# Introduction to Python

Michelle Torres

August 7, 2016

# Course Overview

- Michelle's office hours (277):
  - Officially one hour after every class meeting
  - Feel free to stop by any time I'm in
  - Email questions or if you want to meet
- Homeworks:
  - Will be about 6 homework assignments
  - Will be due Thursday and Monday (end of day)
  - Can work together, but each keystroke should be your own
  - All work must be done on git – commit often with comments
  - Direct all questions about grading, due date, etc. to Erin
- Poster session TBD

# GOALS

- Learn Python
  - Web scraping, APIs, data structures, etc.
- Transferable skills to other languages
  - Ruby, SQL, Perl, programming logic
- Send a signal!

# Quiz (!)

- Please go to:
  - http://smtorres.org/quiz1.html
  - http://smtorres.org/quiz2.html

# Syntax

- Object types
  - String
  - Int
  - Float
  - List
  - Tuple
  - Dictionary
- Conditionals
- Loop
- Functions

# STRINGS

- Any group of characters recognized as text.

# STRINGS

- Any group of characters recognized as text.
- Written between single quotes, double quotes or triple quotes.

# STRINGS

- Any group of characters recognized as text.
- Written between single quotes, double quotes or triple quotes.

```
>>> name='Michelle'
>>> age='29'
>>> intro="Hi my name is "+name+".\nI'm "+age+" years old."
>>> intro
>>> print intro
>>> new_intro = """Hello!
... I'm Michelle.
... What's up?"""
>>> new_intro
>>> print new_intro
```

# String

- You can call any character in the string.

# String

- You can call any character in the string.

```
>>> intro[0]
>>> intro[1]
>>> intro[3]
```

# String

- You can call any character in the string.

```
>>> intro[0]
>>> intro[1]
>>> intro[3]
```

- Strings are immutable.

# String

- You can call any character in the string.

```
>>> intro[0]
>>> intro[1]
>>> intro[3]
```

- Strings are immutable.
- But you can split a string into words.

# String

- You can call any character in the string.

```
>>> intro[0]
>>> intro[1]
>>> intro[3]
```

- Strings are immutable.
- But you can split a string into words.

```
>>> intro.split()
```

# String

- You can call any character in the string.

```
>>> intro[0]
>>> intro[1]
>>> intro[3]
```

- Strings are immutable.
- But you can split a string into words.

```
>>> intro.split()
```

- Or into any other chunks using a character.

# String

- You can call any character in the string.

```
>>> intro[0]
>>> intro[1]
>>> intro[3]
```

- Strings are immutable.
- But you can split a string into words.

```
>>> intro.split()
```

- Or into any other chunks using a character.

```
>>> intro.split(".")
>>> new_intro.split('\n')
```

# String

- Create this string

# STRING

- Create this string

```
>>> wustl = 'WashingtonUniversity'
```

- Let's check how the characters are positioned...

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W | a | s | h | i | n | g | t | o | n | U | n | i | v | e | r | s | i | t | y |
| -20 | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -10 | -9 | -8 | -7 | -6 | -5 | -4 | -3 | -2 | -1 |

# String

- Run this code. What is happening?

# STRING

- Run this code. What is happening?

```
>>> wustl[2:]
>>> wustl[-2:]
>>> wustl[:2]
>>> wustl[:-2]
>>> wustl[::2]
>>> wustl[::-2]
>>> wustl[::3]
>>> wustl[1:8]
```

# String

- It requires a little more work to split a string into letters.

# String

- It requires a little more work to split a string into letters.

```
>>> [letter for letter in name]
>>> [letter for letter in intro]
```

- Let's combine them again.

# String

- It requires a little more work to split a string into letters.

```
>>> [letter for letter in name]
>>> [letter for letter in intro]
```

- Let's combine them again.

```
>>> myletters=[letter for letter in intro]
>>> ''.join(myletters)
>>> '\n'.join(myletters)
```

# INT

- Integers.

# Int

- Integers.
- You can do mathematical operations using these.
  - Usual suspects: + - * /
  - Exponentiate: **
  - Remainder: %

# Int

- Integers.
- You can do mathematical operations using these.
  - Usual suspects: + - * /
  - Exponentiate: **
  - Remainder: %
- Remember the results are *always* rounded down!

# Int

- Integers.
- You can do mathematical operations using these.
  - Usual suspects: + - * /
  - Exponentiate: **
  - Remainder: %
- Remember the results are *always* rounded down!

```
>>> whole=5/3
>>> remainder=5%3
>>> "Five divided by three is %d and %d fifths" % (whole, remainder)
```

# Int

- Integers.
- You can do mathematical operations using these.
  - Usual suspects: + - * /
  - Exponentiate: **
  - Remainder: %
- Remember the results are *always* rounded down!

```
>>> whole=5/3
>>> remainder=5%3
>>> "Five divided by three is %d and %d fifths" % (whole, remainder)
```

- You can assign numbers using different operators.

# Int

- Integers.
- You can do mathematical operations using these.
  - Usual suspects: + - * /
  - Exponentiate: **
  - Remainder: %
- Remember the results are *always* rounded down!

```
>>> whole=5/3
>>> remainder=5%3
>>> "Five divided by three is %d and %d fifths" % (whole, remainder)
```

- You can assign numbers using different operators.

```
>>> five=5
>>> five+=1
>>> five
>>> five/=3
>>> five
>>> five-=2
>>> five
```

# Float

- Real numbers.

# Float

- Real numbers.
- Written by adding the decimal to an integer.

# FLOAT

- Real numbers.
- Written by adding the decimal to an integer.

```
>>> 12.0/5
>>> float(7)
>>> type(2.*8)
```

# List

- Collection of any type objects – even lists

# LIST

- Collection of any type objects – even lists

```
>>> myletters
>>> type(myletters)
```

- Lists can be changed, and include multiple object types

# LIST

- Collection of any type objects – even lists

```
>>> myletters
>>> type(myletters)
```

- Lists can be changed, and include multiple object types

```
>>> myletters.append(5)
>>> myletters[-1]
>>> type(myletters[-1])
>>> myletters[0]='Orange'
```

# List

- Collection of any type objects – even lists

```
>>> myletters
>>> type(myletters)
```

- Lists can be changed, and include multiple object types

```
>>> myletters.append(5)
>>> myletters[-1]
>>> type(myletters[-1])
>>> myletters[0]='Orange'
```

- Indexing starts at 0!

# List

- Collection of any type objects – even lists

```
>>> myletters
>>> type(myletters)
```

- Lists can be changed, and include multiple object types

```
>>> myletters.append(5)
>>> myletters[-1]
>>> type(myletters[-1])
>>> myletters[0]='Orange'
```

- Indexing starts at 0!

```
>>> myletters[len(myletters)]
```

# List

- Collection of any type objects – even lists

```
>>> myletters
>>> type(myletters)
```

- Lists can be changed, and include multiple object types

```
>>> myletters.append(5)
>>> myletters[-1]
>>> type(myletters[-1])
>>> myletters[0]='Orange'
```

- Indexing starts at 0!

```
>>> myletters[len(myletters)]
```

- You can insert into any position

```
>>> myletters.insert(2, '!')
```

# List

- Collection of any type objects – even lists

```
>>> myletters
>>> type(myletters)
```

- Lists can be changed, and include multiple object types

```
>>> myletters.append(5)
>>> myletters[-1]
>>> type(myletters[-1])
>>> myletters[0]='Orange'
```

- Indexing starts at 0!

```
>>> myletters[len(myletters)]
```

- You can insert into any position

```
>>> myletters.insert(2, '!')
```

- And remove from any position

# List

- Collection of any type objects – even lists

```
>>> myletters
>>> type(myletters)
```

- Lists can be changed, and include multiple object types

```
>>> myletters.append(5)
>>> myletters[-1]
>>> type(myletters[-1])
>>> myletters[0]='Orange'
```

- Indexing starts at 0!

```
>>> myletters[len(myletters)]
```

- You can insert into any position

```
>>> myletters.insert(2, '!')
```

- And remove from any position

```
>>> myletters.pop(1)
```

# TUPLES

- Tuples are like lists – combination of any objects

# TUPLES

- Tuples are like lists – combination of any objects
- But are immutable

# TUPLES

- Tuples are like lists – combination of any objects
- But are immutable
- Not very common, but very useful sometimes

# TUPLES

- Tuples are like lists – combination of any objects
- But are immutable
- Not very common, but very useful sometimes

```
>>> tup=(1,6,5,'Apple')
>>> tup[1]
>>> tup[1]=9
>>> tup.append(9)
>>> (a,b) = (1, ['I', 'Like', 'You'])
>>> a
```

# Dictionary

- It is what it sounds like.

# DICTIONARY

- It is what it sounds like.
- Here is how you create one.

# DICTIONARY

- It is what it sounds like.
- Here is how you create one.

```
>>> myDict={'name':'Mich', 'last_name':'Torres', 'age':29}
```

- Unlike lists, there is no order to elements.

# DICTIONARY

- It is what it sounds like.
- Here is how you create one.

```
>>> myDict={'name':'Mich', 'last_name':'Torres', 'age':29}
```

- Unlike lists, there is no order to elements.
- You call elements using keys.

# DICTIONARY

- It is what it sounds like.
- Here is how you create one.

```
>>> myDict={'name':'Mich', 'last_name':'Torres', 'age':29}
```

- Unlike lists, there is no order to elements.
- You call elements using keys.

```
>>> myDict
>>> myDict.keys()
>>> myDict.values()
>>> myDict['last_name']
>>> myDict['middle_name']='George'
```

# DICTIONARY

- It is what it sounds like.
- Here is how you create one.

```
>>> myDict={'name':'Mich', 'last_name':'Torres', 'age':29}
```

- Unlike lists, there is no order to elements.
- You call elements using keys.

```
>>> myDict
>>> myDict.keys()
>>> myDict.values()
>>> myDict['last_name']
>>> myDict['middle_name']='George'
```

- These are particularly useful when we start defining classes (next class)

# CONDITIONALS

- Perform an operation (or several) if condition is met (or not)

# CONDITIONALS

- Perform an operation (or several) if condition is met (or not)

```
>>> x=2
>>> if x==1:
...     print 'x is one'
... elif x==2:
...     print 'x is two'
... else:
...     print 'x is neither one nor two'
```

# CONDITIONALS

- Perform an operation (or several) if condition is met (or not)

```
>>> x=2
>>> if x==1:
...     print 'x is one'
... elif x==2:
...     print 'x is two'
... else:
...     print 'x is neither one nor two'
```

- Can be conditions or boolean (True or False)

# CONDITIONALS

- Perform an operation (or several) if condition is met (or not)

```
>>> x=2
>>> if x==1:
...     print 'x is one'
... elif x==2:
...     print 'x is two'
... else:
...     print 'x is neither one nor two'
```

- Can be conditions or boolean (True or False)
- Multiple lines of code:

# CONDITIONALS

- Perform an operation (or several) if condition is met (or not)

```
>>> x=2
>>> if x==1:
...     print 'x is one'
... elif x==2:
...     print 'x is two'
... else:
...     print 'x is neither one nor two'
```

- Can be conditions or boolean (True or False)
- Multiple lines of code:
  - Indentation matters!

# CONDITIONALS

- Perform an operation (or several) if condition is met (or not)

```
>>> x=2
>>> if x==1:
...     print 'x is one'
... elif x==2:
...     print 'x is two'
... else:
...     print 'x is neither one nor two'
```

- Can be conditions or boolean (True or False)
- Multiple lines of code:
  - Indentation matters!
  - Consistency is important, but exactly 4 spaces is 'Pythonic'

# CONDITIONALS

- Perform an operation (or several) if condition is met (or not)

```
>>> x=2
>>> if x==1:
...     print 'x is one'
... elif x==2:
...     print 'x is two'
... else:
...     print 'x is neither one nor two'
```

- Can be conditions or boolean (True or False)
- Multiple lines of code:
  - Indentation matters!
  - Consistency is important, but exactly 4 spaces is 'Pythonic'
  - Will cause errors

# CONDITIONALS

- Perform an operation (or several) if condition is met (or not)

```
>>> x=2
>>> if x==1:
...     print 'x is one'
... elif x==2:
...     print 'x is two'
... else:
...     print 'x is neither one nor two'
```

- Can be conditions or boolean (True or False)
- Multiple lines of code:
  - Indentation matters!
  - Consistency is important, but exactly 4 spaces is 'Pythonic'
  - Will cause errors
  - Even an empty line with spaces can cause errors

# Loops

- Two types of loops: for and while

# Loops

- Two types of loops: for and while
- for loop: loops over some list

# Loops

- Two types of loops: for and while
- for loop: loops over some list
- while loop: loops while condition is true

# Loops

- Two types of loops: for and while
- for loop: loops over some list
- while loop: loops while condition is true
- Can nest loops (and conditionals, etc.)

# Loops

- Two types of loops: for and while
- for loop: loops over some list
- while loop: loops while condition is true
- Can nest loops (and conditionals, etc.)

```
>>> even_numbers=[]
>>> for i in range(1,10):
...     if i%2==0:
...         even_numbers.append(i)
...
>>> for letter in 'word': print letter
...
>>> sum([.05**i for i in range(1,10)])
>>> while len(myletters)>1:
...     myletters.pop()
...
```

# QUICK EXERCISE

- Write code that saves the first ten numbers of the Fibonacci sequence to a list:

# QUICK EXERCISE

- Write code that saves the first ten numbers of the Fibonacci sequence to a list:
  - With a for loop

# QUICK EXERCISE

- Write code that saves the first ten numbers of the Fibonacci sequence to a list:
  - With a for loop
  - With a while loop

# QUICK EXERCISE

- Write code that saves the first ten numbers of the Fibonacci sequence to a list:
  - With a for loop
  - With a while loop
- A while loop can always do what a for loop does, but syntax is simpler

# FUNCTIONS

- They help write cleaner code.

# FUNCTIONS

- They help write cleaner code.
- Keep them simple.

# FUNCTIONS

- They help write cleaner code.
- Keep them simple.
- You can return any type of object.

# FUNCTIONS

- They help write cleaner code.
- Keep them simple.
- You can return any type of object.
- Don't forget to add `return` for output.

# FUNCTIONS

- They help write cleaner code.
- Keep them simple.
- You can return any type of object.
- Don't forget to add `return` for output.

```
>>> def addSquares(x,y):
...     return x**2+y**2
...
>>> addSquares(3,4)
```

# FUNCTIONS

- They help write cleaner code.
- Keep them simple.
- You can return any type of object.
- Don't forget to add `return` for output.

```
>>> def addSquares(x,y):
...     return x**2+y**2
...
>>> addSquares(3,4)
```

- Change the Fibonacci code to find first *n* numbers of sequence