

# Week 1: Intro to Python

**DSUA111: Data Science for Everyone, NYU, Fall 2020**

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<https://github.com/jpowerj/dsua111-sections>  
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## We'll be coding in Python - Why?

- Python rocks
- Very easy to write and to read
- Huge library of outside code you can use
- Now the default language for machine learning
- But also applied to many other usecases, such as the web (for example Instagram's backend)

# What is Jupyter?

- We'll be writing python code - but there are many different tools to write that code in
- For example, there are many different ways to write word documents, like Microsoft Word, Google Docs, text edit, etc.
- The words are the same, but different platforms have different tools
- The same is true for coding, there are many different platforms or IDEs (Integrated Development Enviroment) such as Pycharm, sublimetext, Spyder, or even just text edit
- We'll be using Jupyter Notebooks, which is probably the most popular IDE for datascience

## So what is a programming language? What is Python?

- From wikipedia:
  - "A programming language is a formal language, which comprises a set of instructions that produce various kinds of output. Programming languages are used in computer programming to implement algorithms."

# Programming Languages

- In theory, they tell the computer what to do.
- But in practice, computers dumb - they only understand a small number of VERY specific instructions
- So learning to program is basically two things:
  1. Learning those instructions
  2. Figuring out how to put them together (into a program) that does what you want it to do
- Let's start

## First, let's create a variable

- We'll create a variable (AKA an object), called 'a', and assign it the value 5
- We'll type it in a cell (the square thing where we write text), then press SHIFT + ENTER (or press run above)

In [1]:

```
a = 5
```

In [2]:

```
a == 6
```

Out[2]:

```
False
```

In [3]:

```
a == 5
```

Out[3]:

```
True
```

In [4]:

```
print(a)
```

5

## What is a?

- we assign (or map) 'a' to the number 5 with just one '='
- Ok, so we created 'a', what does this mean?
- Well, we created a mapping to 'a'. When I tell the computer, "hey, use 'a' to..." the computer will look at 'a', and see what it maps to
- So let's ask the computer what it maps to, we can usually do this with a print statement, which is just..

```
In [5]: print(a)
```

5

```
In [6]: a
```

```
Out[6]: 5
```

# Jupyter's default output behavior

- In Jupyter I can also just run a line of Python code by itself in a cell to output the result

In [7]: `c = 47`

In [8]: `d = 5`

In [9]: `c + d`

Out[9]: 52

In [10]: `2 + 5`

Out[10]: 7

In [11]: `answer = c + d`

In [12]: `answer`

Out[12]: 52



## So how is this useful?

- First things first, computers can do arithmetic (it's the basis for all the other fun things it can do!)
- Addition and subtraction:

In [13]: `12 + 25`

Out[13]: `37`

In [14]: `120030498 + 12375`

Out[14]: `120042873`

In [15]: `123 - 5`

Out[15]: `118`

# Multiplication and Division

In [16]:

```
123/65
```

Out[16]: 1.8923076923076922

In [17]:

```
1/123123321321321874981239847298
```

Out[17]: 8.121938145172706e-30

In [18]:

```
3/4
```

Out[18]: 0.75

In [19]:

```
12*4
```

Out[19]: 48

In [20]:

```
c/d
```

Out[20]: 9.4

# Exponents!

- For example we can compute  $3^4$  as:

In [21]: `3**4`

Out[21]: 81

In [22]: `new_answer = c**2`

In [23]: `new_answer`

Out[23]: 2209

And remember, we can do roots as exponents by making them fractions:

- So  $\sqrt{16}$   
     $= 16^{\frac{1}{2}}$   
     $=$

In [24]: `16**(1/2)`

Out[24]: 4.0

In [25]: `16**(1/4)`

Out[25]: 2.0

# Math with variables

- First off, notice how we use parenthesis, just like in normal math (Python knows PEMDAS)
- But we can get fancier than just typing in specific numbers like 16, 1/4, etc.
- Python can do arithmetic on objects that map to numbers too
- so let's write a simple program

```
In [26]: a = 15  
  
b = 30  
  
answer = a + b  
  
print(answer)
```

45

```
In [27]: answer
```

Out[27]: 45

```
In [28]: a
```

Out[28]: 15

## From Numbers to Variable and back to Numbers

- Notice, I reassigned 'a' to a new value, and created b
- I then created a new object, called 'answer', that maps to their new value
- and finally I printed that out
- Ok, so how could this be useful?
- Now lets do it for the [Pythagorean \(pythagorean?\) theorem](https://en.wikipedia.org/wiki/Pythagorean_theorem)  
([https://en.wikipedia.org/wiki/Pythagorean\\_theorem](https://en.wikipedia.org/wiki/Pythagorean_theorem)).

In [29]:

```
a = 6  
b = 8  
c = (a**2 + b**2)**(1/2)  
print(c)
```

10.0

In [30]:

```
c
```

Out[30]: 10.0

## When you make the computer angry

- Finally, computers are very, very sensitive
- They can't handle it when they don't understand the code
- This is called an error!
- It is NO BIG DEAL (srsly, it's not... more on that later)

## Let's make it angry, for fun

In [31]: `c_hello`

```
-----  
NameError                                Traceback (most recent call last)  
<ipython-input-31-f0a6956ee073> in <module>  
----> 1 c_hello  
  
NameError: name 'c_hello' is not defined
```



## What's happening?

- All of my variables still exist, nothing is broken
- Before python runs the code, it reads it
- If there are instructions in there that are not Python (for example typos)
- Python 'throws' an error - it doesn't actually run it.
- All the variables you created before are still in memory - the computer hasn't forgotten them
- Python even tells you what is wrong
- So make mistakes, experiment, etc. Python doesn't care while you learn

Please try: <https://www.learnpython.org/>  
(<https://www.learnpython.org>)