.7.4
```

```
(base) C:\Users\LenovoY540>python --version
Python 3.7.4

(base) C:\Users\LenovoY540>where python
C:\Users\LenovoY540\Anaconda3\python.exe
```

### First Python Program



#### There are two mods of programming to execute the programs

1. Interactive Mode Programming

Invoking the interpreter without passing a script file as a parameter brings up the following prompt

### First Python Program



There are two mods of programming to execute the programs

#### 2. Script Mode Programming

Invoking the interpreter with a script parameter begins execution of the script and continues until the script is finished. When the script is finish, the interpreter is no longer active.

```
Python 3.4.0 Shell

File Edit Shell Debug Options Windows Help

print('a')
print('b')
print('c')
print('d')
```

# Lecture Agenda



- ✓ Section 1: Python Features
- ✓ Section 2: Python Content
- ✓ Section 3: Practice on Online Judges
- **✓** Section 4: Tutorials and References
- ✓ Section 5: Online Courses
- ✓ Section 6: Python Installation



