

COMS BC1016

Introduction to Computational Thinking and Data Science

Lecture 3: Introduction to Python

BARNARD COLLEGE OF COLUMBIA UNIVERSITY

Sept 3, 2025

Logistical Updates

- Labs and HWs will be posted on Courseworks
 - Download the files from the assignment page
 - 1017 sections share the same Courseworks
- Lectures and in-class activities will still be posted on course website
 - Slides uploaded by 11:30am day of
 - Preliminary versions of slides may appear earlier

▼ Upcoming Assignments

 **Lab 1**
Available until Sep 16 at 11:59pm | Due Sep 12 at 11:59pm | -/10 pts

Lab 1 

Start Assignment

Due Friday by 11:59pm

Points 10

Submitting a file upload

File Types pdf

Available Sep 10 at 12am - Sep 16 at 11:59pm

[lab01.zip](#) 

Lecture Schedule				
The schedule below will be updated as the course progresses.				
Week	Date	Topic	Lab	Assignment
1	9/3	Introduction Slides Demo (Code) , Demo (PDF)		
	9/8	Cause and Effect Slides		
2	9/10	Intro to Python: Part 1 Slides lec03-type-exercise.ipynb	Lab 1 Released (Due 9/12) Courseworks	

Lab Updates

- The other 1016 section didn't have enough students enrolled, so we lost a lab section :(
- If you need help getting into a different lab section, please talk to me!
- Minor changes to the other labs
 - Section 4 (W 2:30p) lab starts at 2:40p
- Email your TA if you'll be late or missing!
 - 50% of your lab grade is attendance!
 - One unexcused absence + lowest lab dropped

Labs:

- W 2:40pm - 4:00pm, Milstein Center 516 (Ken Mah)
- W 4:00pm - 5:30pm, Milstein Center 516 (Erin Ma)
- Th 9:40am - 11:10am, Milstein Center 516 (Amaya Kejriwal)
- Th 11:20am - 12:50pm, Milstein Center 516 (Justin Zeng)

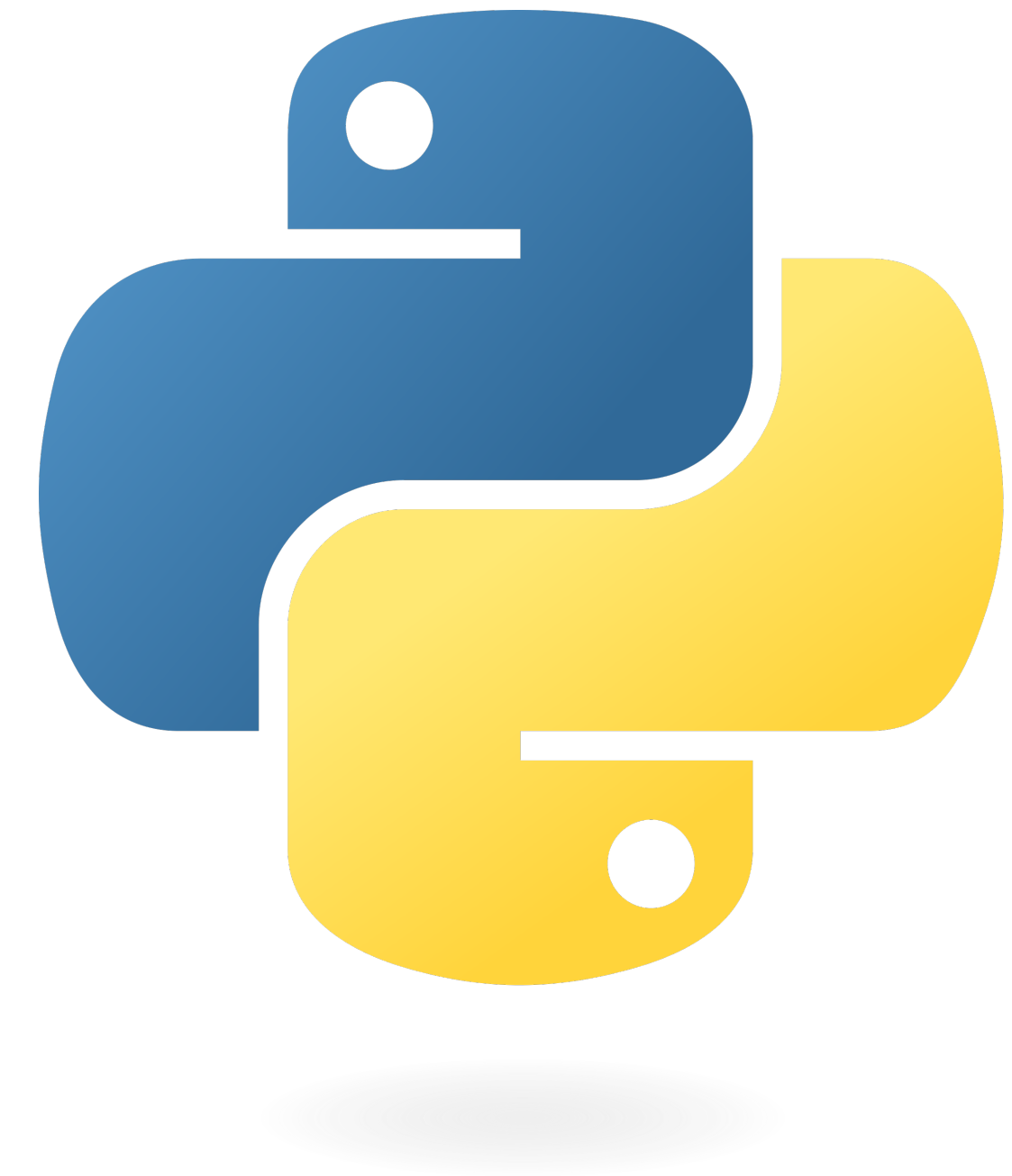
Misc Updates

- No TA office hours this week
 - I'll still be having office hours if you want to stop by
- We're (probably) not getting a larger room
 - Apparently this room has a capacity of 70???
- First HW will be released on Monday

Python

Python Intro

- Popular programming for software development
- Especially popular for data science
- Learning programming is about learning how to think computational & transfers to other languages

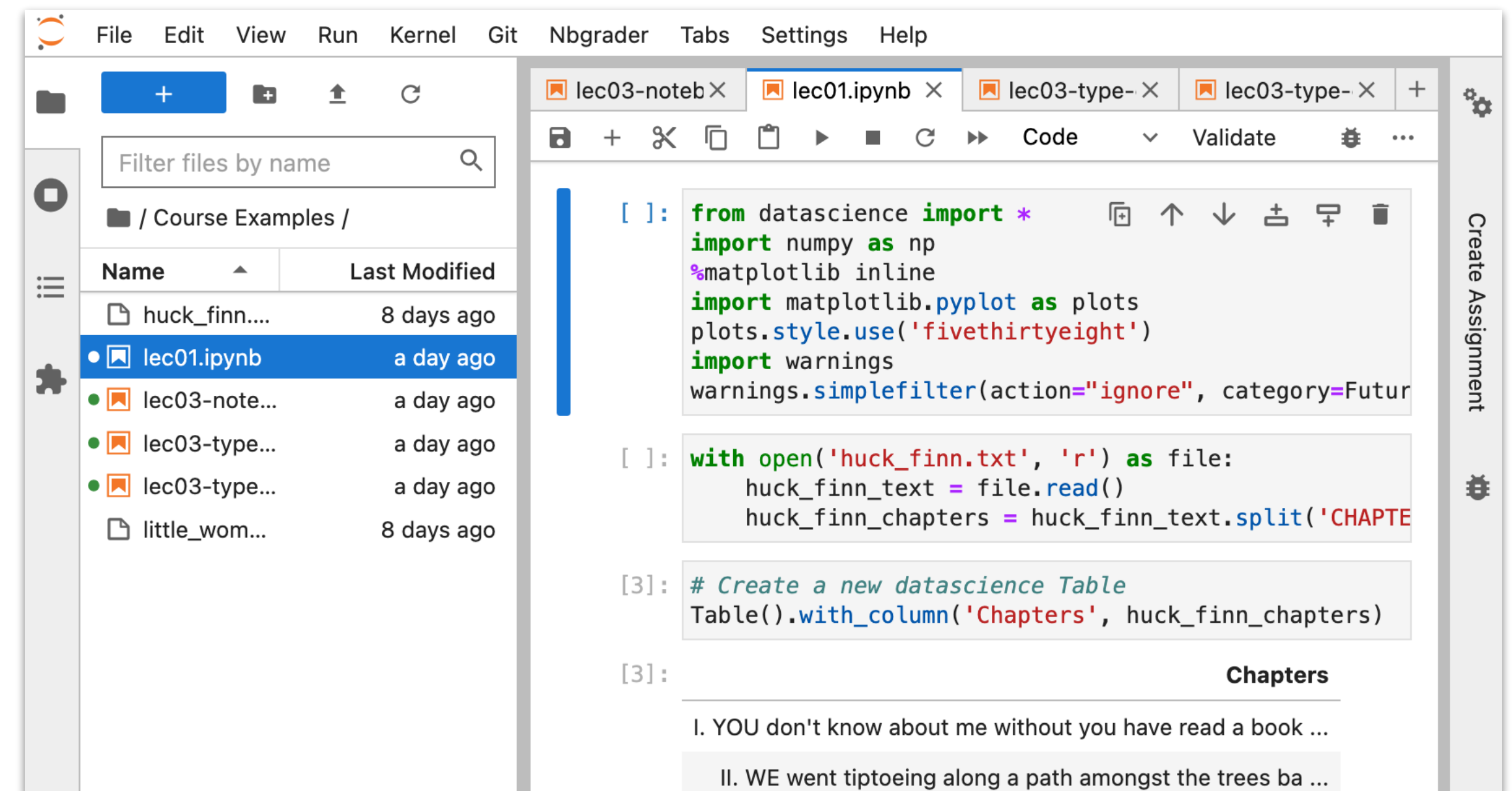


How to Approach Programming in BC1016

- Programming is all about practice
 - Class: Demos introduce terms & rules
 - Labs & Homework: Try out programming yourself
 - Ultimate 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



Data Types and Demos

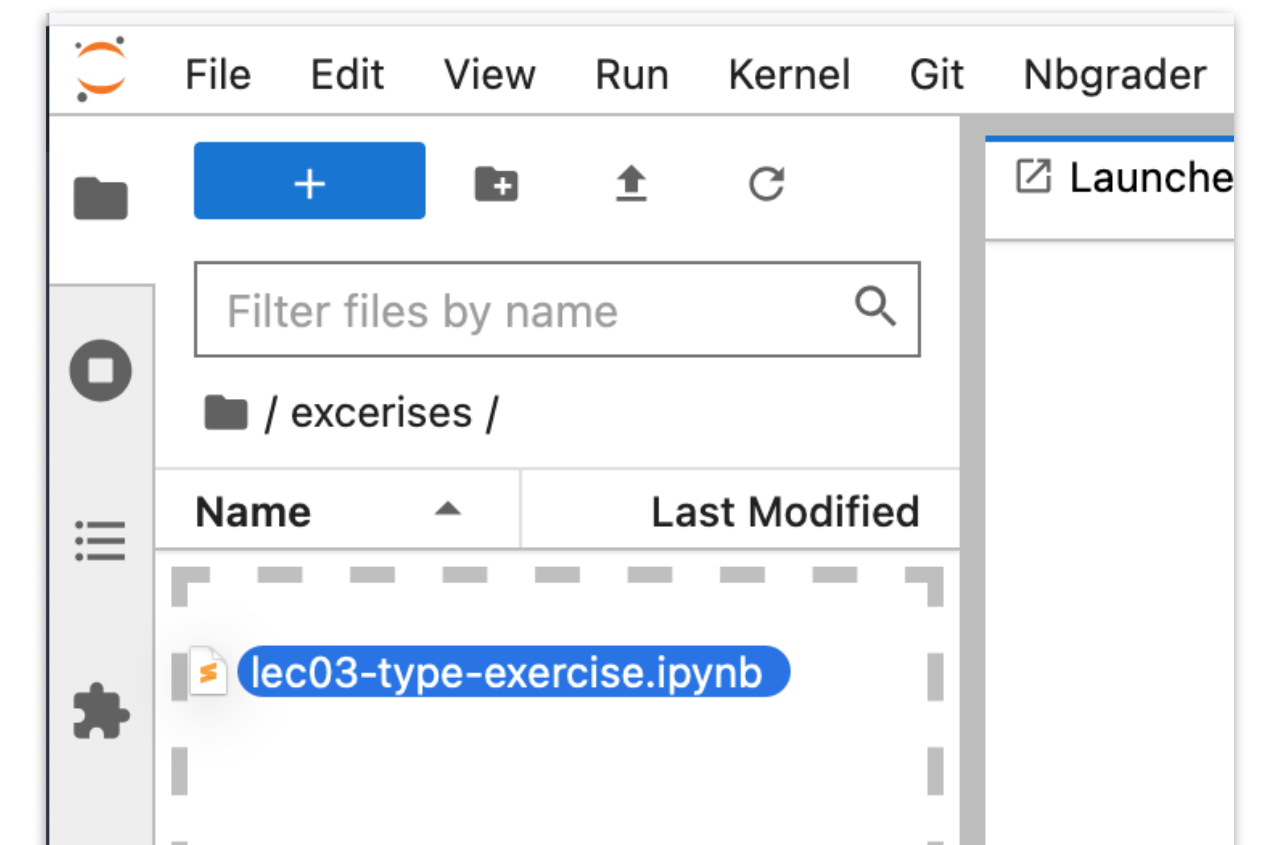
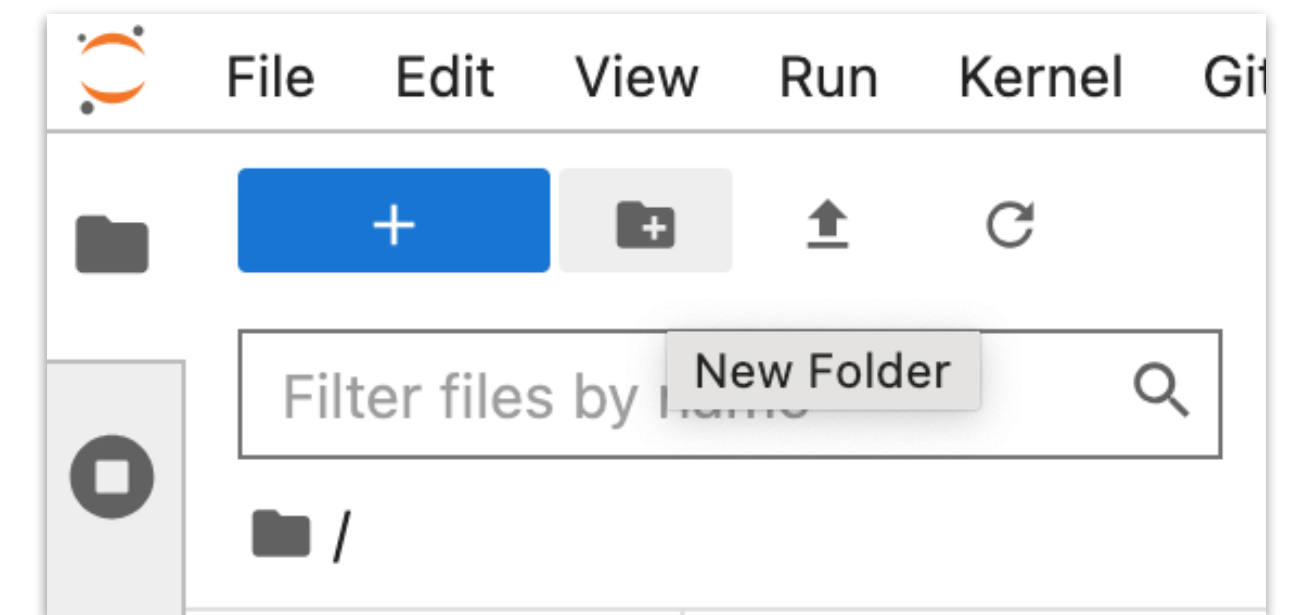
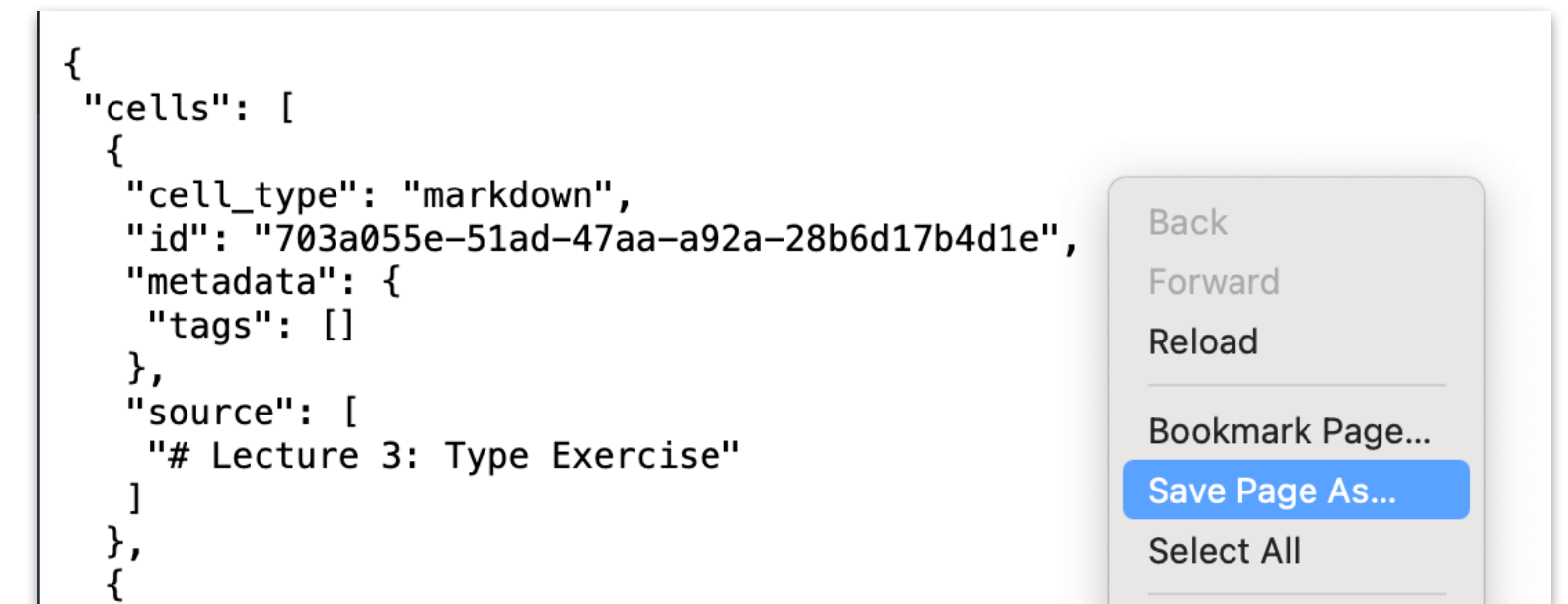
Follow Along!

1. Download the class exercise python notebook (.ipynb) from the course website
2. Go to the course Jupyter Hub link
3. Create a folder called “exercises”
4. Drag the lec03-type-exercise.ipynb file into the folder

For the first half, follow along in the lecture and we'll try things together

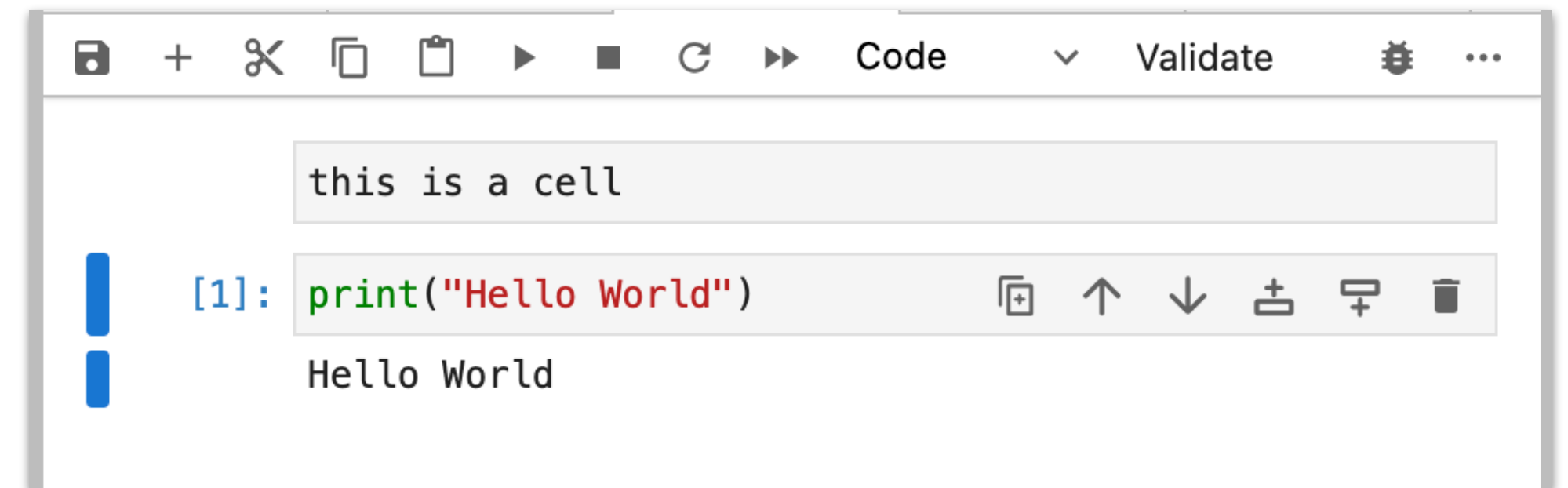
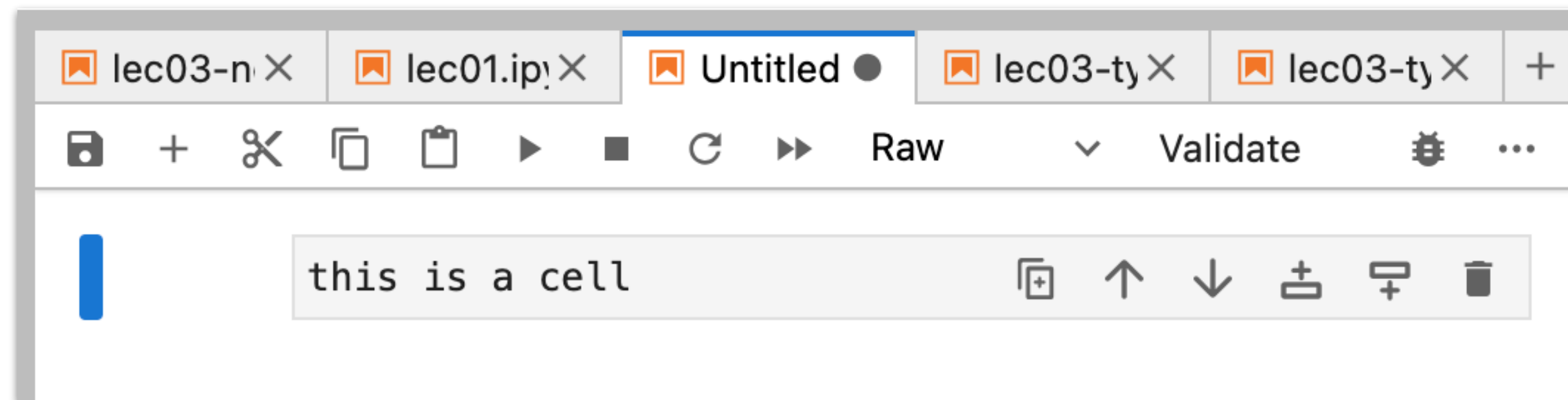
For the second half, I'll give examples that you have 10 minutes to work out for each one

```
{
  "cells": [
    {
      "cell_type": "markdown",
      "id": "703a055e-51ad-47aa-a92a-28b6d17b4d1e",
      "metadata": {
        "tags": []
      },
      "source": [
        "# Lecture 3: Type Exercise"
      ]
    },
    {}
  ],
  {}
}
```



Jupyter Notebooks: Terms

- Cells: block or section for writing code / notes / etc
- Kernel: executes code in cells (when you run a “cell”)



Some notes about Python

- Spaces and new lines matter
 - Each new instruction should be on a new line
 - 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
```

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., +, -, *, /

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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?

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)
```

Function

```
200
```

inputs separated
by commas

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

```
2.0
```

We tell Python this
function is from here

Assignment Statements

- 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

Strings

- Text in python!
 - `"a"`
 - `'This is a sentence'`
 - `"This is another sentence. Wow!"`
- 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')`

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

Arrays

Note: In this course we'll mostly be using a special version of arrays, which will be covered in more detail next lecture

- Arrays 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']
- Arrays are zero-indexed
 - The first element is the 0th and the second is 1st

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)
```

Type Exercise

Take 10 min to work on your own
or with a neighbor!

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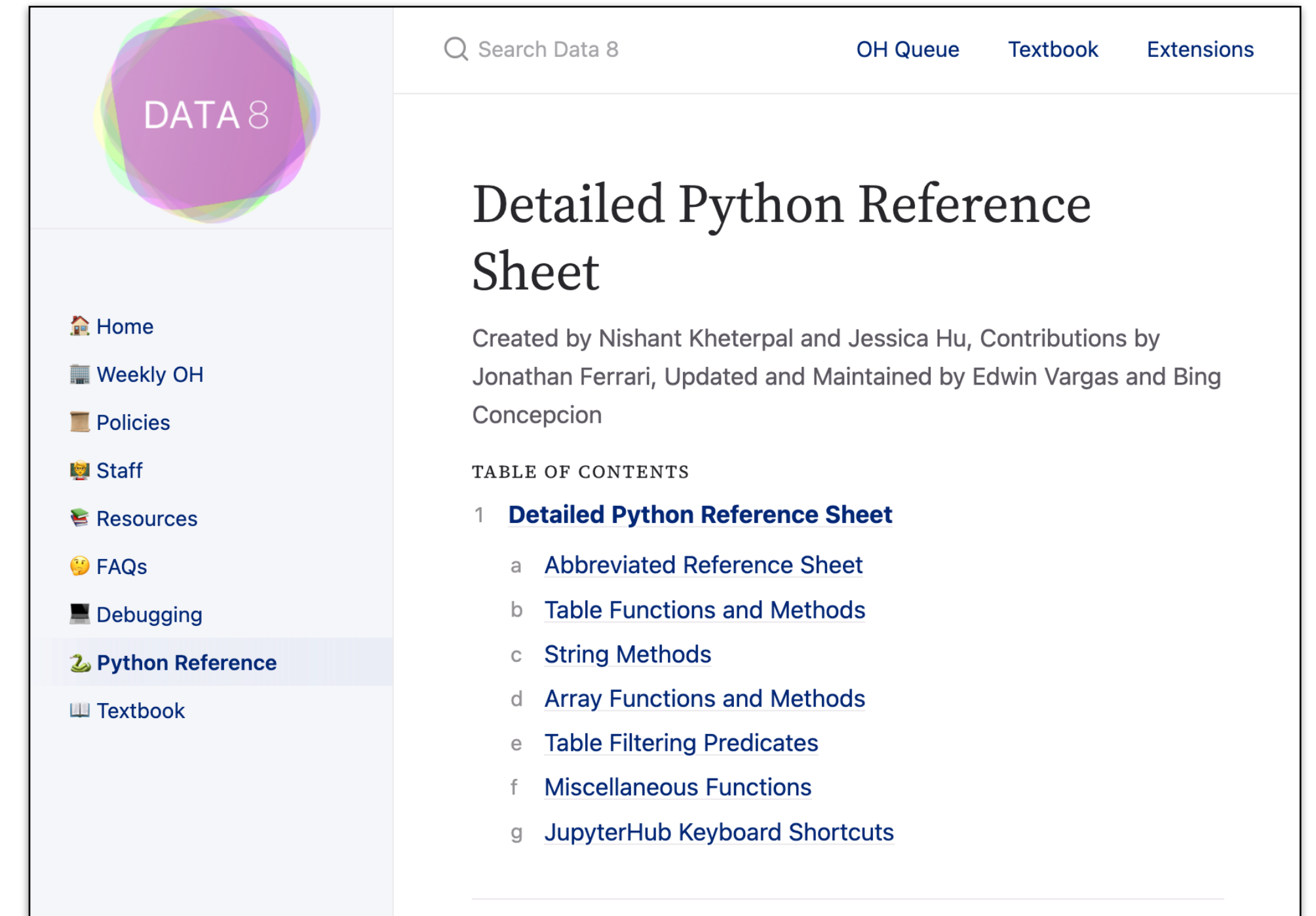
What would the source of
the error in this example:

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

How could you fix it?

Python Reference

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



The screenshot shows the Data 8 website's Python Reference page. The header includes a search bar, "OH Queue", "Textbook", and "Extensions" links. The left sidebar contains navigation links: Home, Weekly OH, Policies, Staff, Resources, FAQs, Debugging, Python Reference (highlighted), and Textbook. The main content area is titled "Detailed Python Reference Sheet" and credits Nishant Kheterpal, Jessica Hu, Jonathan Ferrari, Edwin Vargas, and Bing Concepcion. It includes a "TABLE OF CONTENTS" with links to various reference sheets and shortcuts.

DATA 8

Search Data 8 OH Queue Textbook Extensions

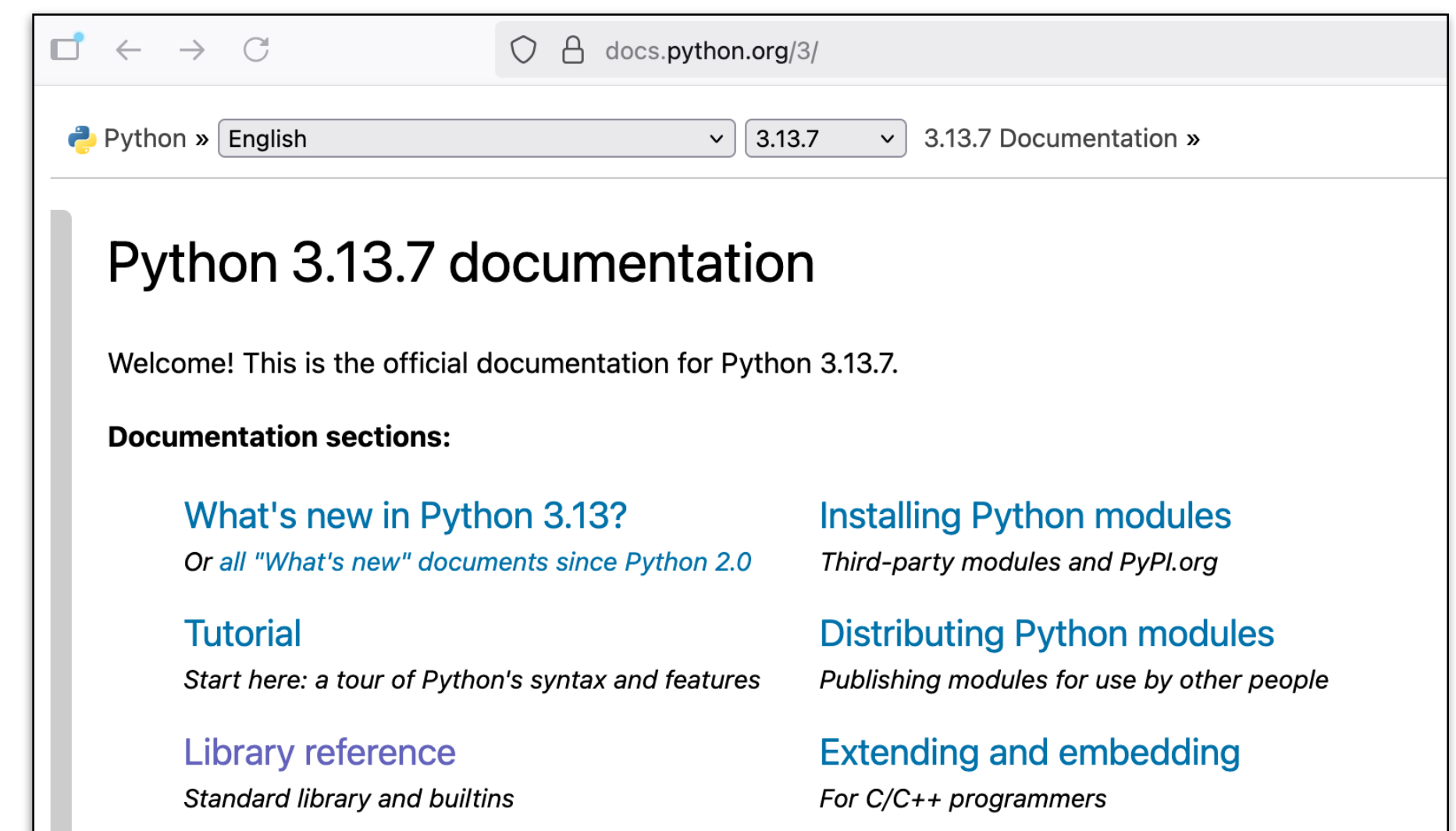
Detailed Python Reference Sheet

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

TABLE OF CONTENTS

- 1 **Detailed Python Reference Sheet**
 - a Abbreviated Reference Sheet
 - b Table Functions and Methods
 - c String Methods
 - d Array Functions and Methods
 - e Table Filtering Predicates
 - f Miscellaneous Functions
 - g JupyterHub Keyboard Shortcuts

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



The screenshot shows the official Python 3.13.7 documentation website. The browser address bar shows "docs.python.org/3/". The page has a header with "Python »", a language dropdown set to "English", a version dropdown set to "3.13.7", and a link to "3.13.7 Documentation ». The main heading is "Python 3.13.7 documentation". Below it, a welcome message states: "Welcome! This is the official documentation for Python 3.13.7." A section titled "Documentation sections:" lists several links with descriptions:

- [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
 - Expressions
 - Data Types
- Monday
 - Tables
- Wednesday
 - Charts & Visualization