Programming in Python

IAP 2013

Student Information Processing Board
Nathan Arce ‘13 – Luke O’Malley ‘14

Day 1

1. Background
2. Install Python
3. Using Python as a Calculator
4. “Hello World!”
5. Functions and Arguments
6. Control Flow Tools
7. Coding Challenge

Who Uses Python?

Google Search I'm Feeling Lucky

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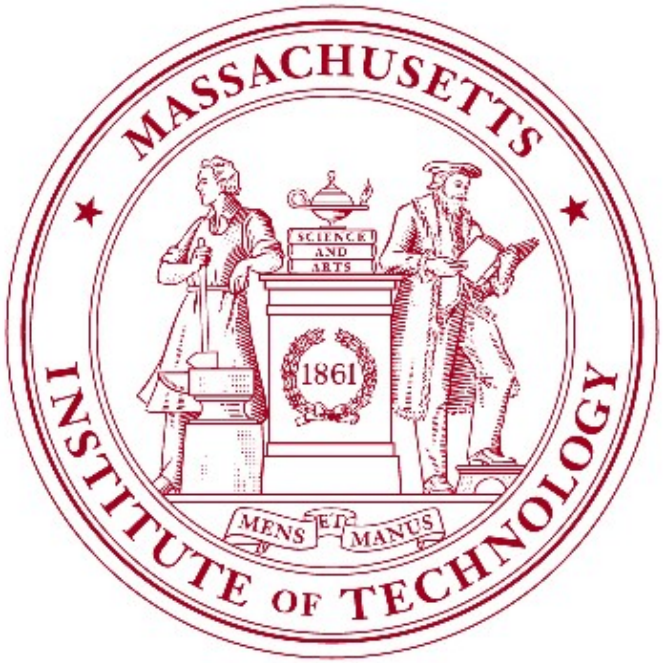
django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Why Use Python?

Windows

1. Visit http://www.python.org/getit/
2. Install Python 2.7.3

Mac/Linux

1. Check if Python is already installed by opening a Terminal
2. In the Terminal, type:

```
your-user-name$ python --version
Python 2.7.3
```

3. If it errors and you don't have Python call us over

Use Python as a Calculator

“Hello World?”

Functions and Arguments

Conditional Flow Tools

Coding Challenge!

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If we list all the natural numbers below 10 that are multiples of 3 or 5, we get 3, 5, 6 and 9. The sum of these multiples is 23. Find the sum of all the multiples of 3 or 5 below 1000.

End Day 1!

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http://bit.ly/11a8ITS

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Day 2

1. Coding Warm-up
2. Data Stores
    - Lists
    - Dictionaries
3. Objects/Classes
4. Recursive Functions
5. Scope

import this

Write a function sleep_in(weekday, vacation) that tells us True/False can we sleep in. The parameter weekday is True if it is a weekday, and the parameter vacation is True if we are on vacation. We sleep in if it is not a weekday or we're on vacation. Return True if we sleep in.

sleep_in(False, False) → True
sleep_in(True, False) → False
sleep_in(False, True) → True

Given a string, we'll say that the front is the first 3 chars of the string. If the string length is less than 3, the front is whatever is there. Return a new string which is 3 copies of the front

front3('Java') → 'JavJavJav'
front3('Chocolate') → 'ChoChoCho'
front3('abc') → 'abcabcabc'
front3('q') → ‘qqq’

Lists

Initialize an empty list:

```
>>> empty_list = []
>>> empty_list2 = list()
```

Initialize a list with elements:

```
>>> numbers = [1,2,3]
>>> mixed_list = [‘cat’, 3, [1,2,3]]
>>> 5_list = [None]*5
```

List length:

```
>>> mixed_list = [‘cat’, 3, [1,2,3]]
>>> len(mixed_list)
 3
```

['A', 'B', 'C', 'D', 'E']

Adding to a list:

```
>>> numbers = [1,2,3]
>>> numbers.append(4)
>>> numbers
 [1,2,3,4]
```

Joining lists:

```
>>> one_to_three = [1,2,3]
>>> four_to_six = [4,5,6]
>>> one_to_three + four_to_six
 [1,2,3,4,5,6]

>>> one_to_three.extend(four_to_six)
>>> one_to_three
 [1,2,3,4,5,6]
```

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Changing an element:

```
>>> numbers = [1,2,3]
>>> numbers[0] = 100
>>> numbers
 [100,2,3]
```

Slicing:

```
>>> a = [‘Hello’, ‘World’, ‘!’]
>>> a[0:2]
 [‘Hello’, ‘World’]
```

Given an array of integers, return a new array length 2 containing the first and last elements from the original array. The original array will be length 1 or more.

make_ends([1, 2, 3]) → [1, 3]
make_ends([1, 2, 3, 4]) → [1, 4]
make_ends([7, 4, 6, 2]) → [7, 2]

List Comprehension

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List comprehension:

```
>>> [x**2 for x in range(10)]
[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

List comprehension with conditionals:

```
>>> coord = [12, -2, 5, -71, 39, 13, 4]
>>> [abs(x) for x in coord if x > 10 and x < 70]
 [12, 39, 13]
```

Dictionaries

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Initialize empty dictionary:

```
>>> empty_dict = {}
>>> empty_dict = dict()
```

Initialize dictionary with elements:

```
>>> dictionary = {1: 'The number 1', 'hello': 'A
common english greeting', 'the answer': 42}
```

Adding to a dictionary:

```
>>> d['key'] = 'value’
>>> d[variable] = other_value
```

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Check if a key exists, then access dictionary element if it does:

```
>>> if foo in d:
            print d[foo]

```*If you try to access an element that isn't there, it will give you an error!*```

Joining dictionaries:

```
>>> dict1 = {‘Luke’: 1}
>>> dict2 = {‘Nathan’: 2}
>>> dict1.update(dict2)
>>> dict1
 {'Luke': 1, 'Nathan': 2}
```

Other useful dictionary methods:

- .iteritems( )
- .iterkeys( )
- .keys( )
- .values( )
- .has_key( )

Classes

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Define a class:

```
class MyFirstClass:
    <statement-1>
        .
        .
    <statement-N>
```

Instantiate a class:

```
>>> a = MyFirstClass()
```

Classes can have attributes and methods:

```
class MyFirstClass:
    """A simple example class"""
    i = 12345
    def f(self):
        return 'hello world’
```

Initialize a class with arguments:

```
def MyFirstClass:
    def __init__(self, arg1, arg2, ...)
        self.arg1 = arg1
        self.arg2 = arg2
```

Class methods can then access those arguments:

```
    <... other methods ...>

    def change_color(self):
        if self.color == ‘RED’:
            self.color = ‘WHITE’
        else:
            self.color = ‘BLUE’

    <... more methods ...>
```

Recursion

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Recursion is when a function calls itself.

Recursion is usually used to solve complex problems, that can be broken down into smaller, identical problems.

Problems that can be solved with recursion, most likely can be solved with loops.

```
def print-x-n-times(x, n):
    # always have a base case!
    if (n <= 0):
     return
  print x
  print-x-n-times(x, n - 1)
```

Given a value N, return the Nth Fibonacci number.

Fibonacci numbers are computed by adding the previous two Fibonacci values.

1, 1, 2, 3, 5, 8, 13, 21, 34, …

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Day 3

1. Immutable vs. Mutable Data Types
2. Tuples
3. What is next?
4. Coding

Slides:
http://tinyurl.com/sipb-python

import antigravity

Immutable Data Types

Immutable types:

- cannot change
- are the only things that can be used as dictionary keys
- use these when a value will not change in your code
- by telling Python that a variable won't change, it can optimize itself
- immutable types include:
  - tuples, (1, "bar") ← next slide
  - strings, "Hello World!"
  - numbers, 42

Mutable types:

- can change
- mutable types include:
  - lists, [1, 2, 3, 4, 5]
  - dictionaries, {1: “one”, 2: “two”}

Tuples

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Tuples are immutable, they are constants:

```
>>> test = (“Ben Bitdiddle”, “A”)
>>> test[1] = “F”
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
TypeError: 'tuple' object does not support item assignment
```

Accessing tuples:

```
>>> test[0]
“Ben Bitdiddle”
>>> name, grade = test
>>> (name, grade) = test
>>> name
“Nathan”
```

Tuples as list elements:

```
>>> test_scores = [(“Ben”, “A”), (“Lisa”, “A+”)]
>>> for name, grade in test_scores:
        print “{} got a {}”.format(name, grade)
```

What next?

What next?

- work on personal projects
- learn algorithms (CLRS)
  - performance and memory management
- grab a Python book
- active online community, dive in!
- SIPB, you can get involved with out projects!

Coding:
http://tinyurl.com/sipb-python

What we've done and why we love Python!