Introduction to Python

L435/L555

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A tour of Python

Today we’re going to take a quick tour of Python.

▶ You’ll see many different types of things, but nothing in-depth
▶ By the end, you should be able to:
  ▶ Have some sense of what Python has to offer
  ▶ Run some basic Python commands interactively
  ▶ Write short Python programs and run them

For most of what we’re doing: type `python3` in a terminal, to open the interactive shell
Hello World

```
print('Hello world. ')
print('Hello world. ')
print(4 + 5)
```

Data types are the building blocks from which everything else is built

- Simple Types: numbers, strings (later: booleans, bytes)
  - numbers: 3, 12.443, 89, ...
  - strings: "hello", 'manny', "34", ...

- Complex Types: lists, dictionaries (later: sets, tuples)
  - lists: [1,2,3], [1,2,"a"], ["john", "mama", "denny", "michelle"], ...
  - dictionaries: {"a":1, "b":16}, ...

Python is dynamically typed: you do not have to declare what type each variable is

(http://www.diveintopython3.net/native-datatypes.html)
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Numbers

Some quick examples:

```python
>>> 2+2
4
>>> 3/2
1.5
>>> 3//2
1
```

Python has integers and floating point numbers (& complex numbers), and operations to convert between them:

```python
>>> float(3)
3.0
>>> int(4.123)
4
```
Variables

What is a variable?

Definition
A variable is a name that refers to some value (could be a number, a string, a list etc.)

Example

1. Store the value 42 in a variable named foo
   ```python
   foo = 42
   ```

2. Store the value of foo+10 in a variable named bar
   ```python
   bar = foo + 10
   ```
User input

Example

1. Ask the user to input a name, and store it in the variable `name`
   ```python
   name = input('enter a name: ')  
   ```
2. Create a new string with a greeting
   ```python
   greet = 'hello ' + name  
   ```
3. Print the greeting
   ```python
   print(greet)
   print('hello', name)
   ```


⇒ Let’s look at area.py
User input

Example

1. Ask the user to input a number, and store it in the variable `foo`
   ```python
   foo = int(input('enter an integer: '))
   ```
   ```python
   bar = float(input('enter any number: '))
   ```

2. Add `foo` and `bar` together
   ```python
   foo + bar
   ```

3. Calculate the average of `foo` and `bar`, and save it in a variable named `avg`
   ```python
   avg = (foo + bar)/2
   ```
String basics

- Strings must be enclosed in quotes (double or single)
- Strings can be concatenated using the + operator
  - Note that this is the same as numerical addition ...
  - But you cannot combine a string and a number (common error)

(http://www.diveintopython3.net/strings.html)
Strings

- Many ways to write a string:
  - single quotes: ’string’
  - double quotes: "string"
  - can also use """" to write strings over multiple lines:
    ```python
    >>> s=""""<html>
    ... example
    ... </html>
    ... """
    >>> s
    ' <html>example </html>
    ```
- There are string characters with special meaning: e.g., 
  \n (newline) and \t (tab)
- Get the length of a string by the len function
String indices & slices

You can use slices to get a part of a string (or other sequence)

>>> s = "happy"
>>> len(s)  # use the len function
5
>>> s[3]  # indexed from 0, so 4th character
'p'
>>> s[1:3]  # characters 1 and 2
'ap'
>>> s[:3]  # first 3 characters
'hap'
>>> s[3:]  # everything except first 3 characters
'py'
>>> s[-4]  # 4th character from the back
'a'
Functions

What is a function?

Definition

A function is like a mini-program. It can take several *arguments*, and *returns* a value.

We won’t look at the syntax of these yet.
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Modules

What is a module?

Definition

Python is easily extensible. Users can write programs that extend the basic functionality, and these programs can be used by other programs, by loading them as a module.

Example

1. Load the math module
   ```python
   import math
   ```

2. Round quotient of foo and bar down to nearest integer
   ```python
   math.floor(foo/bar)
   ```

3. Get the value of pi
   ```python
   math.pi
   ```

(https://docs.python.org/3.2/library/math.html)
Sidebar: Anaconda Python

There are built-in modules (e.g., `math`, `re`)
  ▶ ... and then there are third-party packages which extend Python in numerous ways

Some people like to install Anaconda Python
  ▶ This is Python + 720 other packages (including NLTK, NumPy, SciPy, etc.)
  ▶ [https://www.continuum.io/downloads](https://www.continuum.io/downloads)

Note: the package is quite large
  ▶ There is the miniconda option: [http://conda.pydata.org/miniconda.html](http://conda.pydata.org/miniconda.html)
Saving and executing programs

Example

- Script File: hello.py

```python
# this prints 'hello world' to stdout
print("hello world")

# note how # denotes comments!
# (i.e., ignored by python interpreter)
```

- Run the program:
  ```
  python3 hello.py
  ```
Creating & Editing Python files

Python files are simply text files, so we just need a text editor. Some options:

- **Windows**: Notepad(++)/Wordpad → Save as plain text
  - Sometimes Windows is set up s.t. it forces you to add a .txt extension to your file.
  - This isn’t a problem, but to get rid of it, (I think) you need to save as “All files” and also change your desktop settings so that they show file extensions

- **Mac/Unix**: nano, Emacs (or Aquamacs [which I use]), VIM, TextWrangler, and probably others
  - I use Aquamacs, but will likely use TextWrangler & IDLE (next slide) in class, but use what you like ...
  - Note: Emacs & VIM provide a lot of Python support
Some text editors offer **syntax highlighting**, which shows variable names, indentation, etc.

**Integrated Development Environments (IDEs)** offer syntax highlighting, debugging features, streamlined code-running, etc.

- One IDE which comes with Python is IDLE (https://docs.python.org/3/library/idle.html)
  - Windows: Once you’ve installed Python, this should be available from something like: Start → Applications → Python34 → ...
  - Mac: Check the Applications folder (or use spotlight to find it)
IDEs

Other than IDLE, there are a number of IDEs that are popular:

- PyDev: http://www.pydev.org
  - runs on top of Eclipse (http://www.eclipse.org)
- PyCharm: http://www.jetbrains.com/pycharm/
- IDEs for Anaconda: https://docs.continuum.io/anaconda/ide_integration
  - ...

Also consider

- ipython (jupyter): https://ipython.org
  - Graphical, interactive interface
  - Integrated with notebook facilities