

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



Google Search

I'm Feeling Lucky



Dropbox

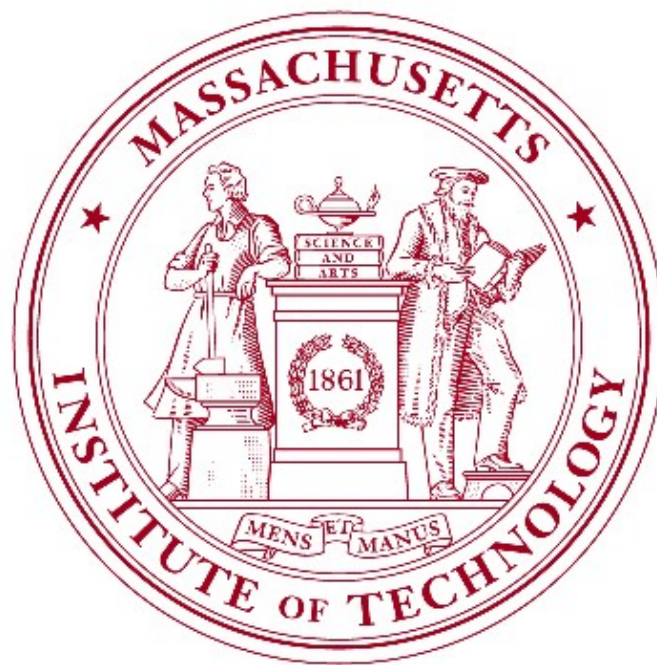


Watch a Video

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django





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!



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!



<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') → 'abcabcab'`

`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]
```



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



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



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
```




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



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



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 N th 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. Tuples
2. What is next?
3. 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



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 our projects!



Slides:

<http://tinyurl.com/sipb-python>



What we've done and why we love
Python!