Python Overview 1:

Getting Started

Credits: parts extracted from presentations by Moshe Goldstein and Michael DiRamio

Presentation Overview

- Running Python
- Variables
- Basic data types
- Control flow

Installation / set-up

- Python 3 comes with most Linux distributions and can be easily installed on Mac OS X
  - Just open a terminal window and type "**python3**"
  - You'll get a prompt like this:

    >>>

```
jmcgibney@demo: ~
jmcgibney@demo:~$ python3
Python 3.5.2 (default, Nov 12 2018, 13:43:14)
[GCC 5.4.0 20160609] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

Installation / set-up

- Can get Windows version, but better to run Python on Linux (in a virtual machine is fine). Mac is also fine.

- Choose Python 3 rather than Python 2
  - Latest stable version is 3.7.2 (at time of writing) but any recent version should be ok.
  - Python 3 comes preinstalled on many Linux distributions. The command is *python3*

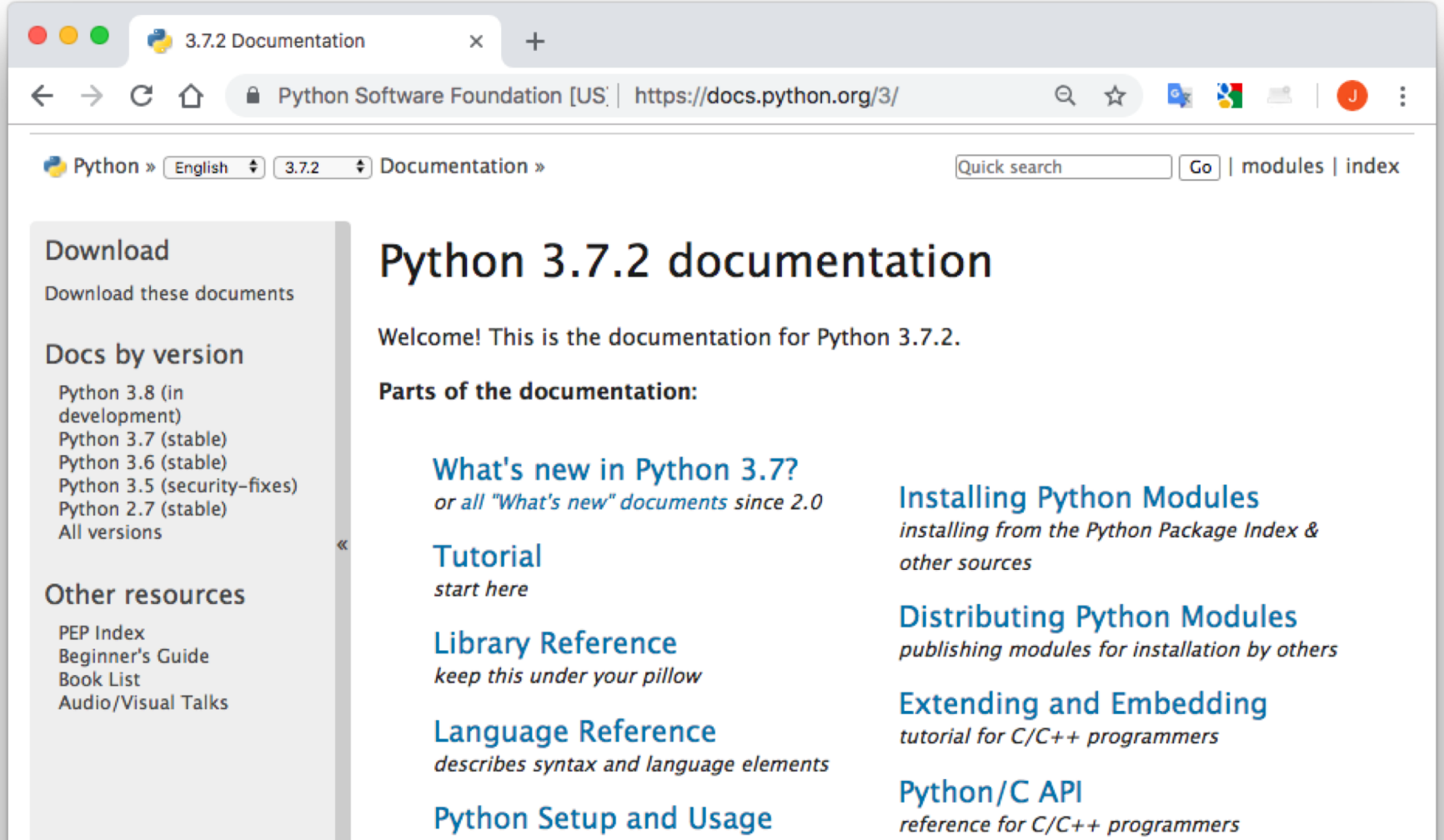
    ```
    $ python3
    ```

  - For Amazon Linux, Python 3 first needs to be installed

    ```
    $ sudo yum install python37
    $ python3
    ```

Official documentation

https://docs.python.org/3/



Official documentation – tutorial

https://docs.python.org/3/tutorial

The Python Tutorial — Python

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Python » English 3.7.2 Documentation » Quick search Go | previous | next | modules | index

Previous topic
Changelog

Next topic
1. Whetting Your Appetite

This Page
Report a Bug
Show Source

The Python Tutorial ¶

Python is an easy to learn, powerful programming language. It has efficient high-level data structures and a simple but effective approach to object-oriented programming. Python's elegant syntax and dynamic typing, together with its interpreted nature, make it an ideal language for scripting and rapid application development in many areas on most platforms.

The Python interpreter and the extensive standard library are freely available in source or binary form for all major platforms from the Python Web site, https://www.python.org/, and may be freely distributed. The same site also contains distributions of and pointers to many free third party Python modules, programs and tools, and additional documentation.

The Python interpreter is easily extended with new functions and data types implemented in C or C++ (or other languages callable from C). Python is also suitable as an extension language for customizable applications.

This tutorial introduces the reader informally to the basic concepts and features of the Python language and system. It helps to have a Python interpreter handy for hands-on experience, but all examples are self-contained, so the tutorial can be read off-line as well.

Official documentation – reference

https://docs.python.org/3/reference

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Python » English 3.7.2 Documentation » Quick search Go | previous | next | modules | index

Previous topic
4. Using Python on a Macintosh

Next topic
1. Introduction

This Page
Report a Bug
Show Source

The Python Language Reference

This reference manual describes the syntax and "core semantics" of the language. It is terse, but attempts to be exact and complete. The semantics of non-essential built-in object types and of the built-in functions and modules are described in The Python Standard Library. For an informal introduction to the language, see The Python Tutorial. For C or C++ programmers, two additional manuals exist: Extending and Embedding the Python Interpreter describes the high-level picture of how to write a Python extension module, and the Python/C API Reference Manual describes the interfaces available to C/C++ programmers in detail.

Google's Python class - **recommended**

Google's Python Class | Pyth

https://developers.google.com/edu/python/

Google for Education > Python

Search

- Python Course
  - Overview
  - Python Set Up
  - Introduction
  - Strings
  - Lists
  - Sorting
  - Dicts and Files
  - Regular Expressions
  - Utilities
- Lecture Videos day1, day2
- Python Exercises

Google's Python Class

Welcome to Google's Python Class -- this is a free class for people with a little bit of programming experience who want to learn Python. The class includes written materials, lecture videos, and lots of code exercises to practice Python coding. These materials are used within Google to introduce Python to people who have just a little programming experience. The first exercises work on basic Python concepts like strings and lists, building up to the later exercises which are full programs dealing with text files, processes, and http connections. The class is geared for people who have a little bit of programming experience in some language, enough to know what a "variable" or "if statement" is. Beyond that, you do not need to be an expert programmer to use this material.

Google's Python class

- Available at:

  https://developers.google.com/edu/python/

- Very suitable for this module because:
  - It covers almost exactly the areas that we need
  - It is pitched at the right level (assumes a little programming already)
  - Good exercises are included (with built-in tests of correct completion
- However there is one drawback:
  - It is based on Python 2 rather than Python 3
  - For this reason we have created a Python 3 version of the exercises – see labs.

The Python Interpreter

- Python is an interpreted language
- The interpreter provides an interactive environment to play with the language
  - Really useful for trying out syntax
- Results of expressions are printed on the screen

```
>>> 3 + 7
10
>>> 3 < 15
True
>>> 'print me'
'print me'
>>> print ('print me')
print me
>>>
```

Interactive Python – Hello World

- At the Python >>> prompt, type 'Hello world!'

```
>>> 'Hello world!'
Hello world!
```

Interactive Python prompt

- Or alternatively:

```
>>> print ('Hello world!')
Hello world!
```

Or put it in a script/program

- … to make your code reusable
- Use an editor to create a file called helloworld.py and type in a line of code containing the call to print()

Linux prompt

```
$ nano helloworld.py
(enter code: print ('Hello world!'))
$ cat helloworld.py
print ('Hello world!')
$ python3 helloworld.py
Hello world!
```

The print Statement

- Elements separated by commas print with a space between them

```
>>> print ('Hello')
Hello
>>> print ('Hello', 'there')
Hello there
>>>
```

Comments

starts a comment

```
print ('This will print') # comment here
#print ('This will not')
```

Variables

- Variables are not declared, just assigned
- The variable is created the first time you assign it a value
- Variables are references to objects
- Type information is with the object, not the reference
- Everything in Python is an object

All variables are objects

- Everything is an object
- Data type is a property of the *object* and not of the variable

```
>>> x = 7
>>> print(x)
7
>>> x = 'Hello'
>>> print(x)
'Hello'
>>>
```

Numbers

- Python has integers, long integers and floating point numbers (plus others types like complex numbers)

```
>>> 132224
132224
>>> 132323 ** 4
306578259430545516241
>>> 1.23232
1.23232
>>> print (1.23232)
1.23232
>>> 1.3E7
13000000.0
>>>
```

String Literals

- Strings are *immutable*
  - *i.e. they can't be changed*
  - *we just create a new string when we carry out an operation*
- + is overloaded to do concatenation

```
>>> x = 'hello'
>>> x = x + ' there'
>>> print (x)
'hello there'
>>>
```

*Here a **new** string is created and assigned to variable x*

- Short video on string immutability: https://www.youtube.com/watch?v=LTw5-5tx5wg

String Literals: many kinds

- Can use single or double quotes, and three double quotes for a multi-line string

```
>>> print('I am a string')
'I am a string'
>>> print ("So am I!")
'So am I!'
>>> s = """And me too,
though I am much longer
than the others"""
>>> print (s)
And me too,
though I am much longer
than the others
```

Booleans

- The following are false:
  - 0
  - *None*
  - *False*
  - An empty string, list, tuple, or dictionary

- All other values are considered true

Boolean Expressions

- Boolean expressions can be evaluated directly by the interpreter
- Note that when *None* is returned the interpreter does not print anything

```
>>> True and False
False
>>> False or True
True
>>> None and 2
>>> None or 2
2
>>>
```

No braces – i.e. no { }

- Python uses ***indentation*** instead of braces { } to determine the scope of expressions
- All lines must be indented the same amount to be part of the scope (or indented more if part of an inner scope)
- This forces the programmer to use proper indentation since the indenting is part of the program!

Control flow: **if**

```
x = 20
y = 30
if x < y :
    print ('x is less than y')
elif x > y :
    print ('x is greater than y')
else :
    print ('x is equal to y')
```

while loops

```
x = 1
while x < 5 :
    print (x)
    x = x + 1
```

whileloop.py

```
$ python3 whileloop.py
1
2
3
4
$
```

Running in a shell

for loops

- Iterates through a list of values

forloop1.py

```
for x in [1,7,13,2]:
    print (x)
```

```
$ python forloop1.py
1
7
13
2
$
```

forloop2.py

```
for x in range(5) :
    print (x)
```

```
$ python forloop2.py
0
1
2
3
4
$
```

range(N) generates a list of numbers [0,1, …, n-1]