

# Introduction to Programming with Python

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## Introduction to Myself

- ▶ Technical Experience:
  - ▶ Used Python for twenty mumble years
  - ▶ Wide variety of research and commercial groups
- ▶ Organisational Experience
  - ▶ Local User group
  - ▶ Australian Python conference in Brisbane
  - ▶ Volunteer at other Open events:
    - ▶ Health Hack, Library Hack, Gov Hack
- ▶ Teaching Experience:
  - ▶ Conference Speaking and Tutorials
  - ▶ CoderDojo
  - ▶ Software Carpentry

## Outline

Introduction

Fundamentals of Python

Fundamental Programming Concepts

Stepping Stones

Data Structures

Flow Control

Resources

## Introduction to this Class

- ▶ Take away skills:
  - ▶ Fundamental knowledge of:
    - ▶ all programming languages
    - ▶ of the Python language
    - ▶ of the Python ecosystem
- ▶ Tried to use non-technical language
- ▶ Instant gratification, use the interpreter
- ▶ Extend the examples:
  - ▶ add, remove, change arguments!
  - ▶ don't move on till you get an error!
- ▶ Self directed, internal motivation

## Design Goals of Python

- ▶ Takes care of a lot of details for you
- ▶ To be fast and easy to learn
- ▶ Low cognitive load, lets you work on your problem
- ▶ Does not lock things down
- ▶ Minimise eye strain

## Fundamentals Python Concepts

- ▶ Everything is an object
  - ▶ An object is data and related methods
- ▶ Some objects change, some objects don't
- ▶ Easy to use data structures

## Python Details

- ▶ Professional programming language used all over the world in many industries
- ▶ It's Open Source, your skills are portable.
- ▶ There are lots of implementations of Python, we're only looking at one, but 99% of today is useful to all
- ▶ Comes with Linux. Older versions come bundled with Apple. Easyish to install on Windows.

## Fundamental Programming Concepts

- ▶ Computers run a lot of tiny steps very quickly.
  - ▶ Move this bit of memory into the cpu
  - ▶ Move this other bit of memory into the CPU
  - ▶ Add these two numbers in the CPU
  - ▶ Put the result back into memory
- ▶ Most programming comes down to organising steps:
  1. Doing one step after another
  2. Repeating steps
  3. Choosing between two steps
  4. Grouping steps
- ▶ Variables and assignment
  - ▶ A box named anything
  - ▶ Spreadsheet Cells

## Helping hands

- ▶ For the most part, ignore methods that begin with double underscore

```
> s = "some string"
> type(s)
> help(str)
```

## Example steps

- ▶ assignment

```
> angle = 30
> a, b = "a", "b"
```

- ▶ function calls

```
> min(10, 3)
```

- ▶ method calls

```
> pancake.flip()
```

- ▶ maths

```
> 10 + 3.4
```

## Grouping of Steps

- ▶ functions

```
> def excited(message):
>     print(message + "!!!")
```

- ▶ classes

```
> class Pancake:
>     def flip(self):
>         self.flipped = True
```

- ▶ files
- ▶ libraries

## Python Data Structures

- ▶ atoms: numbers, strings
- ▶ molecules: lists, dictionaries
- ▶ mutable or immutable

## Numbers

- ▶ Immutable
- ▶ Whole numbers, floating point

```
> 123
> 3.14
```

- ▶ For more fun, Decimal and Fraction

## Number Methods

```
> 1 + 1
> 3 - 4
> 4 * 2
> 2 ** 4
> 8 / 3
```

## Strings

- ▶ Immutable
- ▶ Letters in between quotes

```
> 'letters in between single quotes'
> "letters in between double quotes"
> """letters in between triple quotes"""
```

## String Methods

```
> "joining" + " " + "strings"
> "needle" in "a haystack"
> "one two three".index("two")
> "one to three".split()
```

## Lists

- ▶ Mutable

```
> l = ["a", "b", "c"]
> l.append("d")
> ["one", "two", "three"] + [4, 5, 6]
```

## List Methods

```
> l = [5, 4, 5, 3, 5, 2, 1, 5]
>
> l.sort()
>
> l.count(5)
```

## Dictionaries

- ▶ Mutable
- ▶ An association between a key and a value
- ▶ Keys must be immutable

```
> d = {"key1": "value1", "key2": "value2"}
>
> d["key3"] = "value3"      # Adding an association
>
> d["key1"]                 # Asking for an association
```

## Dictionary Example

```
> thesaurus = {"red" : ["scarlet", "rosy", "ruddy"],
>              "blue" : ["azure", "navy", "cobalt"]}
>
> thesaurus["red"]
```

## Other data structures

- ▶ Tuples (immutable lists)
- ▶ Sets
- ▶ Queues
- ▶ Heaps
- ▶ ...

## For Loops

- ▶ Loop through a data structure

```
> for element in ["a", "b", "c"]:  
>     print(element)
```

- ▶ Loop through some numbers

```
> for i in range(10):  
>     print(i)
```

## If Statement

```
> if "needle" in ["haystack"]:  
>     print("found the needle!")  
> else:  
>     print("did not find the needle")
```

- ▶ Expressions Examples

```
> a, b = 10, 11  
> a == b      # equals  
> a > b       # greater than  
> a < b       # less than
```

## A more complicated example

```
> upper, lower, other = [], [], []  
> for element in ["one", "TWO", "three", "4"]:  
>     if element.isupper():  
>         upper.append(element)  
>     elif element.islower():  
>         lower.append(element)  
>     else:  
>         other.append(element)
```

## Other loops

### ► While

```
> a = 0
> while a < 10:
>     print(a)
>     a = a + 1
```

## Functions

### ► Let you reuse a block of code

```
> def even_stevens(number):
>     if number % 2 == 0:
>         return True
>     else:
>         return False
```

## Classes and Objects

### ► Lets you organise data and methods together

```
> class Pancake:
>     def __init__(self, batter_ml):
>         self.size = batter_ml
>         self.flipped = False
>
>     def flipped(self):
>         self.flipped = True
>
> p = Pancake(130)
> p
> p.size
> p.flipped
> p.flip()
> p.flipped
```

## Library use

```
> import random
> random.randint(1, 100)
```

## Module List

```
> help() # Then "modules"
```

## Resources

- ▶ These notes: Copyright © 2017 Clinton Roy
  - ▶ <https://github.com/clintonroy/slq2017python> 
- ▶ Websites
  - ▶ <http://python.org/>
  - ▶ <http://jupyter.org/>
- ▶ Books
  - ▶ Automate the Boring Stuff with Python   
<https://automatetheboringstuff.com>
- ▶ Users Groups
  - ▶ Brisbane Python Users Group
  - ▶ Humbug (Home Unix Machine, Brisbane Users Group)
- ▶ Conferences
  - ▶ PyCon Au, PyCon NZ
  - ▶ Videos on Youtube
- ▶ Software Carpentry groups at UQ, QUT, Griffith
- ▶ Podcasts
  - ▶ From Python import podcast
  - ▶ Podcast `__init__`
  - ▶ Python Bytes
  - ▶ Talk Python to Me