

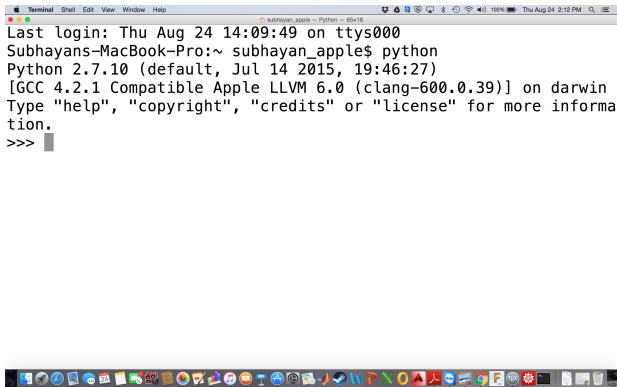
# Introduction to Python

Subhayan De  
Email: Subhayan.De@usc.edu

Teaching Assistant  
CE 408: Risk Analysis in Civil Engineering  
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# Installation

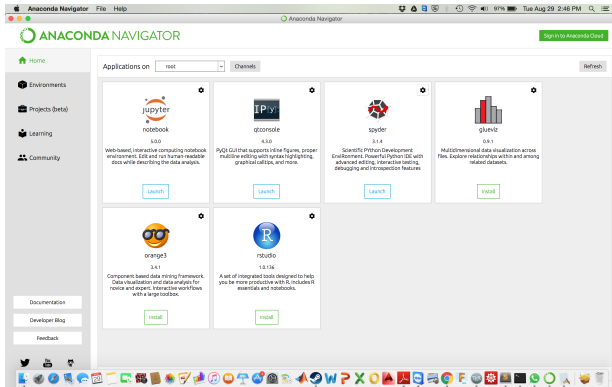
- ▶ Download Python: <https://www.python.org/downloads/>
- ▶ **Mac and Linux users:** you already have some version of the Python compiler in your computer.
- ▶ Open Terminal and type 'python' without the quotes
- ▶ You should see something like the following screenshot:
- ▶ Install Pip (Package manager for Python) by typing *sudo easy\_install pip*



```
Terminal Shell Edit View Window Help
subhayan.apple - Python - 65x18
Last login: Thu Aug 24 14:09:49 on ttys000
Subhayans-MacBook-Pro:~ subhayan.apple$ python
Python 2.7.10 (default, Jul 14 2015, 19:46:27)
[GCC 4.2.1 Compatible Apple LLVM 6.0 (clang-600.0.39)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

# Installation: Anaconda

- ▶ Another good option is Anaconda: Python data science platform (<https://www.anaconda.com/what-is-anaconda/>)
- ▶ Download from here:  
<https://www.anaconda.com/download/#download>
- ▶ After installing you will find this in your applications folder:  
Anaconda-Navigator



# Installation: Windows users

► 3 options:

- Opt. 1 Install Python compiler and Pip by following the steps available at:  
<https://github.com/BurntSushi/nfldb/wiki/Python-&-pip-Windows-installation>
- Opt. 2 Install WinPython (<http://winpython.github.io/>) or Anaconda (<https://www.anaconda.com/what-is-anaconda/>)
- Opt. 3 Use a virtual machine (e.g., Oracle VM VirtualBox) with Linux Ubuntu and follow the steps on the previous slide.

# Build the codes

- ▶ You can use the terminal to run the Python codes:

- ▶ Type the following lines in the terminal:

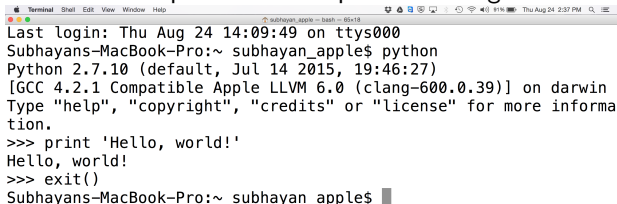
*python*

*print 'Hello, world!'*

Python 3.6 users: *python*

*print ('Hello, world!')*

This should produce an output like the figure here

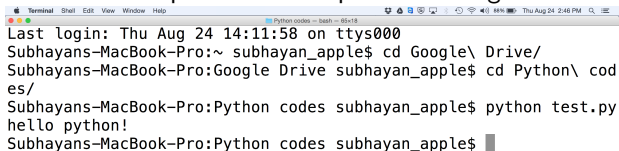
A screenshot of a macOS Terminal window. The title bar shows 'Terminal' and standard macOS window controls. The terminal text shows a login session for 'subhayan\_apple' on 'ttys000'. The user runs 'python', which outputs the Python version (2.7.10) and compiler information (GCC 4.2.1, Apple LLVM 6.0). The user then enters a Python prompt '>>>' and runs 'print 'Hello, world!'', which outputs 'Hello, world!'. Finally, the user runs 'exit()' and returns to the shell prompt 'subhayan\_apple\$'.

```
subhayan_apple ~$ python
Last login: Thu Aug 24 14:09:49 on ttys000
Subhayans-MacBook-Pro:~ subhayan_apple$ python
Python 2.7.10 (default, Jul 14 2015, 19:46:27)
[GCC 4.2.1 Compatible Apple LLVM 6.0 (clang-600.0.39)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> print 'Hello, world!'
Hello, world!
>>> exit()
Subhayans-MacBook-Pro:~ subhayan_apple$
```

# Build the codes

- ▶ You can also use the terminal to run the Python codes using a Python script:
  - ▶ Type *print 'hello python!'* in a file using a text editor and save it as *test.py*
  - ▶ Python 3.6 users: type *print ('hello python!')*
  - ▶ Type the following lines in Terminal:  
*python test.py*

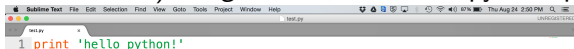
This should produce an output like the figure here



```
Terminal Shell Edit View Window Help
Python codes -- bash -- 65x18
Last login: Thu Aug 24 14:11:58 on ttys000
Subhayans-MacBook-Pro:~ subhayan_apple$ cd Google\ Drive/
Subhayans-MacBook-Pro:Google Drive subhayan_apple$ cd Python\ codes/
Subhayans-MacBook-Pro:Python codes subhayan_apple$ python test.py
hello python!
Subhayans-MacBook-Pro:Python codes subhayan_apple$
```

# Using an IDE: Sublime Text

- ▶ You can also use any IDE (integrated development environment) – e.g., Sublime Text, Jupyter, Spyder.



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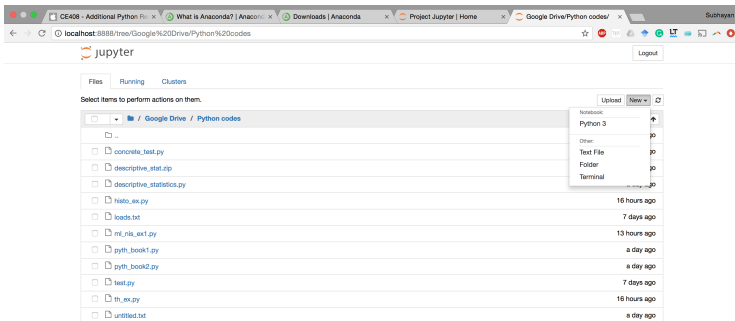
```
hello python!  
[Finished in 0.1s]
```



- ▶ Goto Tools and in the Build system select Python.
- ▶ Build the code in Sublime text using Ctrl+B or Cmd+B.
- ▶ If you are having trouble building from Sublime Text:  
<https://www.youtube.com/watch?v=6ZpuwW-9T54>  
(thanks to Mr. Elezar Kenig)

# Using an IDE: Jupyter

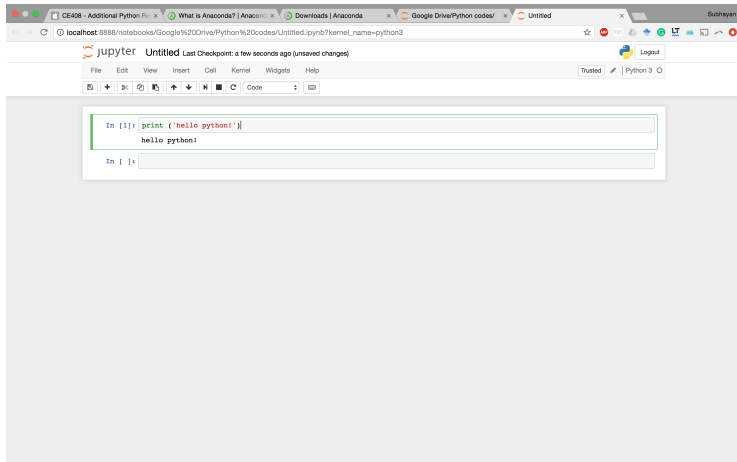
- ▶ The Jupyter Notebook is an open-source web application that can contain live code, equations, visualizations and explanatory text.
- ▶ On top right click on the New button and select *Python 3* or *Python 2* depending on the python compiler version you have installed.





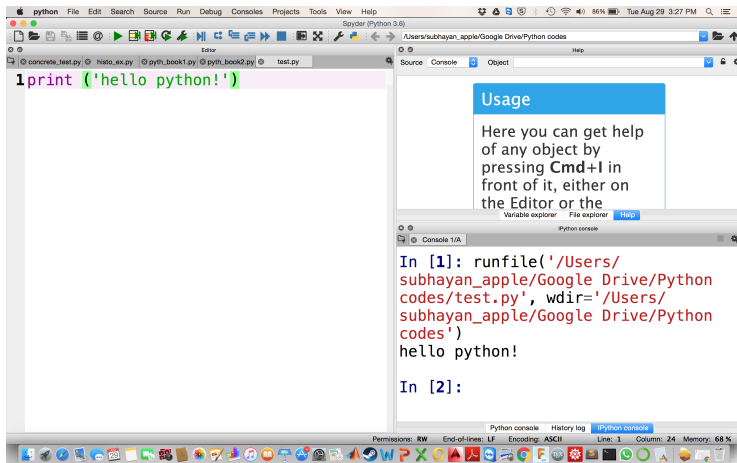
# Using an IDE: Jupyter

- ▶ Type *print ('hello python')* and click on the next button.



# Using an IDE: Spyder

- Type `print ('hello python')` in a new file and save it as `test.py` and press F5



# Install Python libraries

- ▶ Using pip install numPy, SciPy, and matplotlib (libraries for the Python programming language) by typing the following in the terminal (Linux and Mac users):

```
python -m pip install --upgrade pip  
pip install --user numpy scipy matplotlib ipython jupyter  
pandas sympy nose
```

- ▶ Anaconda users: already has these libraries installed
- ▶ Windows users: (Note: WinPython already has these libraries)
- ▶ Download .whl files from here:

```
http://www.lfd.uci.edu/~gohlke/pythonlibs/
```

- ▶ Then type similar to the following in the command prompt for each of these packages:

```
pip install scipy-0.18.1-cp27-cp27m-win_amd64.whl
```

- ▶ Detailed instructions are available here:

```
https://scipy.org/install.html
```

# Arithmetic operations

```
# Arithmetic operations
```

```
a = 5
```

```
b = 10
```

```
c = a + b
```

```
d = a - b
```

```
e = a * b
```

```
f = a / b
```

```
g = b * *a
```

```
print('a + b =', c, 'a - b =', d, 'aXb =', e, 'a/b =', f, 'b * *a =', g)
```

# Loop statements: *for*

The screenshot shows a Python IDE with a file explorer at the top displaying the path `/Users/subhayan_apple/Google Drive/Python codes`. The editor window shows a file named `test2.py` with the following code:

```
1#!/usr/bin/env python3
2# -*- coding: utf-8 -*-
3"""
4Created on Tue Aug 29 15:46:13 2017
5
6@author: subhayan_apple
7"""
8
9import numpy as np
10x=np.array ([1, 2, 3, 4])
11sum1 = 0
12for i in range(len(x)):
13    sum1+=x[i]
14Mean = sum1/len(x)
15print ('Mean = ',Mean)
```

The Variable explorer on the right shows the state of the program:

Name	Type	Size	Value
Mean	float64	1	2.5
i	int	1	3
sum1	int64	1	10
x	int64	(4,)	[1 2 3 4]

The Python console at the bottom shows the execution of the script:

```
help -> Python's own help system.
object? -> Details about 'object', use 'object??' for extra details.

In [1]: runfile('/Users/subhayan_apple/Google Drive/Python codes/test2.py', wdir='/Users/subhayan_apple/Google Drive/Python codes')
Mean = 2.5
```

The status bar at the bottom indicates: Permissions: RW, End-of-lines: LF, Encoding: UTF-8, Line: 8, Column: 1, Memory: 73 %.

# Loop statements: *if*

The screenshot shows a Python IDE with a script editor on the left and a variable explorer on the right. The script editor contains the following code:

```
3 """
4 Created on Thu Aug 31 14:41:25 2017
5
6 @author: subhayan_apple
7 """
8
9 import numpy as np
10 x=np.array ([1, 2, 3, 4])
11 sum1 = 0
12
13 # for loop
14 for i in range(len(x)):
15     sum1+=x[i]
16 Mean = sum1/len(x)
17 print ('Mean = ',Mean)
18
19 # use numpy.mean() to calculate the mean
20 Mean2=np.mean(x)
21
22 # if loop
23 if Mean==Mean2:
24     print('My code is correct!')
```

The variable explorer on the right shows the following variables and their values:

Name	Type	Size	Value
Mean	float64	1	2.5
Mean2	float64	1	2.5
i	int	1	3
sum1	int64	1	10
x	int64	(4,)	[1, 2, 3, 4]

The console on the right shows the output of the script:

```
In [6]: runfile('/Users/subhayan_apple/Google Drive/Python codes/test_if_loop.py',
wdir='/Users/subhayan_apple/Google Drive/Python codes')
Mean = 2.5
My code is correct!

In [7]:
```

The status bar at the bottom indicates: Permissions: RW, End-of-lines: LF, Encoding: UTF-8, Line: 21, Column: 1, Memory: 77 %.

# Loop statements: *while*

The screenshot shows a Python IDE with a script editor on the left and a variable explorer and console on the right.

**Script Editor:**

```
1#!/usr/bin/env python3
2# -*- coding: utf-8 -*-
3"""
4Created on Thu Aug 31 14:45:54 2017
5
6@author: subhayan_apple
7"""
8
9import numpy as np
10x=np.array ([1, 2, 3, 4])
11sum1 = 0
12i=0
13
14# for loop
15while i<len(x):
16    sum1+=x[i]
17    i+=1
18Mean = sum1/len(x)
19print ('Mean = ',Mean)
```

**Variable explorer:**

Name	Type	Size	Value
Mean	float64	1	2.5
Mean2	float64	1	2.5
i	int	1	4
sum1	int64	1	10
x	int64	(4,)	[1, 2, 3, 4]

**Console:**

```
In [7]: runfile('/Users/subhayan_apple/Google Drive/Python codes/
test_while_loop.py', wdir='/Users/subhayan_apple/Google
Drive/Python codes')
Mean = 2.5

In [8]:
```

**Status Bar:** Permissions: RW End-of-lines: LF Encoding: UTF-8 Line: 17 Column: 9 Memory: 77 %

# Define a function

The screenshot shows a Python IDE with a code editor on the left and a variable explorer and console on the right.

**Code Editor:**

```
1#!/usr/bin/env python3
2# -*- coding: utf-8 -*-
3"""
4Created on Tue Aug 29 15:54:29 2017
5
6@author: subhayan_apple
7"""
8
9import numpy as np
10
11def my_mean_fun(data):
12    sum1 = 0
13    for i in range(len(data)):
14        sum1+=data[i]
15    Mean = sum1/len(data)
16    return (Mean)
17
18x=np.array ([1, 2, 3, 4])
19Mean = my_mean_fun(x)
20print ('Mean = ',Mean)
```

**Variable explorer:**

Name	Type	Size	Value
Mean	float64	1	2.5
i	int	1	3
sum1	int64	1	10
x	int64	(4,)	[1 2 3 4]

**Python console:**

```
python codes/test2.py', wdir='/
Users/subhayan_apple/Google
Drive/Python codes')
Mean = 2.5

In [2]: runfile('/Users/
subhayan_apple/Google Drive/
Python codes/test3.py', wdir='/
Users/subhayan_apple/Google
Drive/Python codes')
Mean = 2.5

In [3]:
```

Permissions: RW End-of-lines: LF Encoding: UTF-8 Line: 7 Column: 1 Memory: 73 %



# Codes and Tutorials

- ▶ You can find the codes and notes used during the discussion sessions on my website: *www.subhayande.com* under the Tutorials tab.
- ▶ Office hours: M 2-4 pm, W 4-6 pm (KAP 115).

**THANK YOU**