Python Foundations

Nichole Bennett

Course Information

About Me

Used to research climate change impacts on butterflies (ecology, evolution, behavior, some genomics)

Then, I taught adults data science with General Assembly and taught kids coding through various programs.

Now I research science communication.

In my spare time, I do improvisational acting.

About You

Find a partner, find out the following about them:

- Name
- Where they are from
- What they do for work, for fun
- Why they are here
- One fun fact

Then, we'll share.

Course Overview (subject to change)

Day 1: writing/running Python code, use Python for basic data analysis tasks (cleaning, reformatting, exploration, analysis), understand what Python is useful for

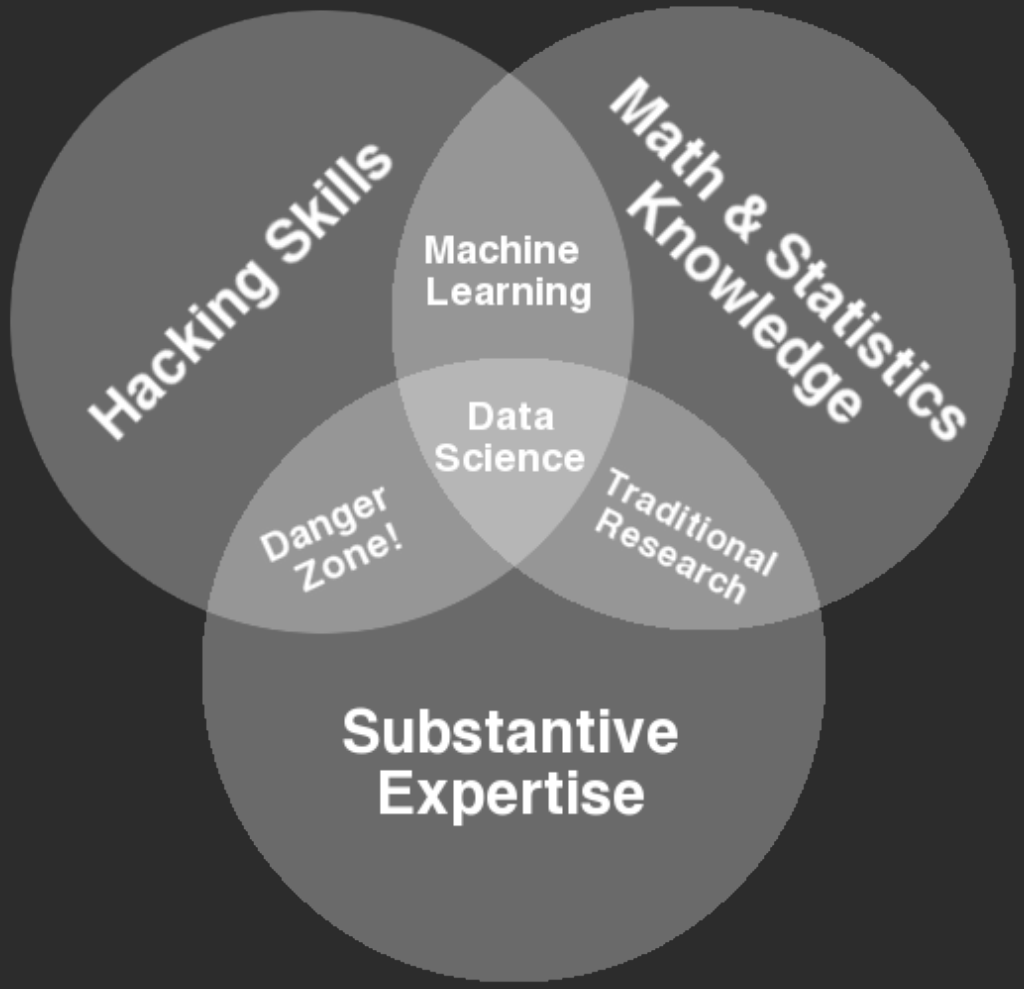
Day 2: collect data from CSVs, explore large datasets, clean and munge data to prepare for analysis, apply machine learning algorithms to gain insight from data, visualize results

Anything missing on here that you were hoping for?

Prerequisites

This should be pretty beginner-friendly.

Feel free to speak out if you don’t understand something--I’ll adjust.



Install Help Time!

Mac/Linux Users: Go to your Terminal and type conda list

PC Users: Go to your Anaconda Prompt and type conda list

ANACONDA®

Questions About Course In General?

Any Requests?

No matter where you are now, you'll be fine.

You have already proven that you are a self-starter and self-learner, and that will take you far.

What is Python?

What is Python?

Created by Guido Van Rossum in 1991

Easy language to learn

Lots of contributors to modules

Emphasizes human readability

What is an interpreted language?

Python is an interpreted language

Code doesn't have to be translated into machine-language before execution (VS compiled code that is executed by the computer's CPU)

This means it's not as fast as compiled code

But also means it's more portable

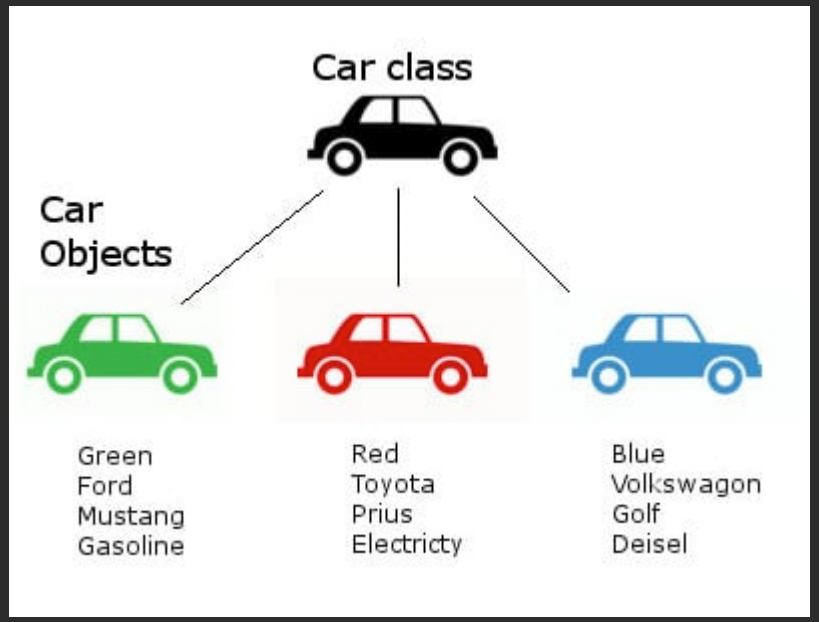
What is an object-oriented language?

Python is an Object-Oriented language

Instead of just being a series of actions, Python lets us form "objects" that have their own data (attributes) and their own actions (methods) to modify their data.

A benefit of OO is that it is easier to reuse the code in other programs.

We'll be using lots of objects. (We may not even realize it).



What is a “high-level” language?

Python is a high-level language

Python

```python
print("hello world")
```

C++

```cpp
#include<iostream>
using namespace std;

int main()
{
    cout << "Hello World!";
    return 0;
}
```

What is a dynamically-typed language?

Python is a dynamically-typed language

This means you don't have to specify what type the variables are. The computer figures it out for you

Why use Python?

Why use Python?

Quick and easy to use

Big community with lots of "batteries included" libraries (especially for machine learning)

Most libraries written by people with a computer science background, so easy to switch from library to library

Why not use Python?

Why not use Python?

If you have something that needs speed

If you are doing lots of stats

Python Interactive Shells

Write code that is executed immediately by the Python interpreter.

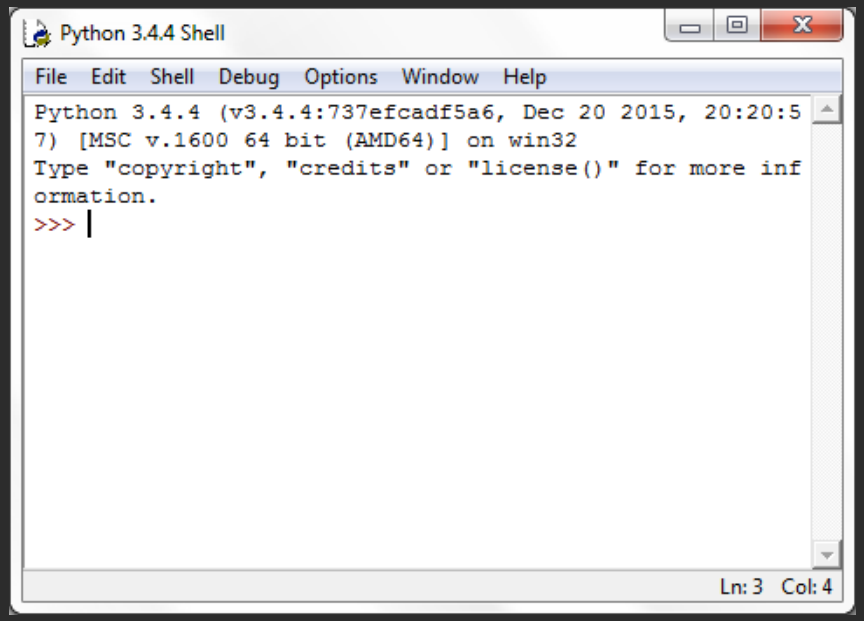
We are able to "interact" with the results of the commands we pass. We can do this using a:

- Python shell
- iPython shell
- Jupyter notebook

Python Shell

A python shell is similar to a Command Line Terminal and it can be launched by typing (into Terminal or Git Bash)

python

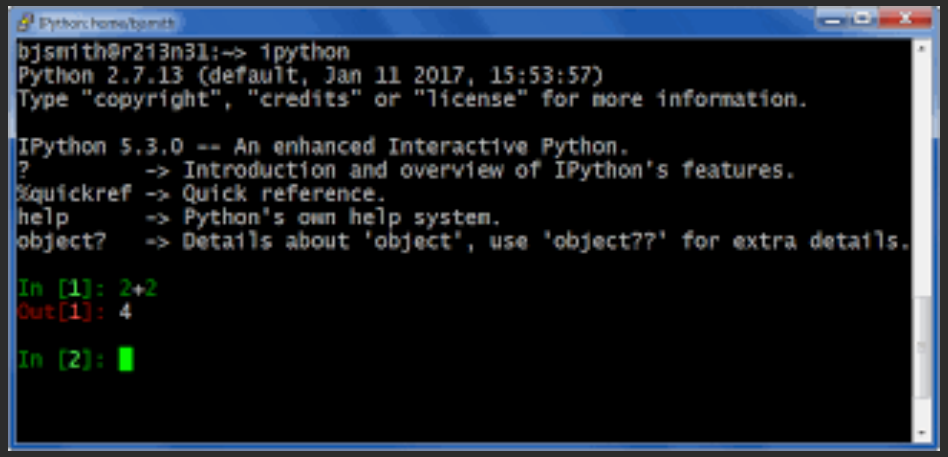


iPython Shell

iPython provides syntax coloring and shortcuts to interact with other code.

You can launch it by typing (into Terminal or Git Bash)

ipython



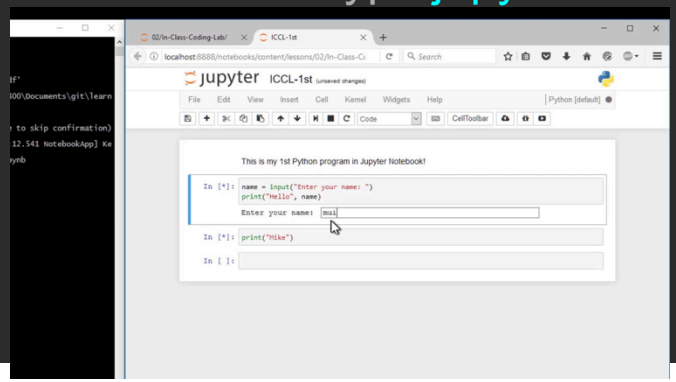
Jupyter Notebook

A Jupyter notebook is a web interface. With it we can use formatting and markdown with our code. This is what we'll be primarily using for this course.

Mac/Linux: In the terminal type jupyter notebook

Windows: Click the "Start" button and type "cmd" type jupyter notebook

Or open Git Bash and type jupyter notebook



Juypter Notebooks

born out of the IPython project--grew to encompass more languages

The name Jupyter is an indirect acronym of the three core languages it was designed for: JUlia, PYThon, and R

Scripting

Sometimes we just want to execute a program and get results, not interact with our Python code.

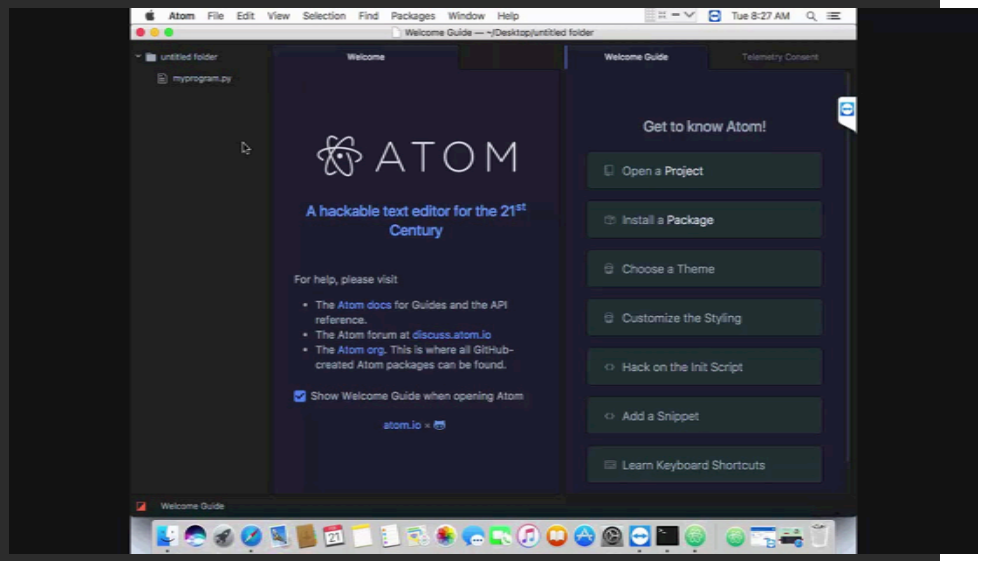
In those cases, we use a Python script.

To do so, we can use a text editor of our choice and save the code in a file with extension “.py”.

Text Editors

Some common plain text editors include:

- Atom
- NotePad (Win), NotePad++ (Win)
- TextEdit (Mac), TextWrangler (Mac).
- Nano (Linux, Mac)



IDEs

Integrated development environments (IDEs) provide tools for writing and testing your software (Brings tools together for you)

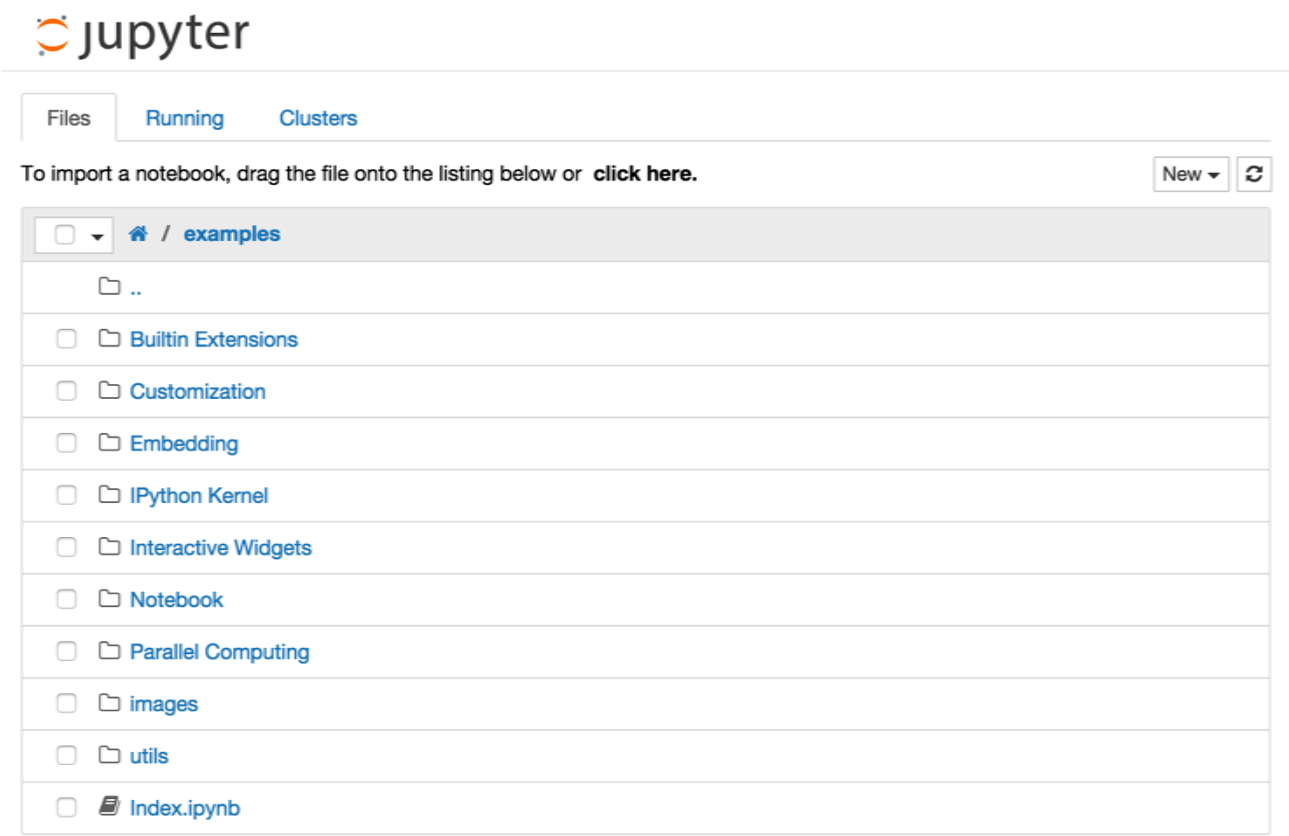
- PyCharm
- Eclipse with PyDev
- Atom
- Spyder (included in Anaconda)

Introduction to Jupyter Notebooks

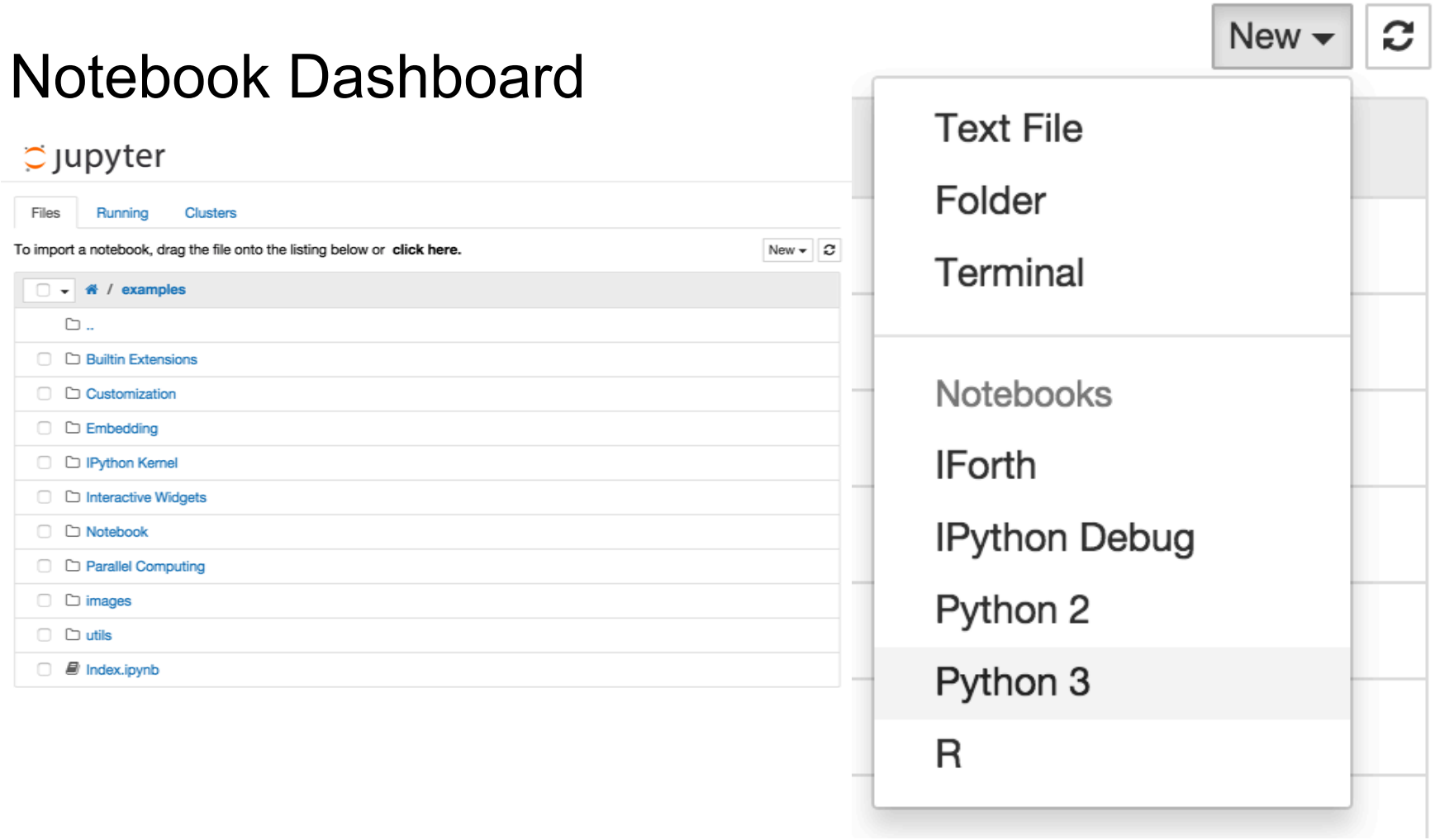
Opening a Jupyter Notebook from Git Bash (Windows) or the Terminal (Mac)

```
Nicholes-MacBook-Air:~ nicholebennett$ jupyter notebook
```

Notebook Dashboard

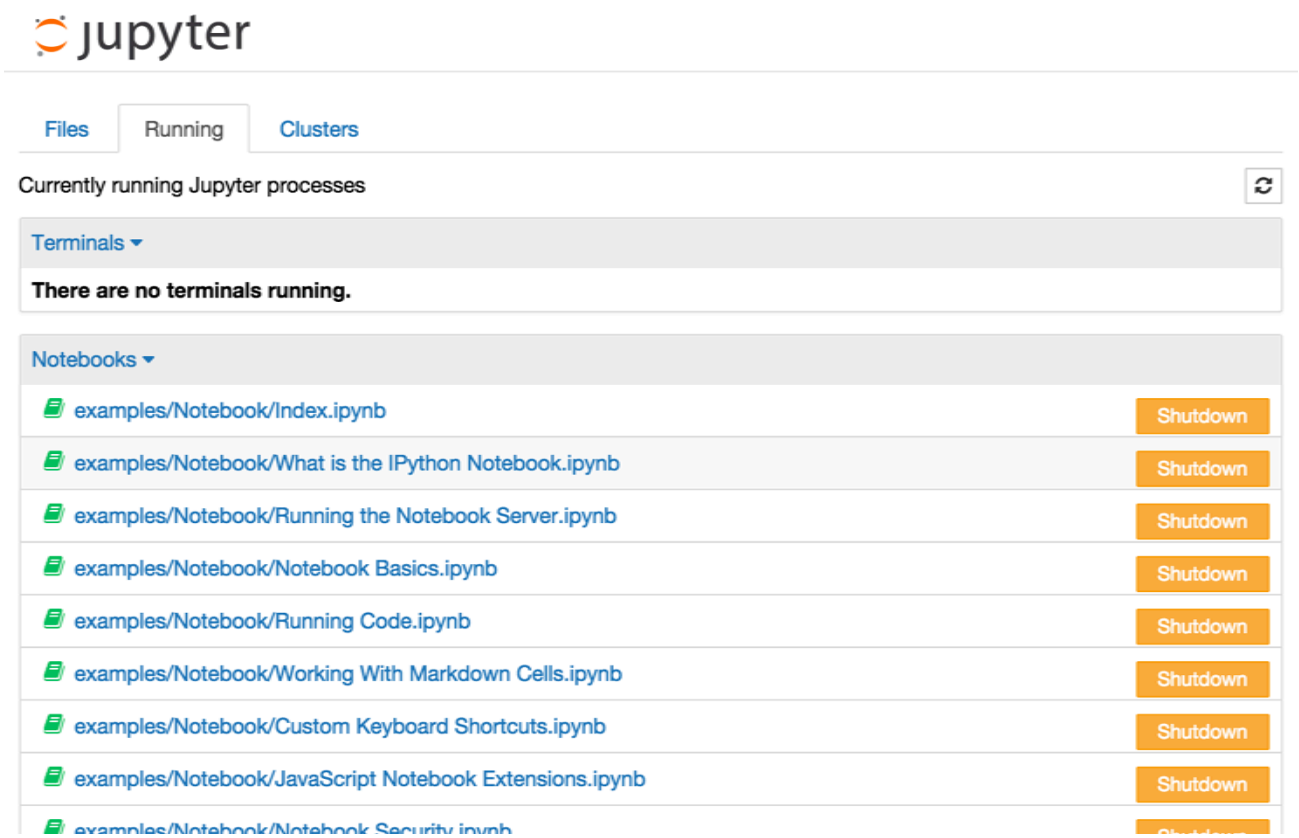


Notebook Dashboard

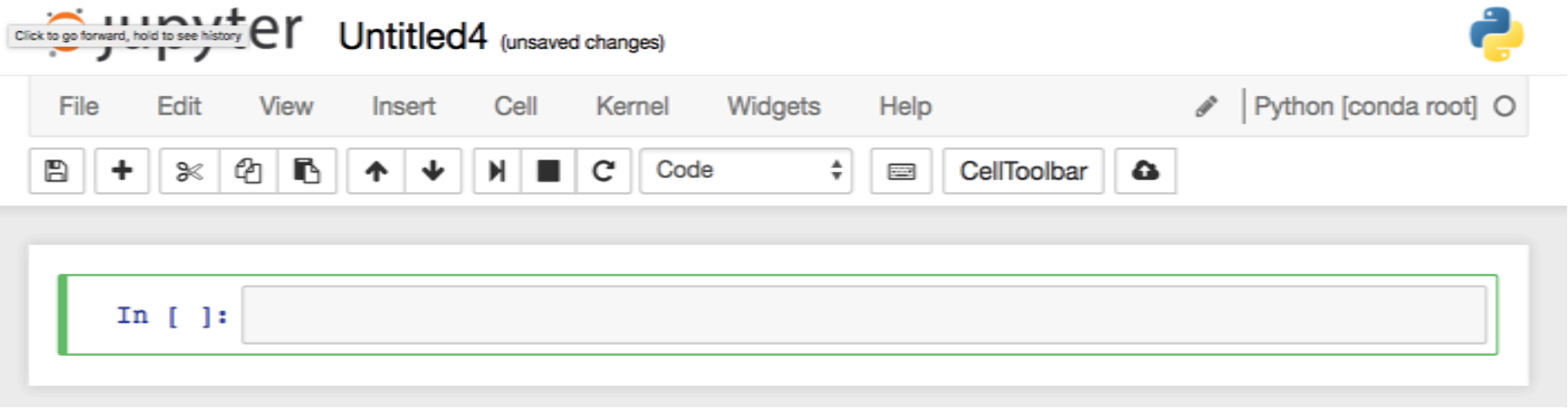


Notebook Dashboard

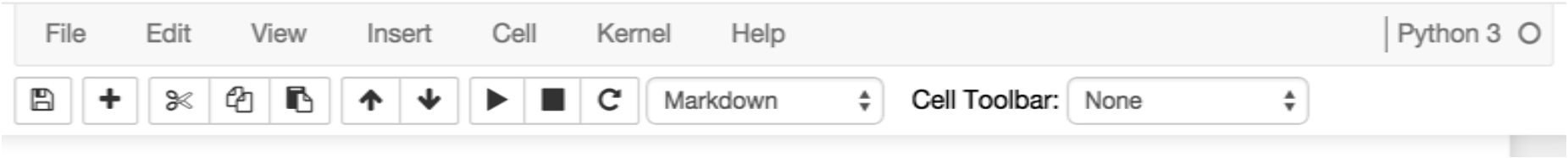
Notebook Dashboard



Notebook User Interface (UI)



Menu and Toolbar



Modes

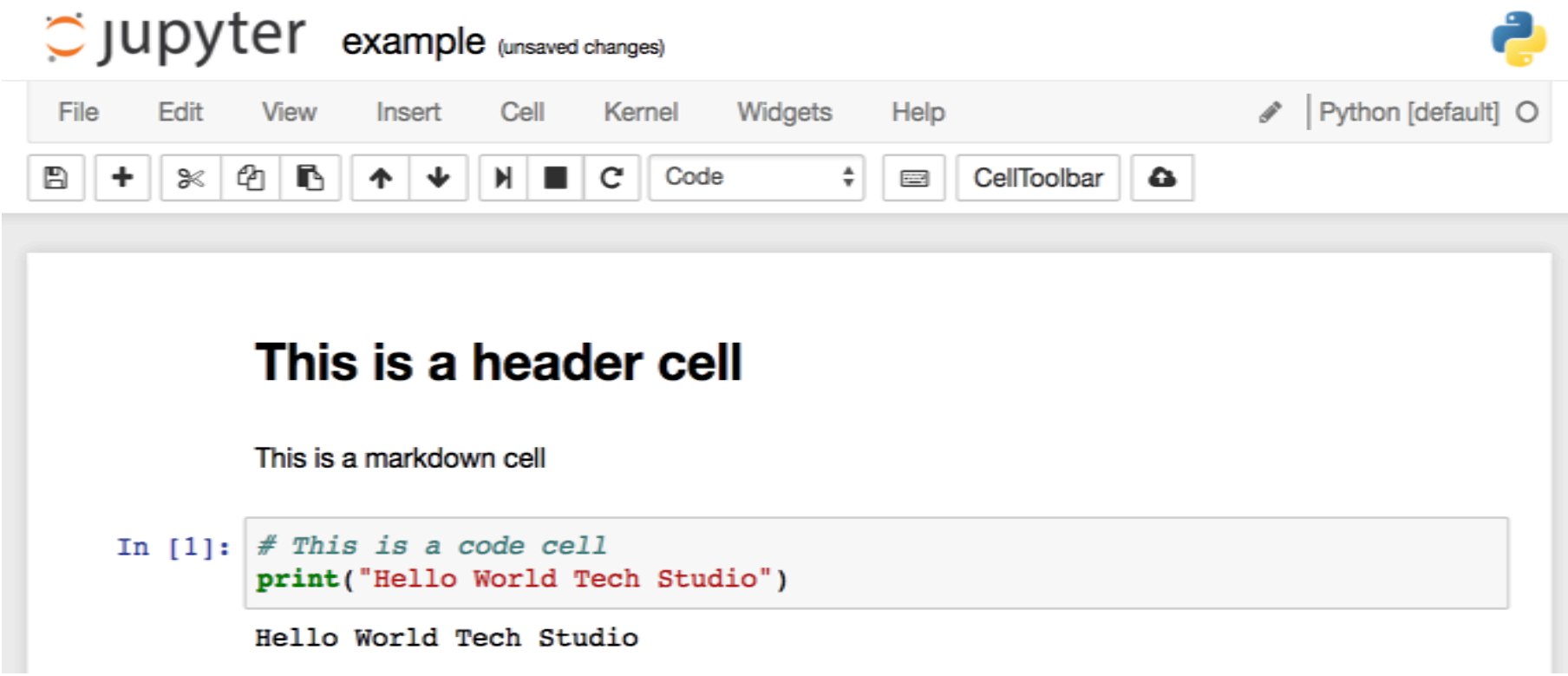
Edit Mode

```
In [1]: a = 10
```

Command Mode

```
In [1]: a = 10
```

Headers, and markdown, and code (oh my!)



Keyboard shortcuts

Go to Help > Keyboard Shortcuts (or Cmd + Shift + P/Ctrl + Shift + P)

Some useful ones:

- Esc will take you into command mode where you can navigate around your notebook with arrow keys….While in command mode:
  - A to insert a new cell above the current cell, B to insert a new cell below.
  - M to change the current cell to Markdown, Y to change it back to code
  - D + D (press the key twice) to delete the current cell
- Enter will take you from command mode back into edit mode for the cell.

Keyboard shortcuts

Go to Help > Keyboard Shortcuts (or Cmd + Shift + P/Ctrl + Shift + P)

Some useful ones:

- Shift + Tab will show you the Docstring (documentation) for the the object you have just typed in a code cell
  - keep pressing this short cut to cycle through a few modes of documentation.
- Ctrl + Shift + - will split the current cell into two from where your cursor is.
- Esc + F Find and replace on your code but not the outputs.

Keyboard Shortcuts

Go to Help > Keyboard Shortcuts (or Cmd + Shift + P/Ctrl + Shift + P)

Some useful ones:

- Select Multiple Cells:
  - Shift + J or Shift + Down selects the next sell in a downwards direction. You can also select sells in an upwards direction by using Shift + K or Shift + Up.
  - Once cells are selected, you can then delete / copy / cut / paste / run them as a batch. This is helpful when you need to move parts of a notebook.
  - You can also use Shift + M to merge multiple cells.

Jupyter Notebook Demo

Jupyter Notebook Obstacle Course

1. Open a new notebook
2. Name the file something specific and useful
3. Add a header for your name
4. Add a code cell
5. Print a short sentence about yourself
6. Add some markdown
7. Explore!

CTRL + C to close out of the Jupyter Notebook from the Terminal or Git Bash

Getting Help

Help menu has documentation for some common libraries

Place ? before a library, method, or variable for a quick syntax reference

You can execute shell commands in notebooks by prepending the command with !

Hello, Colaboratory

File Edit View Insert Runtime Tools Help

CODE TEXT CELL CELL COPY TO DRIVE

Table of contents Code snippets Files

Welcome to Colaboratory!

Colaboratory is a free Jupyter notebook environment that requires no setup and runs entirely in the cloud. See

Getting Started

- Overview of Colaboratory
- Loading and saving data: Local files, Drive, Sheets, Google Cloud Storage
- Importing libraries and installing dependencies
- Using Google Cloud BigQuery
- Forms, Charts, Markdown, & Widgets
- TensorFlow with GPU
- TensorFlow with TPU
- Machine Learning Crash Course: Intro to Pandas & First Steps with TensorFlow
- Using Colab with GitHub

Highlighted Features

Seedbank

Looking for Colab notebooks to learn from? Check out Seedbank, a place to discover interactive machine learning examples.

CODE TEXT

jupyter
nbviewer

JUPYTER FAQ

nbviewer

A simple way to share Jupyter Notebooks

Enter the location of a Jupyter Notebook to have it rendered here:

URL | GitHub username | GitHub username/repo | Gist ID Go!

Programming Languages

IPython

IP[y]: IPython
Interactive Computing

python™

IRuby

File.open('lib/iruby/static/base/images/ipynblogo.png')

IRuby: Notebook

IJulia

An IJulia Preview

julia

Basic Julia interaction

Self-Diagnosis: Comfort With Python

Line up according to how well you think you'd be able to teach Python basics to someone else (e.g. functions, for loops, if/else, lists, dictionaries…)

Then:

Mob Coding (5 groups of 3) on Part 1 and 2

- 1 driver, 1 navigator, 1 thinker
- Goal is to get every member of the group to understand

Then:

Do Python Foundations Practice on your own.