

Python Programming 101

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Today's class

Prerequisites

- No previous programming experience required
- Lots of slides with `actual code`

Goals

- Make you self-sufficient as a Python beginner
- Teach you a little bit about Python's culture

Why Python?

Ideal for scripting and rapid prototyping

- General-purpose, high-level language
- Elegant syntax
- Interpreted
- Dynamic typing
- 'Comes with batteries' (lots of them!)
- The Zen of Python: **import** this

Python 2 vs Python 3

There are two Pythons!

- Currently: Python 2.7.12 and Python 3.5.2
- Minimal differences for beginners (except `print`)
- ‘Python 2.x is legacy, Python 3.x is the present and future of the language’

Let's install Python!

Download Anaconda from

<https://www.anaconda.com/download/>

Using Python

- (I)Python interpreter
- Scripts
- Jupyter (previously IPython) Notebooks

REPL

- **R**ead some input
- **E**valuate
- **P**rint the result
- **L**oop (i.e. repeat)

Let's try it now: what is **2** + **2**?

Python as a calculator

```
1 1 + 2      # Addition
2 3 - 4      # Subtraction
3 5 * 6      # Multiplication
4 7 / 8      # Division (integer division in Python 2)
5 7 // 8     # Integer division
6 9 ** 10    # Exponentiation
7 11 % 10    # Modulo
```


Careful with operator precedence!

```
1  1 + 2 ** 3 * 4
2  1 + (2**3) * 4
3  1 + ((2**3) * 4)
4  ((1) + (((2)**(3)) * (4)))  # Don't overdo it! :-)
```

Variables and operators

Variables

Variables store values of different **types**:

- **booleans** are either **True** or **False**
- **integers** are whole numbers
- **floating point** are decimal numbers
- **strings** are sequences of characters
- **None**

```
1 session = 'Introduction to Python'  # Or use "..."  
2 day = 26  
3 temperature = 21.2  
4 pressure = 7.6e2  # Same as 7.6 * 10**2 = 760
```

Working with variables

```
1 temp_c = 21.2
2 temp_f = temp_c * 1.8 + 32
```

Working with variables

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1 temp_c = 21.2
2 temp_f = temp_c * 1.8 + 32
```

Changing type ('casting')

```
1 int('26')
2 str(21.2)
3 float('21,2') # Oops...
```

Operators

- Assignment: **=**
- Comparison: **==, !=, <, <=, >, >=**
- Mathematical: **+, -, ...**
- Logical: **and, or, not**

```
1 1 + 2
2 1 < 2
3 'Lon' + 'don'
4 'Lon' < 'don'
```

Data structures

Everything in Python is an object

Objects...

- Are the 'nouns' of your programme
- Group together **attributes**
- Have **methods** (also attributes) that define the 'verbs'

```
1 john = Person(first_name='John', last_name='Doe')  
2 john.full_name  
3 john.send_email(subject='I love Python!')
```


Lists

- Lists are **ordered sequences** of items (so are **strings**!)
- Not necessarily of the same type

```
1 a = [0, 1, 1, 2, 3, 5, 8, 13, 21, 34]
2 b = ['I', 'love', 'Python!']
3 a + b
```

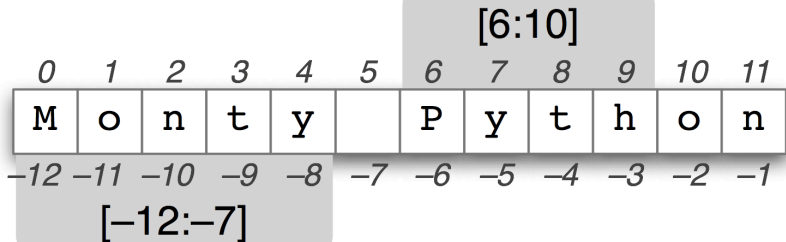
Tuples

- Tuples are similar to lists, but **immutable**
- Not necessarily of the same type

```
1 a = (0, 1, 1, 2, 3, 5, 8, 13, 21, 34)
2 b = ('I', 'love', 'Python!')
3 a + b
```

Indexing and slicing

```
1 a[0]  
2 a[1]  
3 a[-2]  
4 a[3:]  
5 a[:4]  
6 a[5:7]  
7 a[::-2]
```



From *Natural Language Processing with Python*

Dictionaries

- Dictionaries store **key-value pairs**
- (Not necessarily of the same type)

```
1 john = {  
2     'first_name': 'John',  
3     'last_name': 'Doe',  
4     'age': 32  
5 }  
6 john['age']  
7 list(john.keys())  
8 list(john.values())
```

Flow control

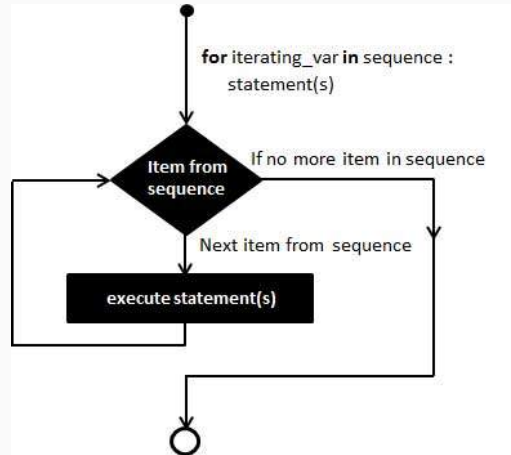
'If' statements

- One **if** followed by a condition
- Zero or more **elif**s (short for 'else if')
- Optionally a final **else**

```
1  if x < 0:  
2      print('x is negative')  
3  elif x == 0:  
4      print('x is zero')  
5  else:  
6      print('x is positive')
```

'For' loops

```
1 for x in range(10):  
2     if x == 3:  
3         continue  
4     elif x == 5:  
5         break  
6     print(x)
```



From [TutorialsPoint.com](https://www.tutorialspoint.com)

'For' loops with lists

```
1 a = ['one', 'two', 'three', 'four', 'five']  
2  
3 for value in a:  
4     print(value)  
5  
6 for index, value in enumerate(a):  
7     print('Item {} is "{}"'.format(index, value))
```


List comprehensions

```
1 a = [0, 1, 2, 3, 4, 5]
2 b = []
3
4 for x in a:
5     if x > 0:
6         b.append(x**2)
```

```
1 a = [0, 1, 2, 3, 4, 5]
2 b = [x**2 for x in a if x > 0]
```

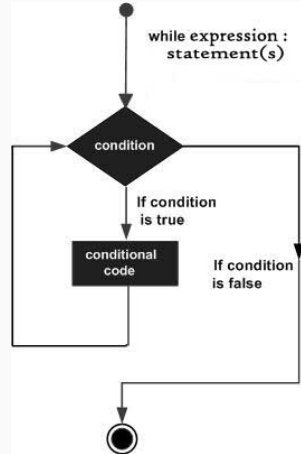
'For' loops with dictionaries

```
1  a = {  
2      'one': 'uno',  
3      'two': 'due',  
4      'three': 'tre',  
5      'four': 'quattro',  
6      'five': 'cinque'  
7  }  
8  
9  for key, value in a.items():  
10     print("{} maps to {}".format(key, value))
```

'While' loops

```
1 X = 0
2 while x < 10:
3     x += 1
4     print(x)
```

```
1 X = 0
2 while True:
3     if x == 10:
4         break
5     x += 1
6     print(x)
```



From [TutorialsPoint.com](https://www.tutorialspoint.com)

Functions and libraries

Functions

Functions...

- Take input **arguments**
- Execute statement(s)
- **return** output
- (Not necessarily of the same type)

```
1 def multiply(a, b):  
2     return a * b  
3  
4 multiply(2, 3)
```

```
1 def greet(name):  
2     print('Hello ' + name)  
3  
4 greet('John')
```

Libraries

Libraries are...

- Reusable collections of code that someone else (or you) has already written
- Part of the Standard Library (e.g. `random`)
- Distributed through PyPI – the Python Package Index (e.g. `pandas`)

```
1 import random
```

```
2  
3 random.randint(1, 100)
```

```
1 from random import randint
```

```
2  
3 randint(1, 100)
```

Making coding more enjoyable

Making coding more enjoyable

Write short lines

- Don't pack too much in a single long line (historically: 80 characters)
- Clever one-liners don't make you smarter
- Karma: the next person to read your code will hate you

Making coding more enjoyable

Write short functions

- If it doesn't fit on screen, break it down
- Think in a modular way (giving birth to programs is painful)
- Write reusable code and don't repeat yourself

Making coding more enjoyable

Choose meaningful names

- For both functions and variables
- Make the purpose clear
- The code should be the documentation... but write the documentation too

Making coding more enjoyable

Rewrite and polish often

- Understand and accept that you will make mistakes
- There is no royal road to coding
- ‘Negative lines of code’