COMS BC1016

Introduction to Computational Thinking and Data Science

Lecture 2: Introduction to Python

Sept. 3, 2025

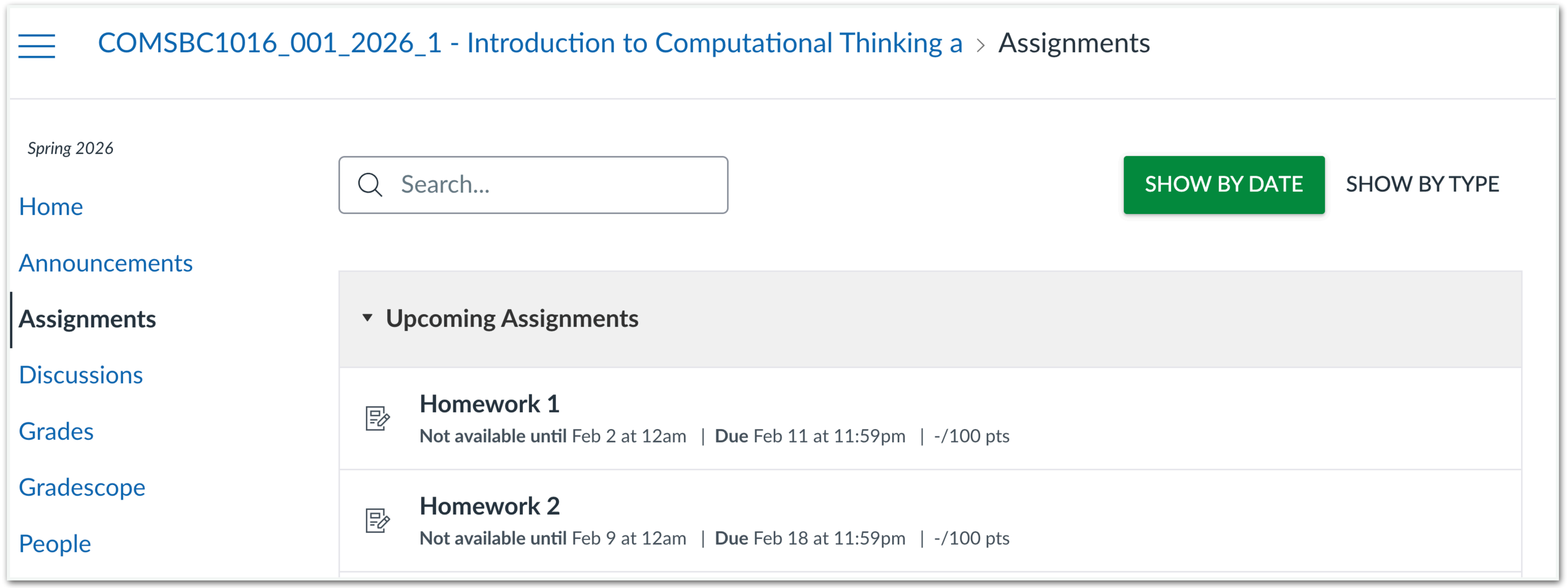
January 26, 2025

Office Hours

- Office hours begin next week (first week of February)
- **Monday**:
  - Elena Lukac, 1:30-3pm in Milstein 503
  - Eysa Lee, 3-5pm in Milstein 512
- **Tuesday**: Nami Jain, 4-5:30pm in Milstein 503
- **Wednesday**: Madeline Gutierrez, 5:30-7pm in Milsten 503
- **Thursday**: Sathya Raman, 4-5:30pm in Milstein 503

Assignments

- Labs and HWs located on Courseworks
    - Download the files from the assignment page
    - HWs posted to 1016, Labs to 1017
- Submit HWs as .ipynb
- Submit Labs as PDFs



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Spring 2026

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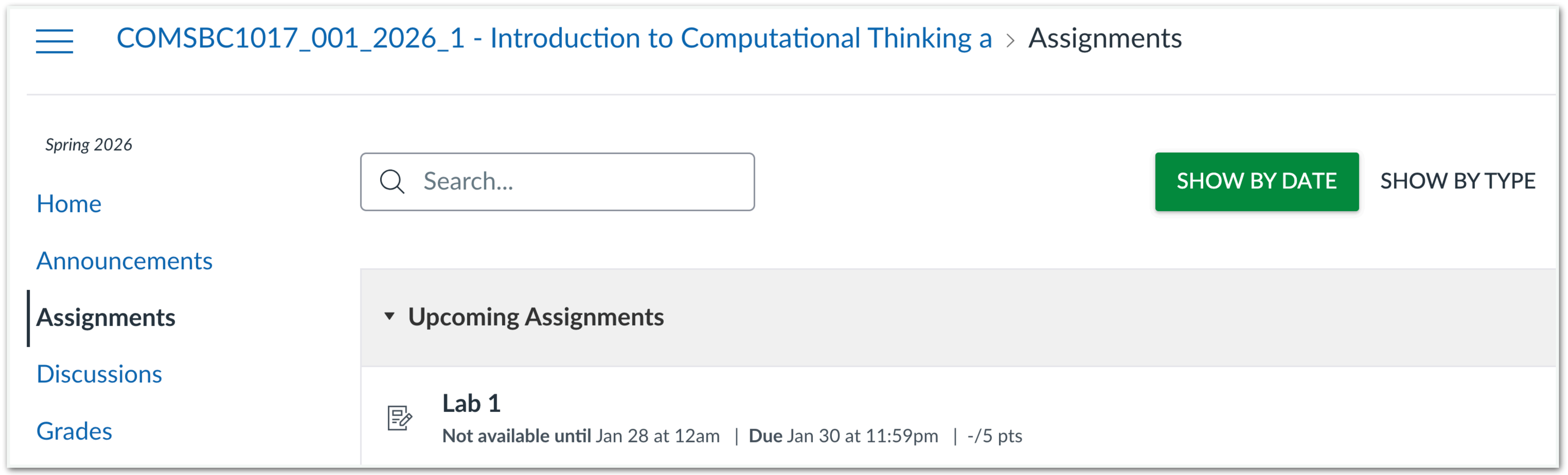
Homework 1
Not available until Feb 2 at 12am | **Due** Feb 11 at 11:59pm | -/100 pts

Homework 2
Not available until Feb 9 at 12am | **Due** Feb 18 at 11:59pm | -/100 pts



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Spring 2026

Home
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Lab 1
Not available until Jan 28 at 12am | **Due** Jan 30 at 11:59pm | -/5 pts

More on Homeworks

- Homeworks will be released on Mondays and due the following Wednesday
  - HW 1 will be released next week Monday
- Autograder tests for common mistakes and type errors
  - We will be checking more than just what tests are in the autograder!
  - True/False, short answer, and multiply choice are all manually graded
- Homeworks are submitted on Gradescope via Courseworks

Lab Reminders

- **Reminder: You must be enrolled in a 1017 section!**
  - As of Sunday night, there are more people enrolled in 1016 than 1017
- Labs begin this week
- **Email your TA if you'll be late or missing!**
  - 50% of your lab grade is attendance!
  - One unexcused absence + lowest lab dropped

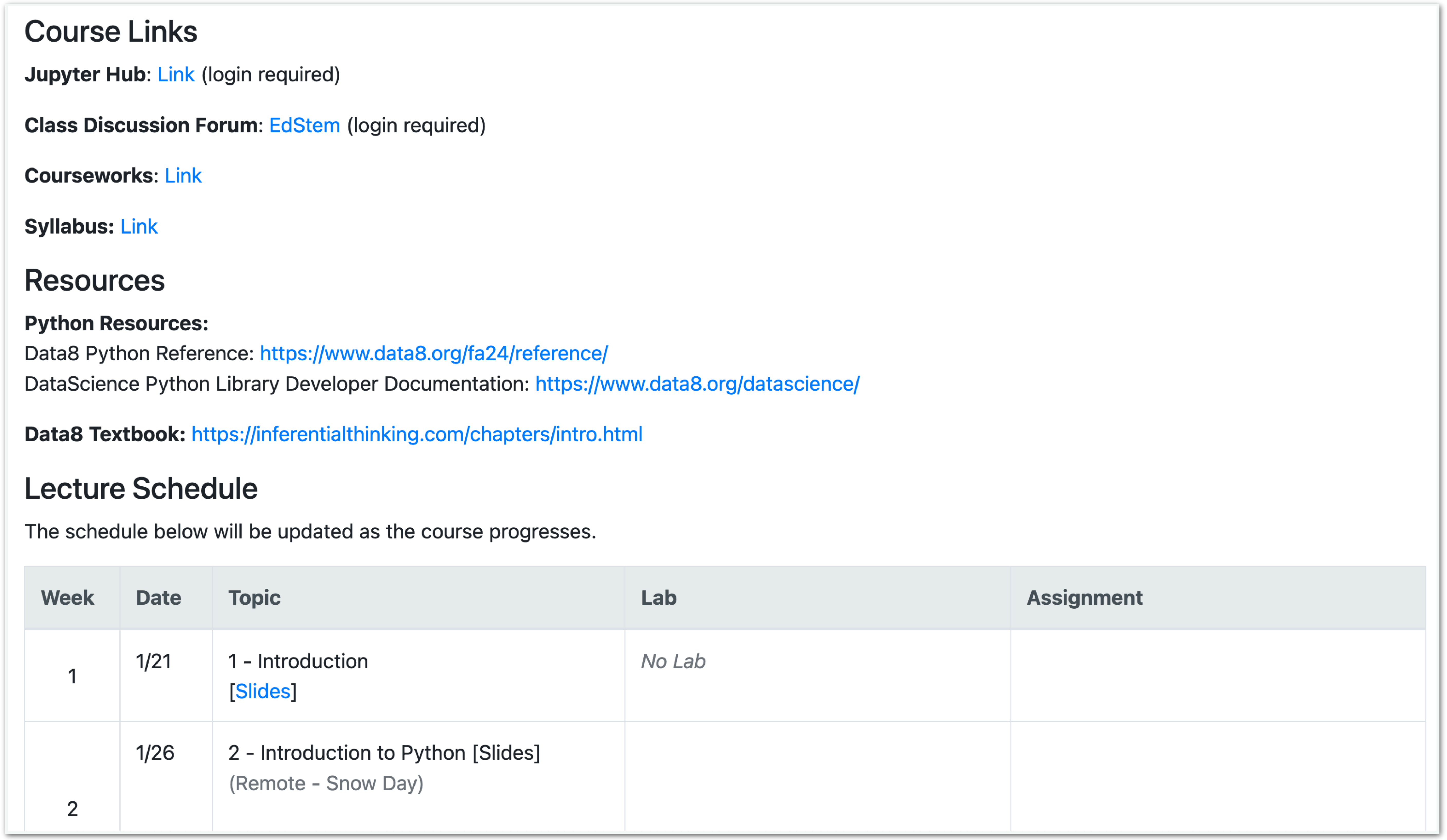
Reminder: Midterm Exam

- Paper exam happens during class **Wednesday, March 11, 2026**
  - This is the week before Spring Recess
- You will be allowed a note sheet to use as a reference during the exam
  - It will be submitted along with your exam
- If you need particular accommodations, please contact CARDS

Course Website

Slides, emails, and helpful links are on the course website:

https://www.eysalee.com/courses/s26/bc1016.html



Course Links

Jupyter Hub: Link (login required)

Class Discussion Forum: EdStem (login required)

Courseworks: Link

Syllabus: Link

Resources

Python Resources:
Data8 Python Reference: https://www.data8.org/fa24/reference/
DataScience Python Library Developer Documentation: https://www.data8.org/datascience/

Data8 Textbook: https://inferentialthinking.com/chapters/intro.html

Lecture Schedule

The schedule below will be updated as the course progresses.

Week	Date	Topic	Lab	Assignment
1	1/21	1 - Introduction [Slides]	*No Lab*	
2	1/26	2 - Introduction to Python [Slides] (Remote - Snow Day)		

Python

Python Intro

- Popular programming for software development

- Especially popular for data science

- Learning programing is about learning how to think computational & transfers to other languages

How to Approach Programming in BC1016

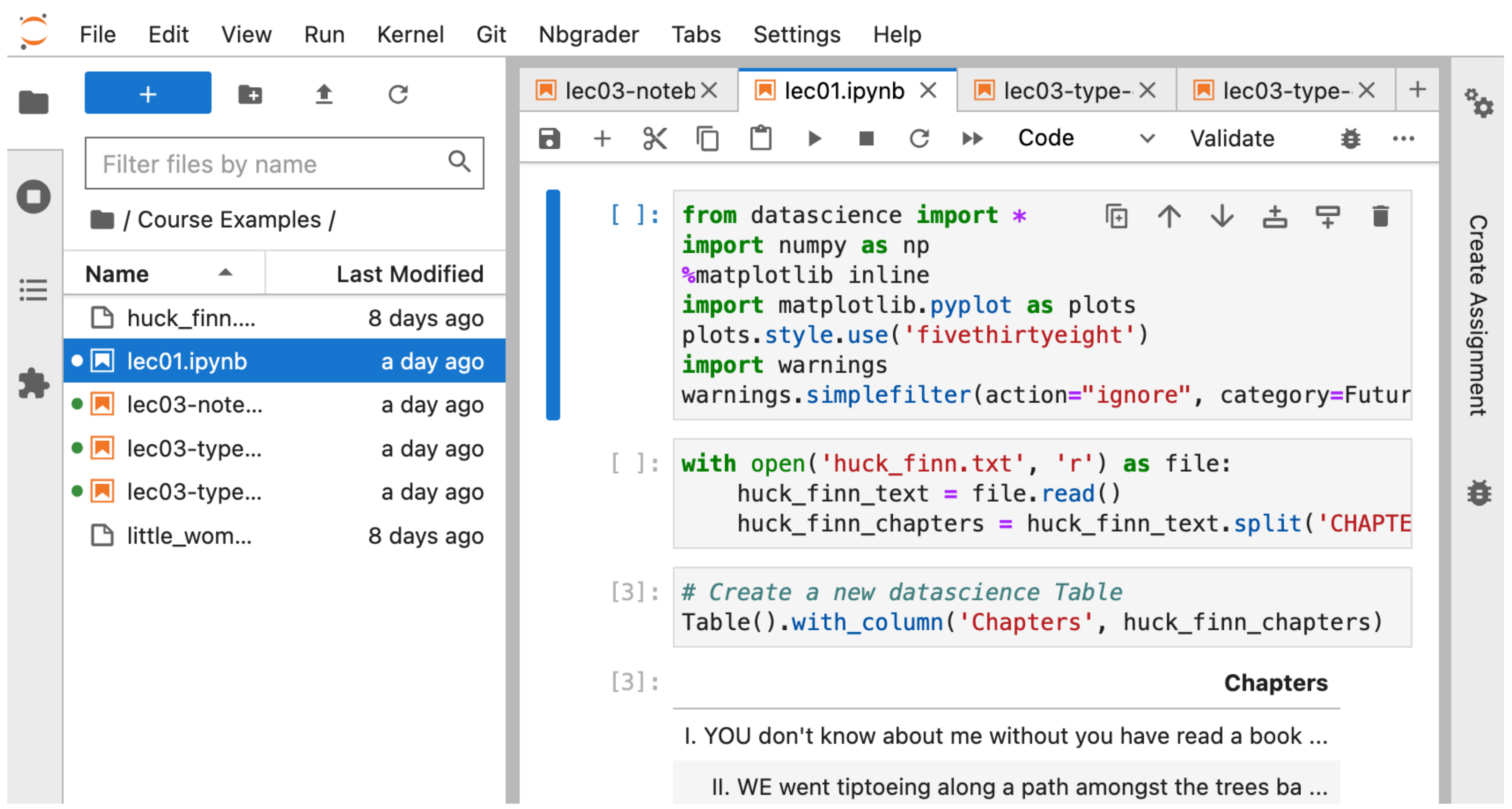
Programming is all about practice

- Class: Demos introduce terms & rules
- Labs & Homework: Try out programming yourself

Goal: writing your own code that can solve new problems!

Jupyter Notebooks

- Can be run locally or in cloud-based environments
    - For this class: JupyterHub Server
- Benefits of cloud-based
    - Access anywhere
    - Expandable compute resources



Name	Last Modified
huck_finn....	8 days ago
lec01.ipynb	a day ago
lec03-note...	a day ago
lec03-type...	a day ago
lec03-type...	a day ago
little_wom...	8 days ago

```
[ ]: from datascience import *
     import numpy as np
     %matplotlib inline
     import matplotlib.pyplot as plots
     plots.style.use('fivethirtyeight')
     import warnings
     warnings.simplefilter(action="ignore", category=Futur

[ ]: with open('huck_finn.txt', 'r') as file:
         huck_finn_text = file.read()
         huck_finn_chapters = huck_finn_text.split('CHAPTE

[3]: # Create a new datascience Table
     Table().with_column('Chapters', huck_finn_chapters)

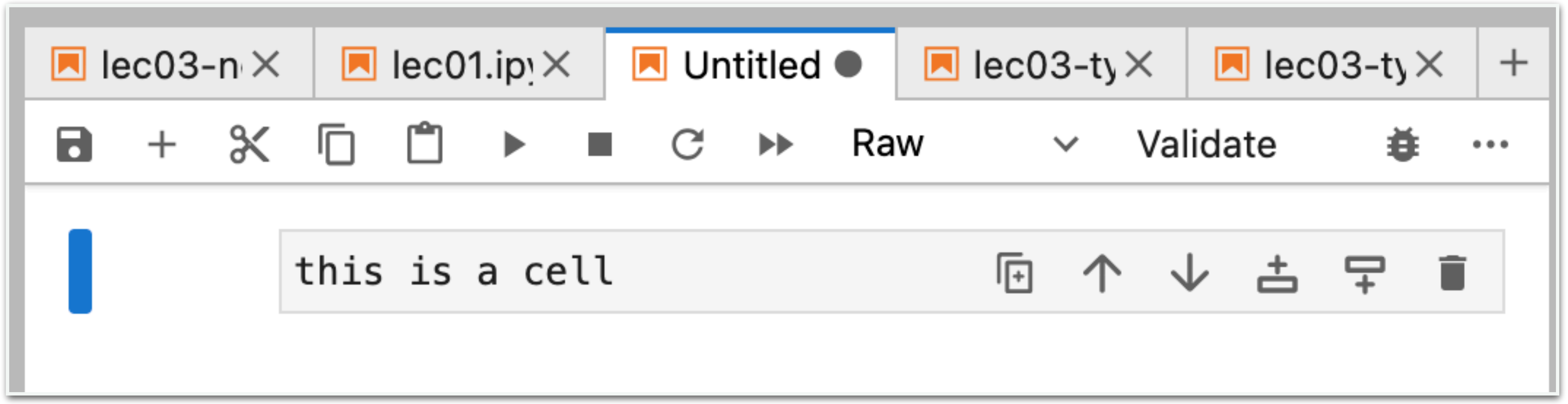
[3]:                                          Chapters
     I. YOU don't know about me without you have read a book ...
          II. WE went tiptoeing along a path amongst the trees ba ...
```

Let's poke around in Jupyter…

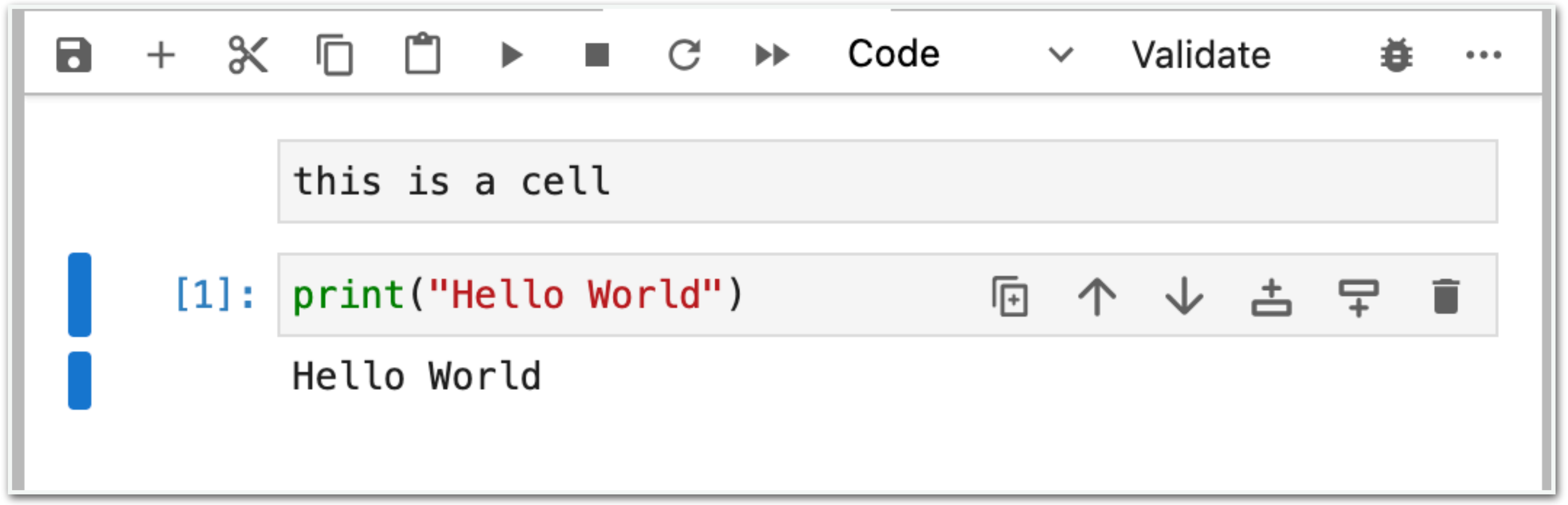
Jupyter Notebooks: Terms

- **Cells**: block or section for writing code / notes / etc

- **Kernel**: executes code in cells (when you run a “cell”)



```
this is a cell
```



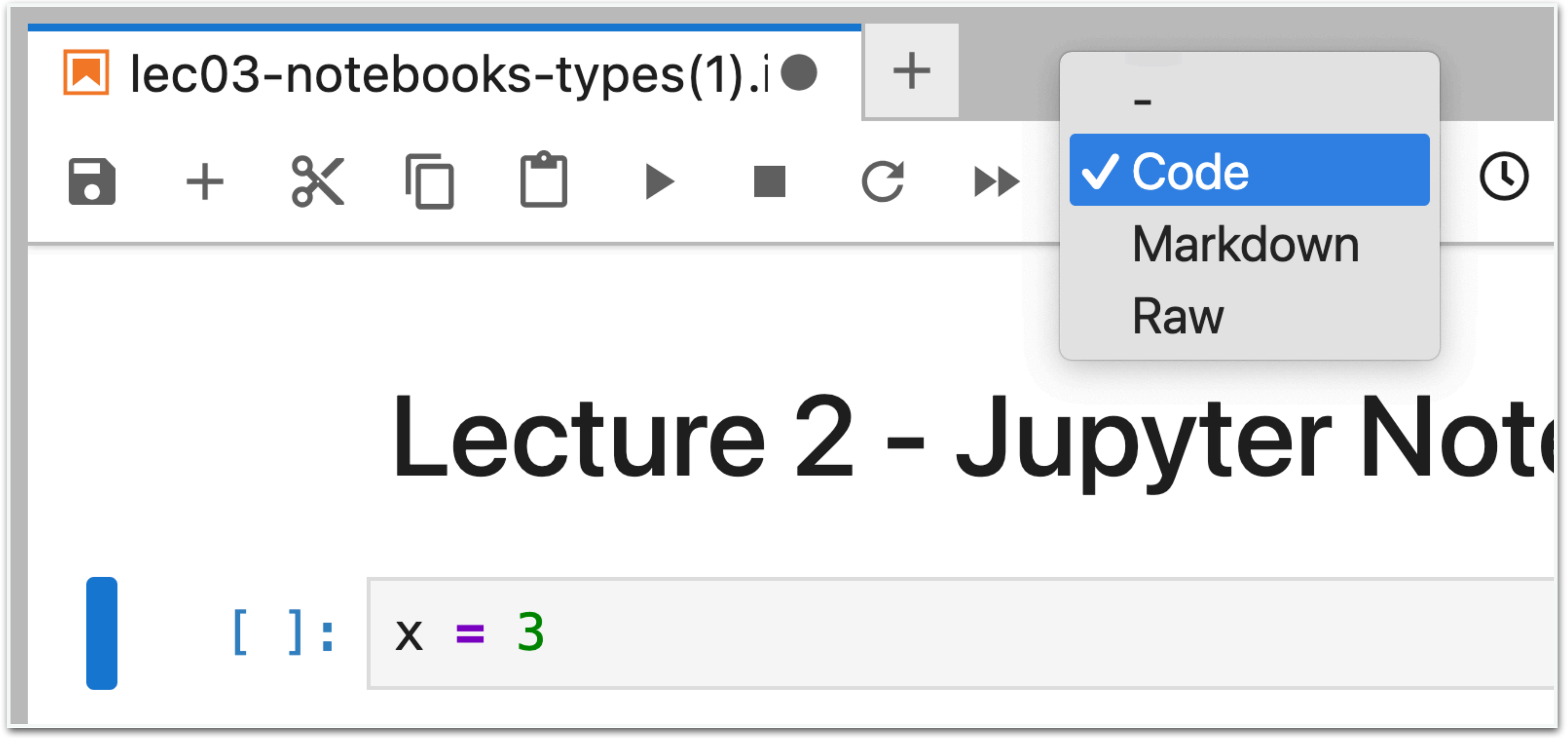
```
this is a cell

[1]: print("Hello World")

Hello World
```

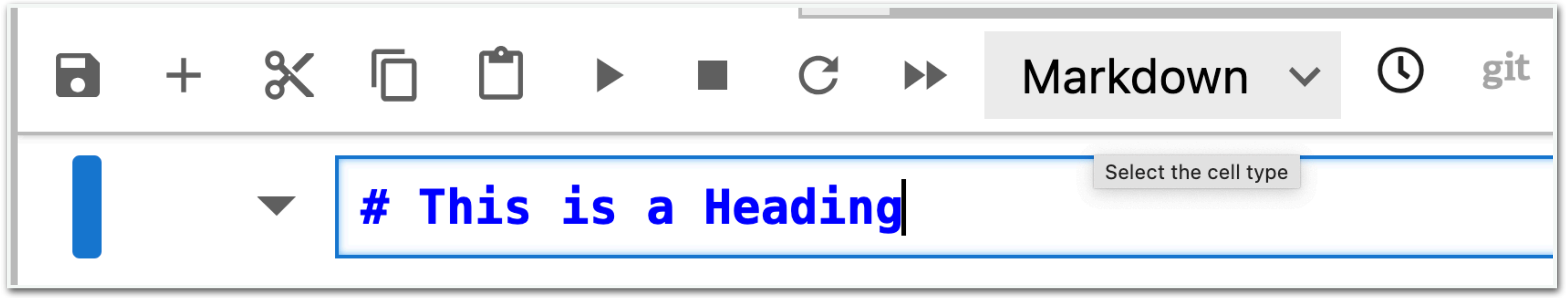
Jupyter Notebooks: Cell Types

- **Code**: For writing and running Python code
- **Markdown**: Markup language for formatting plaintext
  - You've likely come across it on the internet before (`#` for headings, `*text*` for italics, `**text**` for bold, …)
- **Raw**

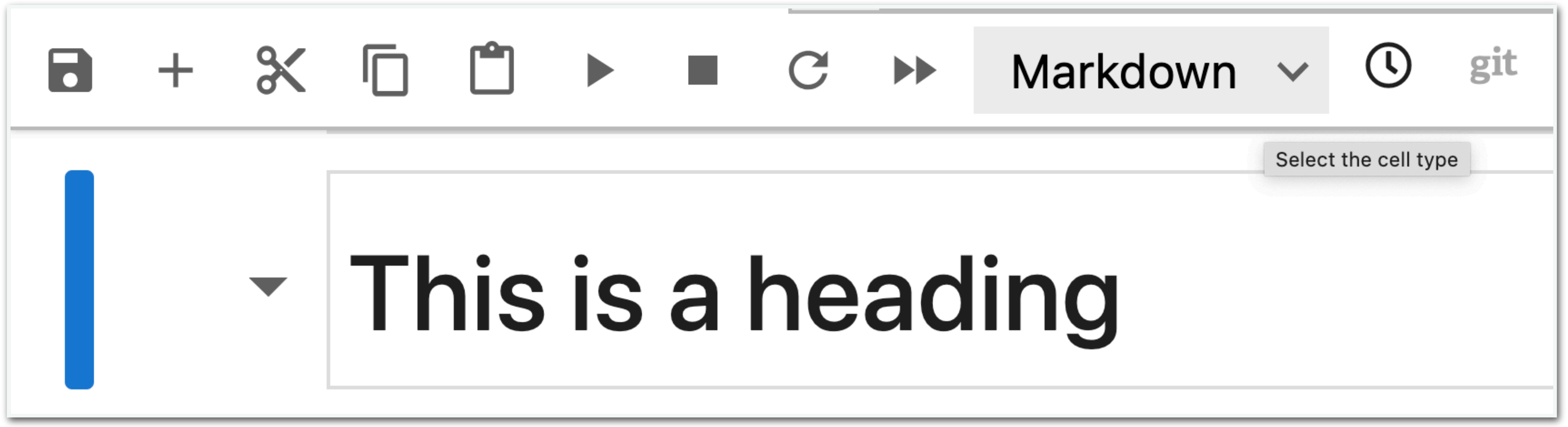


Lecture 2 - Jupyter Not

```
[ ]: x = 3
```



```
# This is a Heading
```



This is a heading

Data Types

Numbers

- **Integers**: Whole numbers
  - e.g., `3, -10, 25`
- **Floats**: Anything with decimals
  - e.g., `3.1, -10.2, 2.0`
- Basic calculations
  - e.g., `+, -, *, /`

Numbers

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- Basic calculations
  - e.g., `+, -, *, /`

Some questions:

1. What happens if we add different number types?
   a. Multiply or divide?
2. What if I wanted 2 raised to the power of 4?

Strings

- Text in python
- You can specify a string using either single quotes or double quotes
  - `“a”`
  - `‘This is a sentence’`
  - `“This is another sentence. Wow!”`

Some questions:

1. What happens if you start a string with a double quote and end it with a single quote?
2. What if I want to write the following sentence as a string using single quotes?
   a. `That’s weird`

Booleans

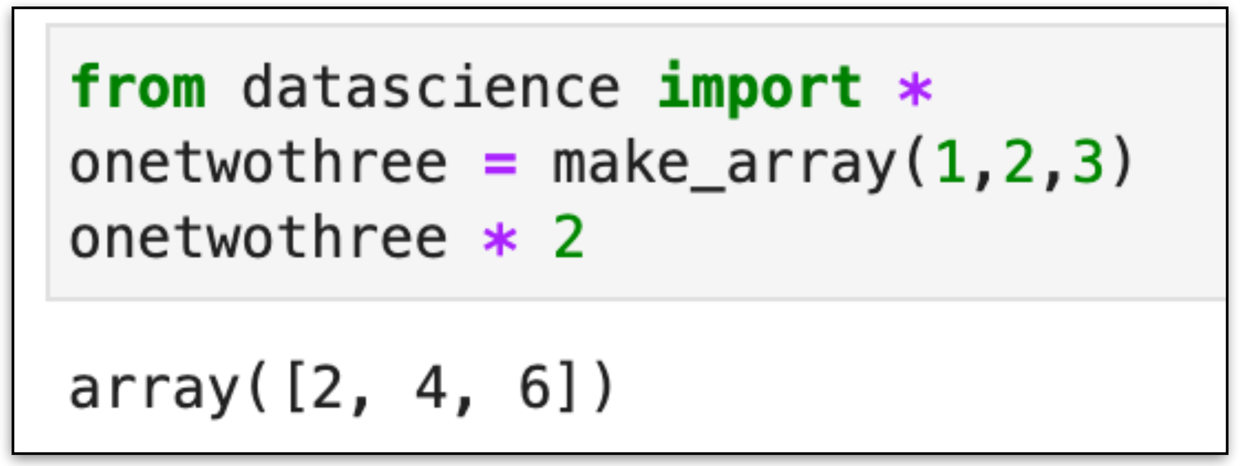
- True or False values
- Useful for conditional statements
  - Usually of the form “if some statement is true, then execute some code. Otherwise, do something else.”
- Use == to check equivalence
- We will talk more about Booleans in a few weeks

Lists

- Lists are sequences of values
- Start with brackets and each element is separated by commas
  - [2,4,6,8]
  - [‘apples’, ‘bananas’, ‘oranges’]
  - [‘apples’, ‘bananas’, ‘apples’, ‘apples’]
- Lists are zero-indexed
  - The first element is the 0th and the last is length-1

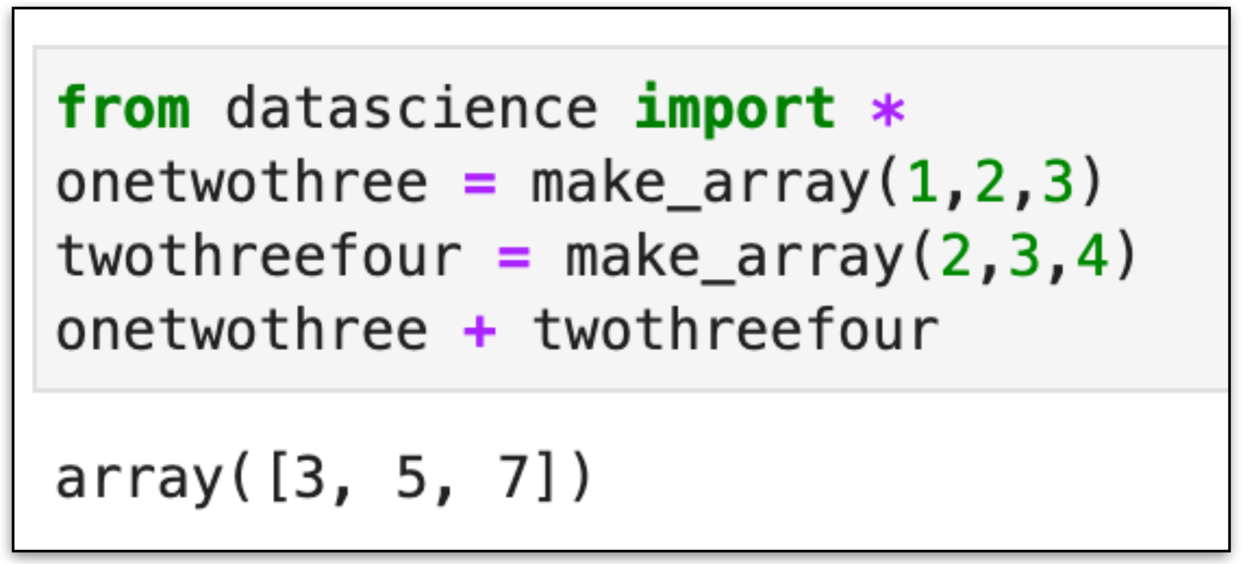
`datascience` **Arrays**

- In this class we'll mostly use NumPy arrays
    - Can make arrays using `datascience.make_array` or `numpy.array`
- Elements of an array should have the same type
    - e.g., `["Mystery", "Abby", "Jinu", "Baby", "Romance"]` or `[1,2,3,5]`
- First element is index 0 and the last is the length-1
- Can perform component-wise arithmetic
    - Note this only works for numpy arrays but not built-in Python lists!



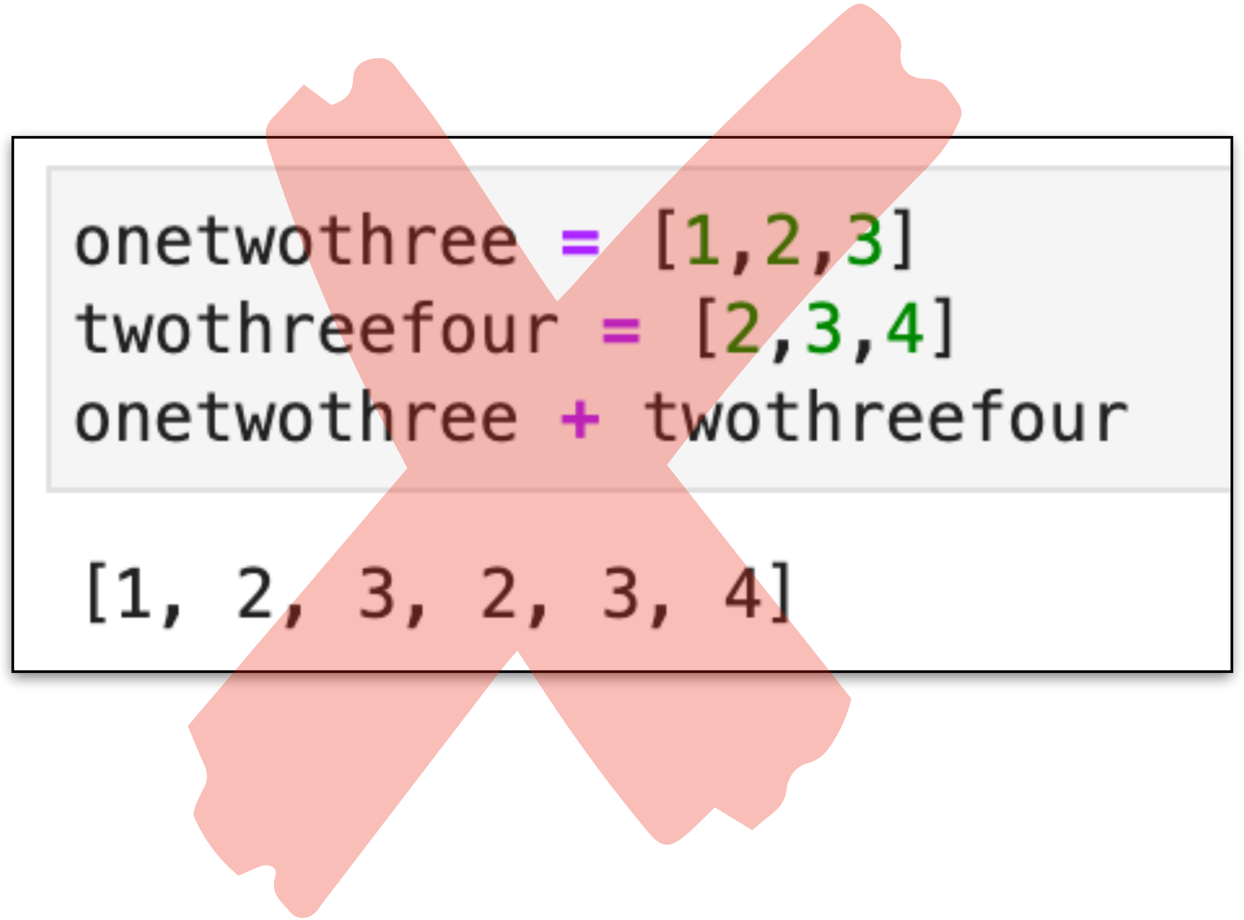
```
from datascience import *
onetwothree = make_array(1,2,3)
onetwothree * 2

array([2, 4, 6])
```



```
from datascience import *
onetwothree = make_array(1,2,3)
twothreefour = make_array(2,3,4)
onetwothree + twothreefour

array([3, 5, 7])
```

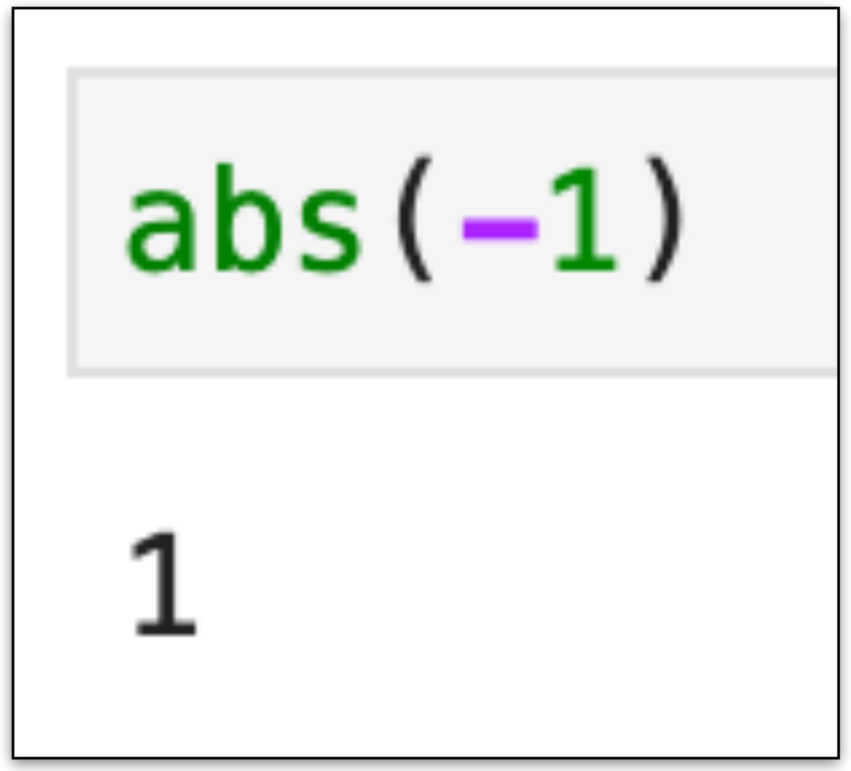


```
onetwothree = [1,2,3]
twothreefour = [2,3,4]
onetwothree + twothreefour

[1, 2, 3, 2, 3, 4]
```

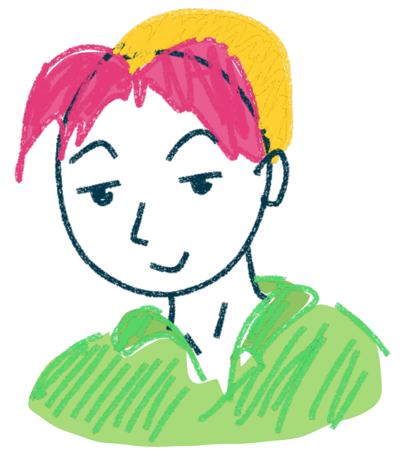
Functions

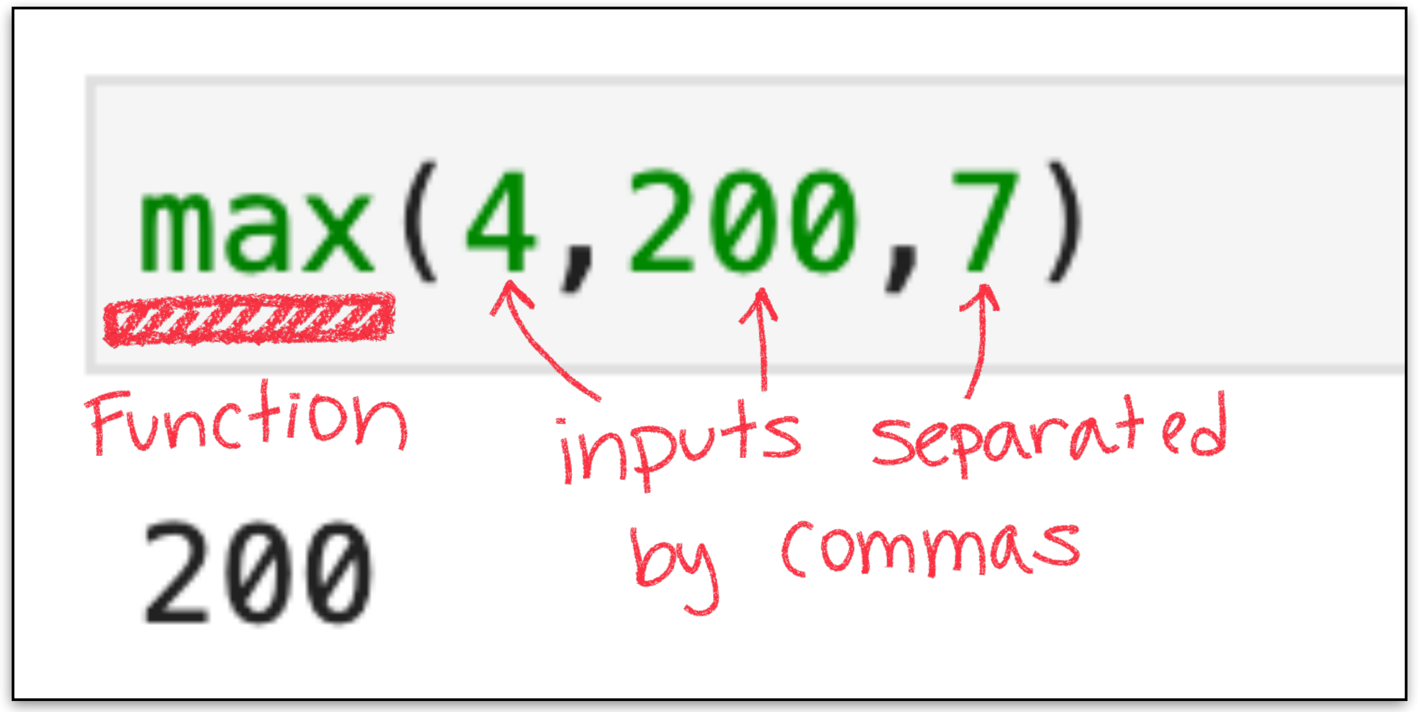
- Type of abstraction for pre-defined set of code or instructions
  - Commonly takes inputs, performs a computation, and produces output
  - Many useful things built in!
  - Some useful functions aren't built in, so we need to import them



```
abs(-1)
```

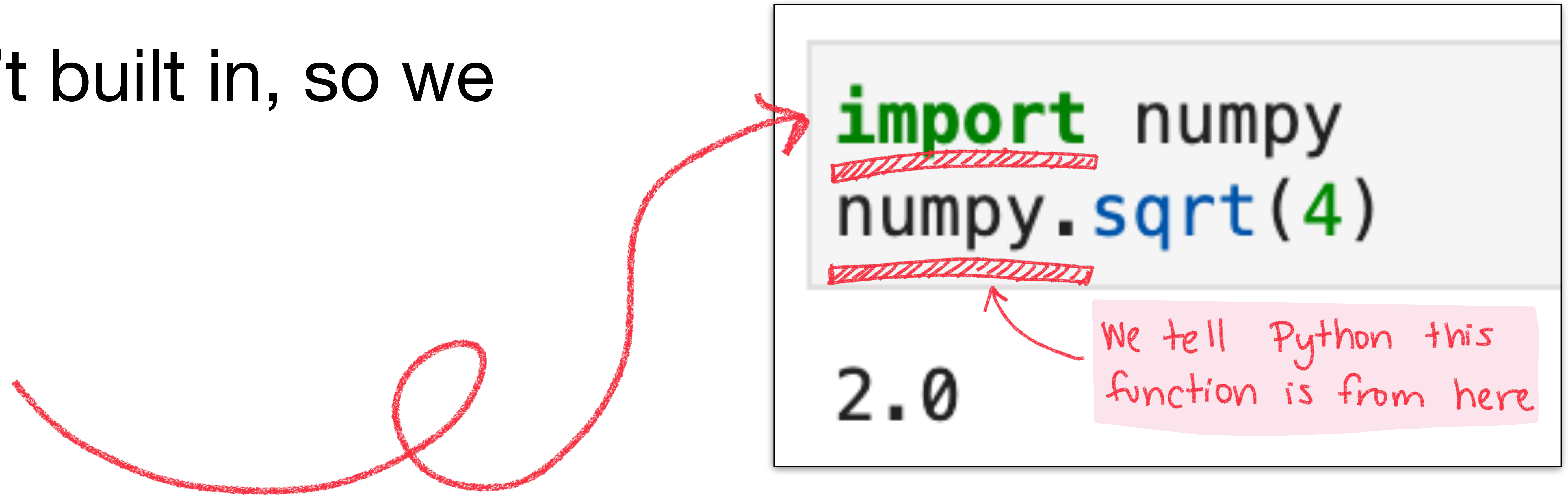
```
1
```





```
max(4,200,7)
```

```
200
```



```
import numpy
numpy.sqrt(4)
```

```
2.0
```

Built-in conversions

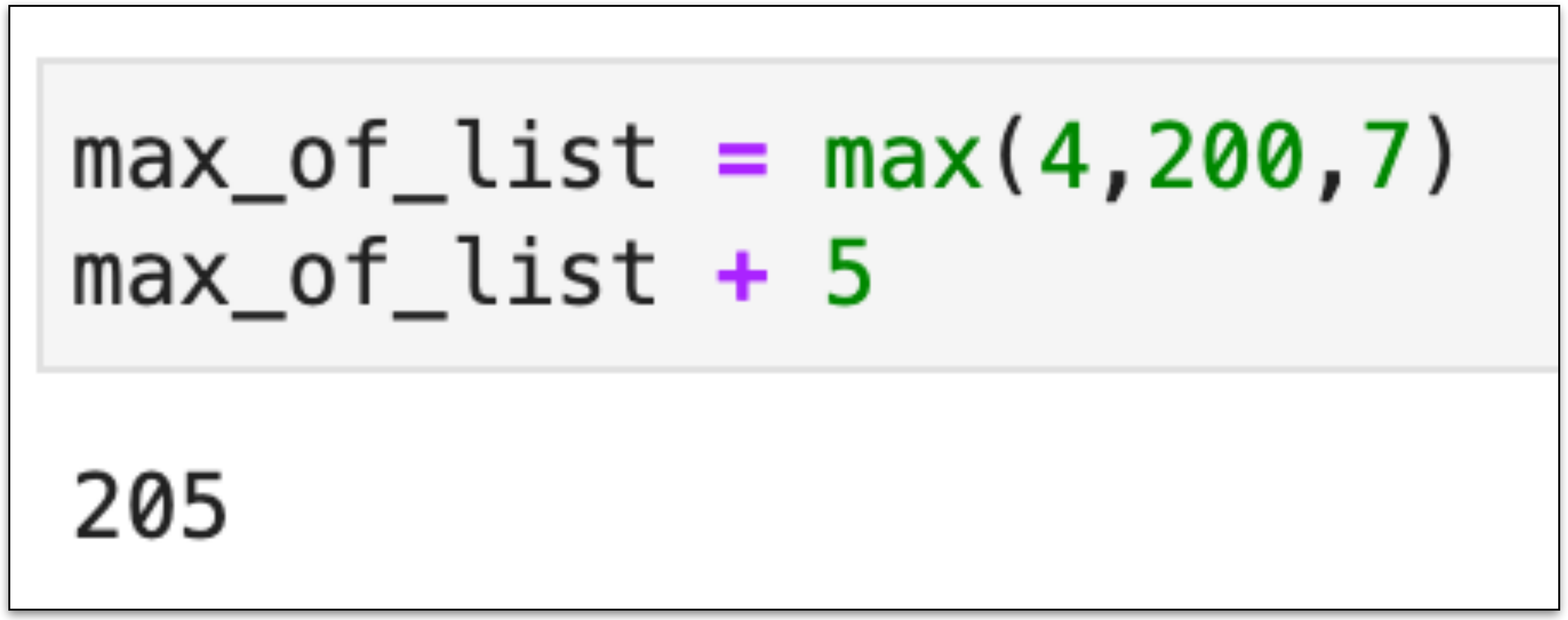
- You can convert values to a string using `str(..)`
  - `str(5)` becomes “5”
- You can convert strings of numbers to numbers
  - `int(’12’),float(‘1.2’)`

Questions:

1. What happens if you try to convert a float to an integer?
2. What happens if you try to convert non-numbers to a number?

Variables and Assignments

- **Assignments** change the meaning of the name to the left the = symbol
- **Variables** are values you can assign values to
    - "Variable" because they can change
- You can assign outputs of functions and operations to variables

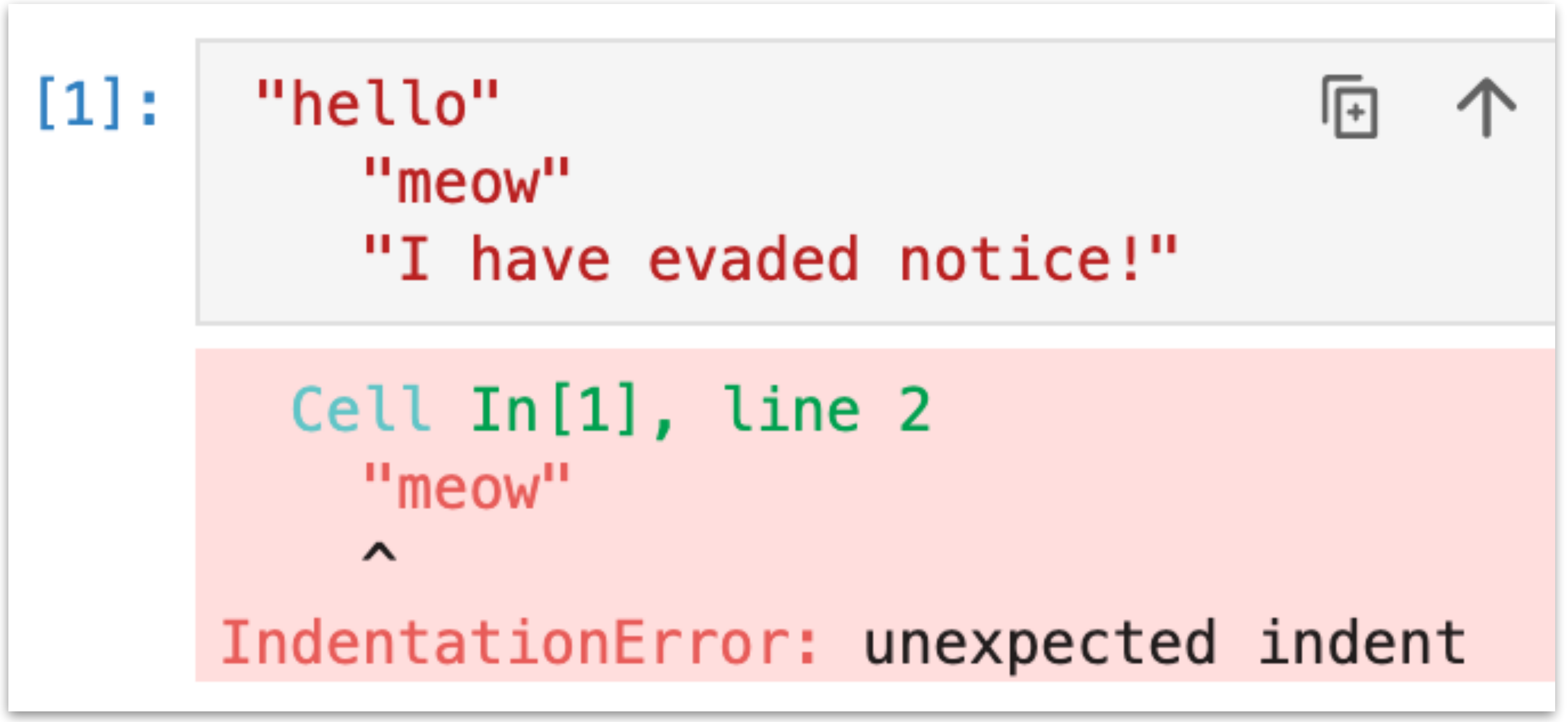


```
max_of_list = max(4,200,7)
max_of_list + 5
```

```
205
```

Python quirks

- Indentation and new lines matter
    - Be careful not to add extra spaces or indentations at the beginning of the line!
- Python runs line-by-line
    - It'll stop as soon as it runs into an issue and tell you what's wrong
- Lines starting with # are comments and are ignored



```
[1]: "hello"
        "meow"
        "I have evaded notice!"
```

```
  Cell In[1], line 2
    "meow"
    ^
IndentationError: unexpected indent
```

Types

Type	**Example**
Int	**3**
Float	3.0
String	‘three’
Boolean	True
Arrays	[1, 2, 3, 4]
Functions	abs(-5)

Type Exercise

Let’s say you have defined the following variables in your notebook

```
x = 3

y = ‘4’

z = ‘5.6’
```

What would the source of the error in these examples?

How could you fix it?

```
1. x + y

2. x + int(y + z)

3. str(x) + int(y)

4. y + float(z)
```

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y = ‘4’

z = ‘5.6’
```

What would the source of the error in this example:

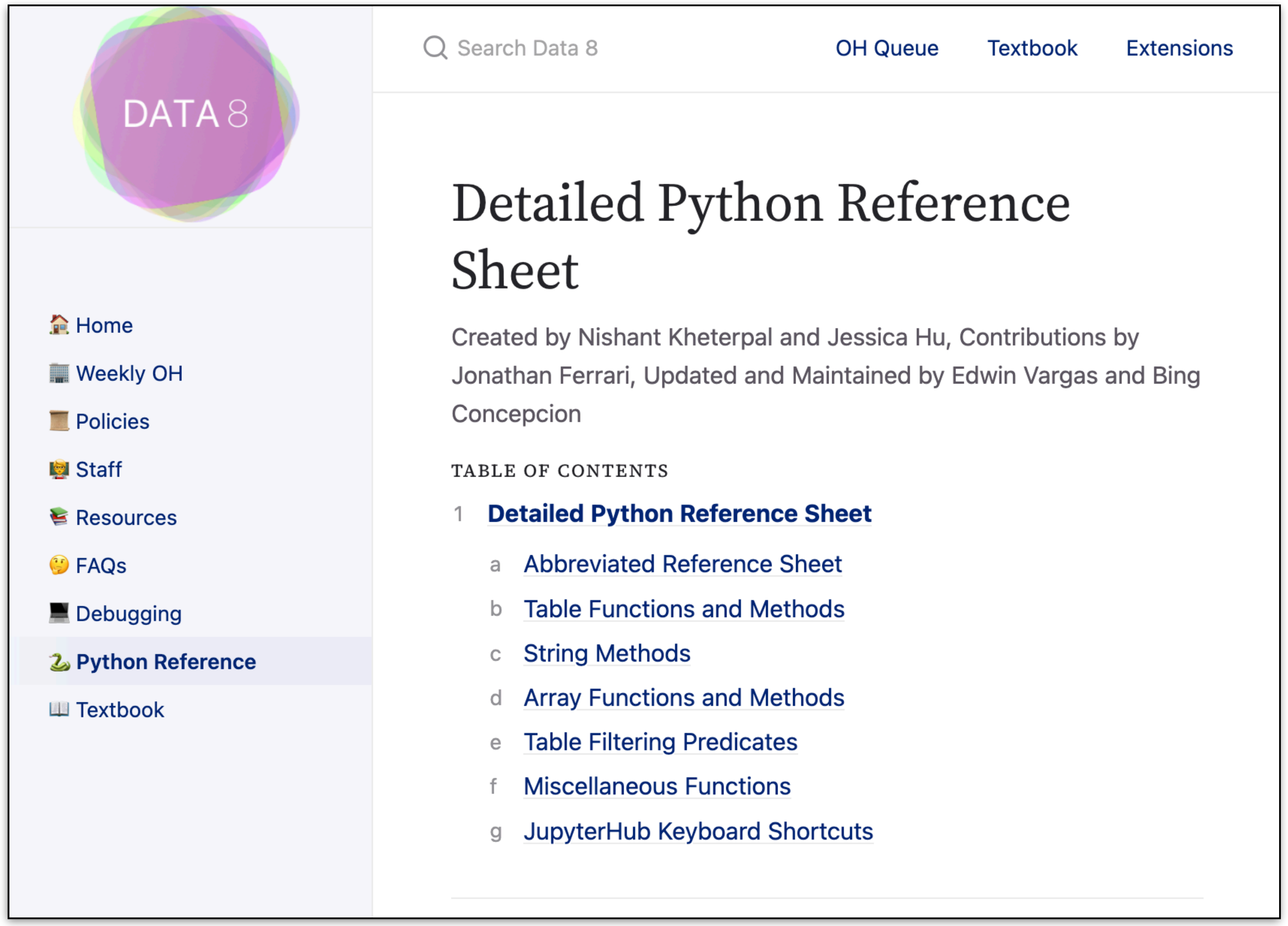
```
y + float(z)
```

How could you fix it?

Python Reference

https://www.data8.org/sp25/reference/

https://docs.python.org/3/



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Resources
FAQs
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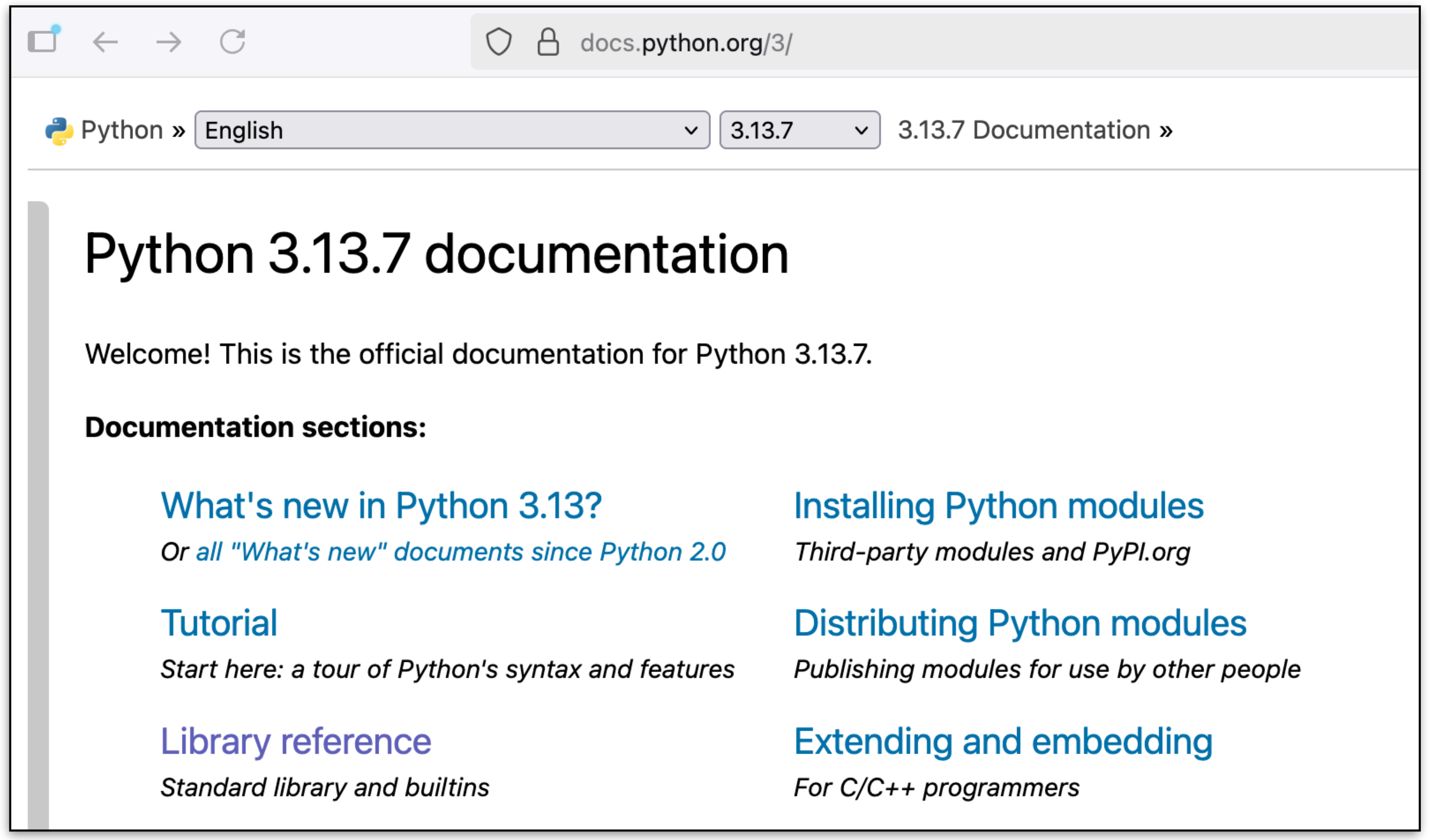
Detailed Python Reference Sheet

Created by Nishant Kheterpal and Jessica Hu, Contributions by Jonathan Ferrari, Updated and Maintained by Edwin Vargas and Bing Concepcion

TABLE OF CONTENTS



docs.python.org/3/

Python » English 3.13.7 3.13.7 Documentation »

Python 3.13.7 documentation

Welcome! This is the official documentation for Python 3.13.7.

Documentation sections:

What's new in Python 3.13?
Or all "What's new" documents since Python 2.0

Installing Python modules
Third-party modules and PyPI.org

Tutorial
Start here: a tour of Python's syntax and features

Distributing Python modules
Publishing modules for use by other people

Library reference
Standard library and builtins

Extending and embedding
For C/C++ programmers

Next Class

- Today
  - Jupyter Notebooks
  - Data Types
- Wednesday
  - Tables
- Monday
  - Charts & Visualization