

Introduction to Python

Computing

Computing is any purposeful activity that marries the representation of some dynamic domain with the representation of some dynamic machine that provides theoretical, empirical or practical understanding of that domain or that machine.

– Isbell, et. al., **(Re)Defining Computing Curricula by (Re)Defining Computing**, SIGCSE Bulletin, Volume 41, Number 4, December 2009

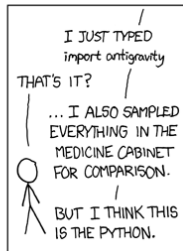
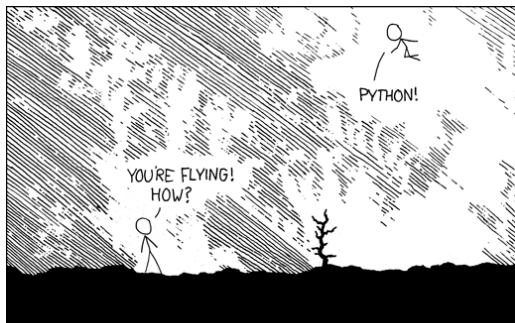
Models, Languages, Machines

Computing is fundamentally a modelling activity.

- ▶ A **model** is a representation of some information, physical reality, or a virtual entity in a manner that can then be interpreted, manipulated, and transformed.
- ▶ A **language** is a means of representation.
 - ▶ A language enables reasoning and manipulation of the model.
- ▶ A computational **machine** allows us to execute our models.
 - ▶ Computational models are **runnable**.

In this course we will learn the Python programming language, one of many programming languages in which computational models can be represented.

Python gives you wings!



<http://xkcd.com/353/>

The Python Language

- ▶ Python is a general-purpose programming language, meaning you can write any kind of program in Python
 - ▶ A **domain-specific language** is designed for one application. E.g., SQL is just for manipulating relational databases.
- ▶ Python is interpreted, meaning you can run programs directly after you write them; you don't have to compile programs to some intermediate form for the operating system or a virtual machine to execute.
- ▶ Python is a great "glue" language; Python programs often bring together disparate components to do a coherent task.
 - ▶ One particular kind of glue is Python's killer feature for data science: easy to create Python bindings for libraries written in other languages
 - ▶ Data science libraries, e.g., NumPy, TensorFlow, are written high-performance languages like C and C++
 - ▶ Python provides a more comfortable way to use high-performance libraries

The coolest thing about Python ...

The Python Name



<https://en.wikipedia.org/w/index.php?curid=6130072>

Python was named for Monty Python, of which Python's creator, Guido van Rossum, is a big fan.

The python3 Program

Practically speaking, Python is a program on your computer that interprets Python programs and statements.

- ▶ You can ask python3 a question without running any Python code. For example, this is how you ask which version of Python is installed (Note: the \$ character is the command prompt in the Unix Bash shell. The Windows command prompt is C:\>.):

```
$ python3 --version  
Python 3.8.10
```

If you get some other response, like command not found, then you haven't properly installed Python.

Executing Python Code

- ▶ You can run a Python program, which has a .py extension by convention:

```
$ python3 myprogram.py
```

- ▶ Or you can invoke the interactive Python shell (sometimes called REPL for "Read-Eval-Print Loop"):

```
$ python3
Python 3.8.10 (default, Jun 2 2021, 10:49:15)
[GCC 9.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

To exit the Python shell type Ctrl-D on Linux/Unix, or Ctrl-Z on Windows.

Hello, Python

Since Kernighan and Ritchie's "The C Programming Language" it's customary for your first program in a new language to be "Hello, world!"

- ▶ Open your text editor, paste the following code into a buffer (or tab or window or whatever your editor calls it), and save it as `hello.py`:

```
print("Hello, world!")
```

- ▶ Then open your command shell (terminal on Unix or CMD.exe on Windows), go to the directory where you saved `hello.py` and enter:

```
$ python3 hello.py
```

Hello, world! will be printed to the console on the next line.

Interpreting Python Programs

What happens when we enter `python3 hello.py` at an operating system command shell prompt?

1. `python3` tells the OS to load the Python interpreter into memory and run it. `python` is the name of an executable file on your hard disk which your OS can find because its directory is on the PATH
2. We invoke `python` with a **command line argument**, which `python3` reads after it starts running
3. Since the command line argument was the name of a file (`hello.py`), the `python3` loads the file and executes the Python code in it.

A Python program, or script, is just a sequence of Python statements and expressions.

The Python REPL

Invoke the Python interactive shell by entering `python` at your command shell's prompt without any arguments and type in the same line we put in `hello.py`:

```
$ python3
Python 3.8.10 (default, Jun 2 2021, 10:49:15)
[GCC 9.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

`>>>` is the command prompt for the Python REPL.

- ▶ REPL stands for **R**ead **E**val **P**rint **L**oop:
 1. **Read** an expression or statement at the command prompt,
 2. **Evaluate** the expression or execute the statement,
 3. **Print** the result to the console, and
 4. **Loop** back to **Read** step

We'll spend a lot of time in the REPL.

Conclusion

- ▶ Python is an interpreted general purpose language
- ▶ Python code can be run as programs or interactively in a Python REPL
- ▶ Python is a great glue language
- ▶ Python is fun!