

COMS BC1016

Introduction to Computational Thinking and Data Science

## Lecture 3: Introduction to Python

Sept 3, 2025

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Sept 10, 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 <a href="#">Slides</a> <a href="#">Demo (Code)</a> , <a href="#">Demo (PDF)</a>		
	9/8	Cause and Effect <a href="#">Slides</a>		
2	9/10	Intro to Python: Part 1 <a href="#">Slides</a> <a href="#">lec03-type-exercise.ipynb</a>	Lab 1 Released (Due 9/12)	<a href="#">Courseworks</a>

# 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)

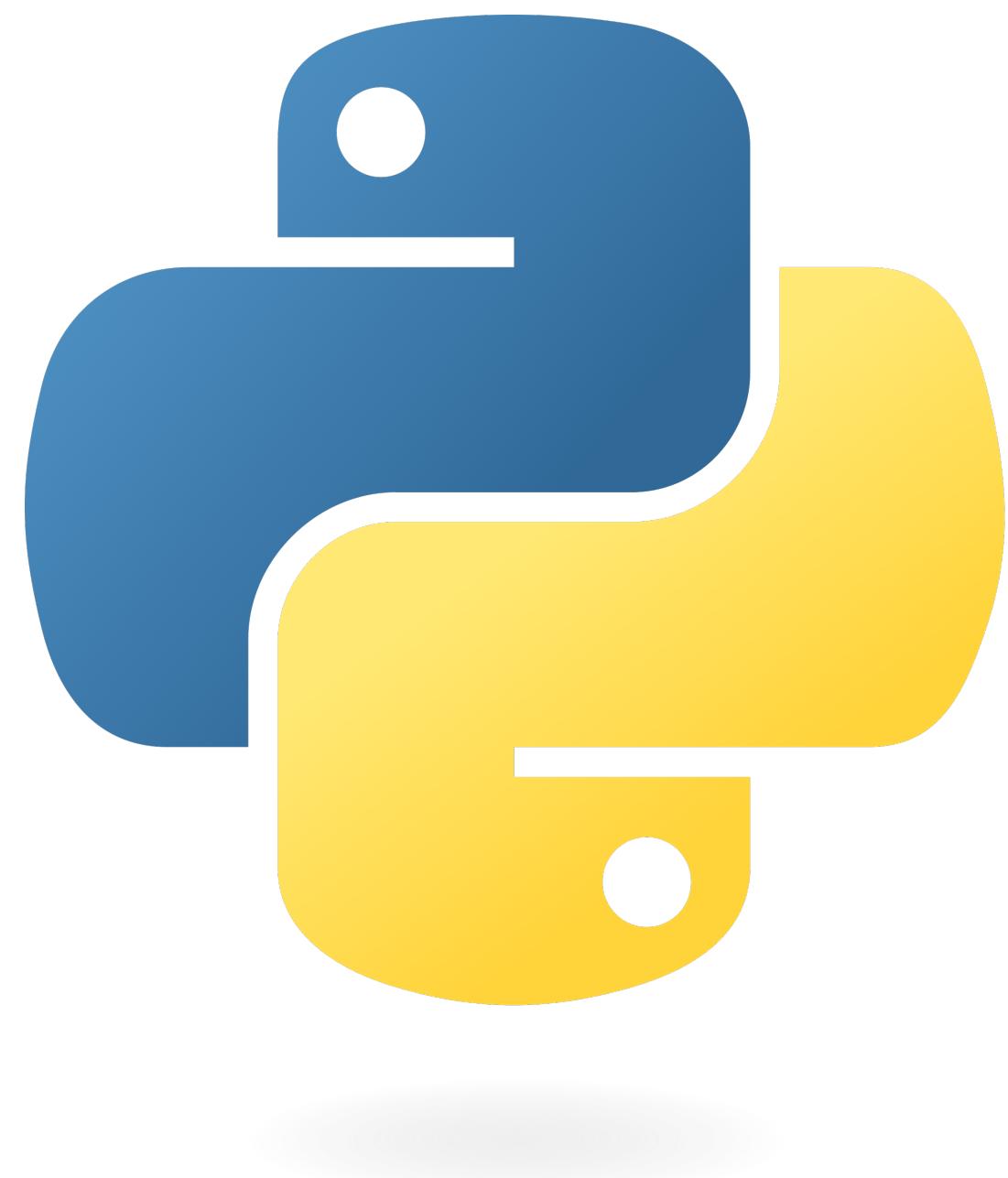
# Misc Updates

- 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

The screenshot shows a Jupyter Notebook interface. On the left, there's a sidebar with a file tree showing a folder named 'Course Examples' containing files like 'huck\_finn....', 'lec01.ipynb', 'lec03-note...', 'lec03-type...', 'lec03-type...', and 'little\_wom...'. The main area has several tabs at the top: 'lec03-notebook.ipynb' (active), 'lec01.ipynb', 'lec03-type...', 'lec03-type...', and 'lec03-type...'. Below the tabs, there are code cells. The first cell contains Python code to import data science libraries and set up plotting. The second cell starts with 'with open('huck\_finn.txt', 'r') as file:'. The third cell is a comment about creating a new data science Table. The fourth cell is a continuation of the previous one, showing a snippet of text from the book 'Huckleberry Finn'. The bottom right corner shows a preview of the 'Chapters' section.

```
[ ]: 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=FutureWarning)

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

[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 ...
```

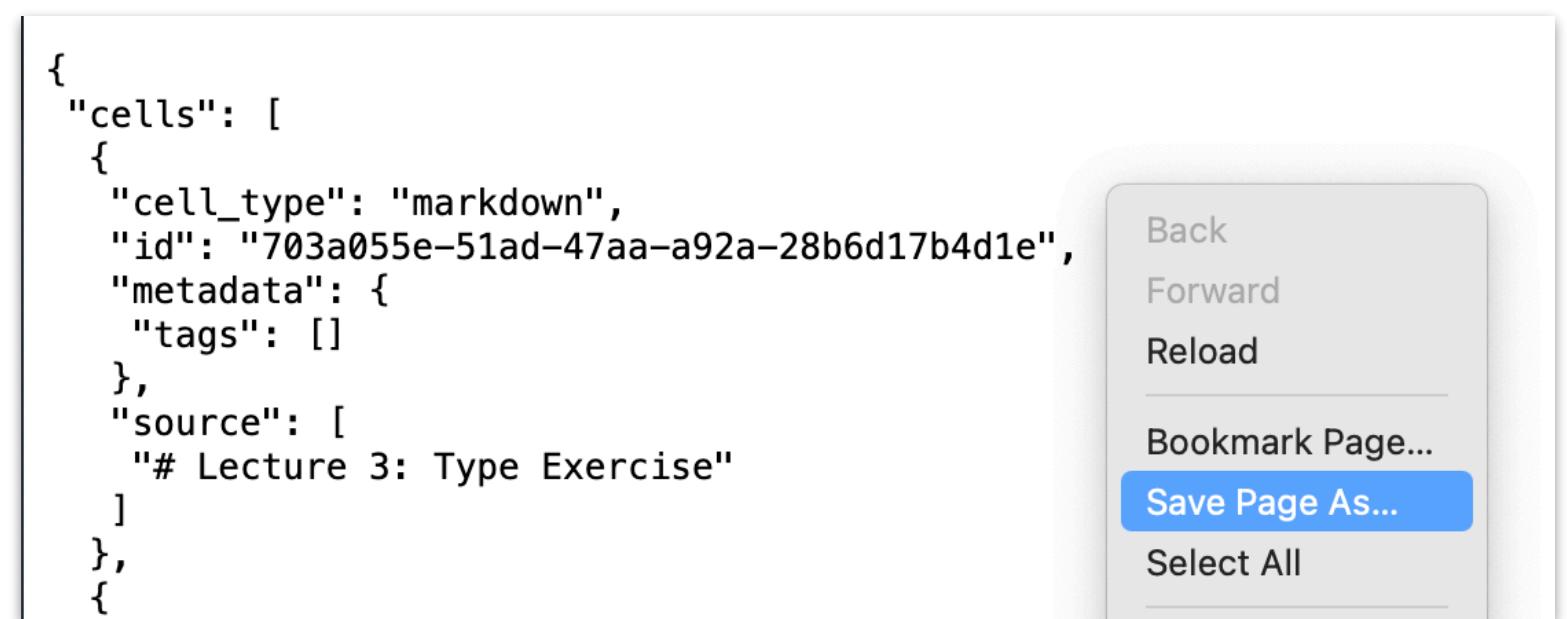
# Data Types and Demos

# Follow Along!

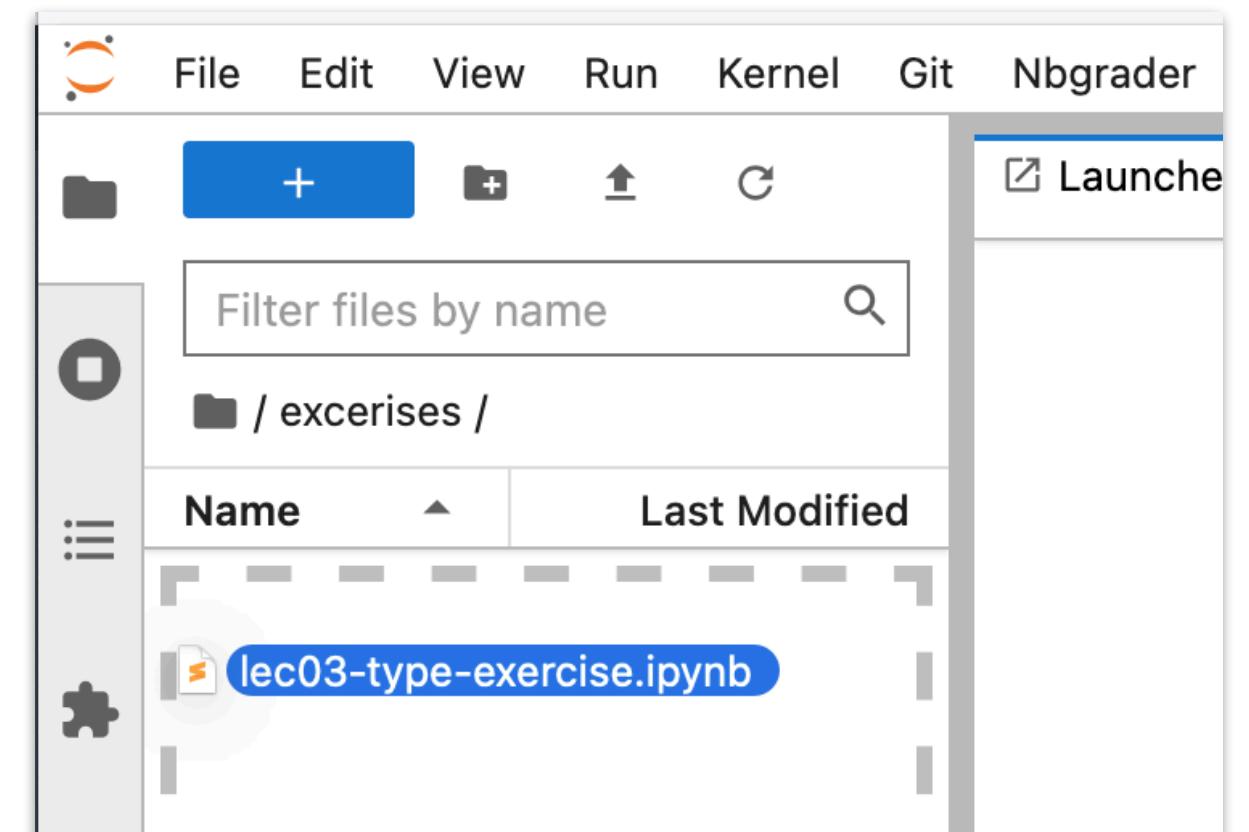
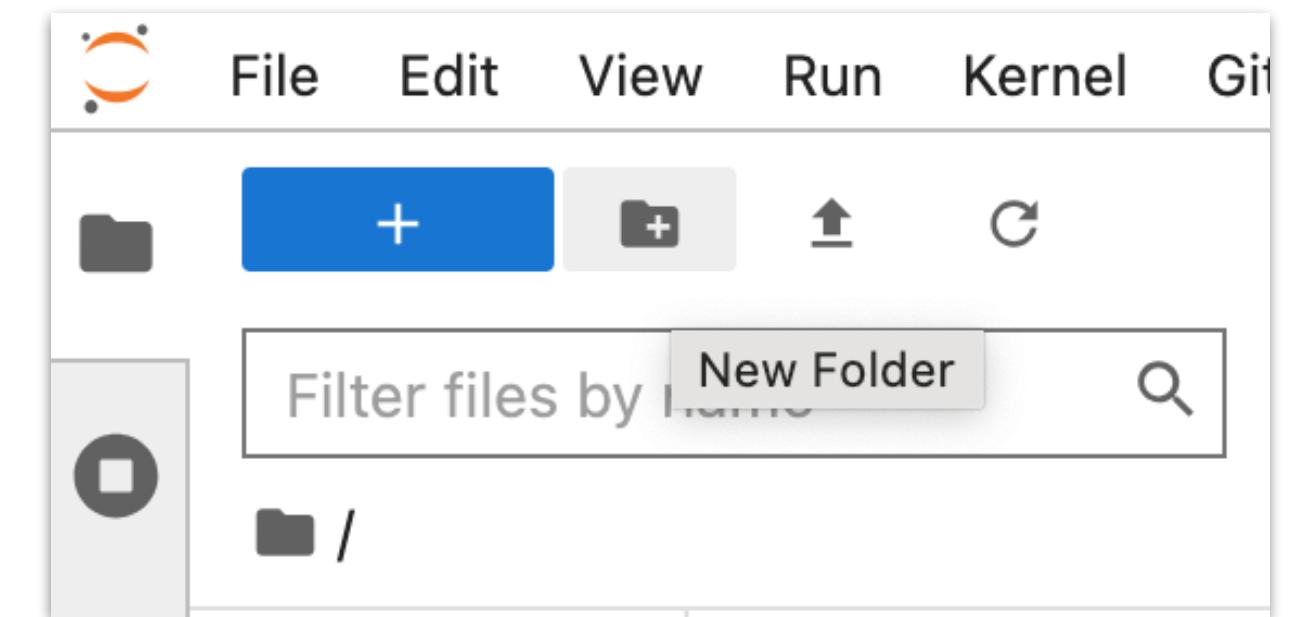
1. Download the class exercise python notebook (.ipynb) from the course website
2. Go to the course Jupyter Hub link
3. Create a folder called “exercises”
4. Drag the lec03-type-exercise.ipynb file into the folder

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

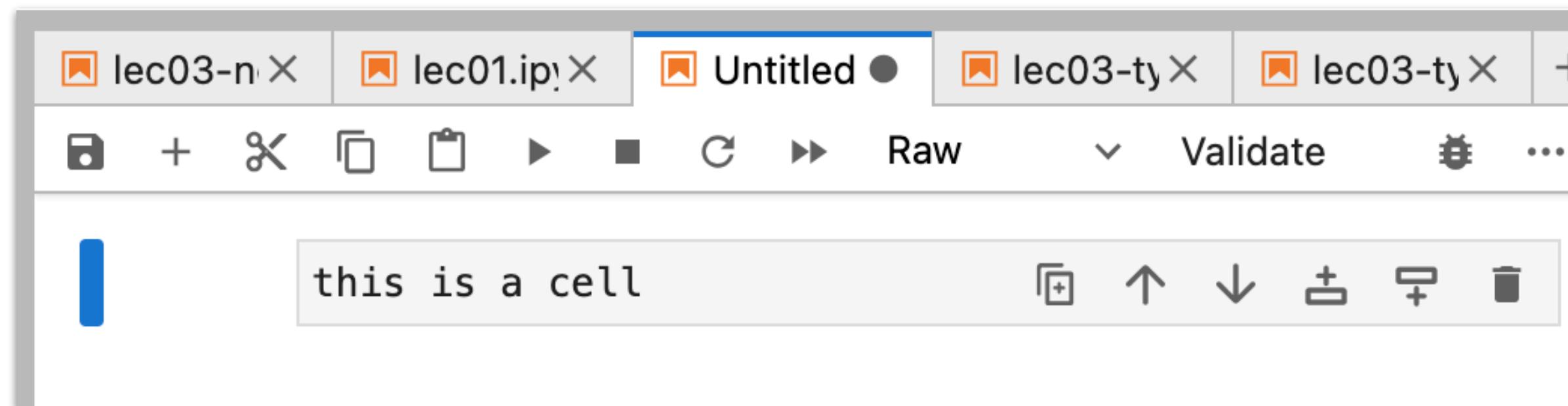


```
{  
  "cells": [  
    {  
      "cell_type": "markdown",  
      "id": "703a055e-51ad-47aa-a92a-28b6d17b4d1e",  
      "metadata": {  
        "tags": []  
      },  
      "source": [  
        "# Lecture 3: Type Exercise"  
      ]  
    },  
    {  
    }  
  ]  
}
```



# Jupyter Notebooks: Terms

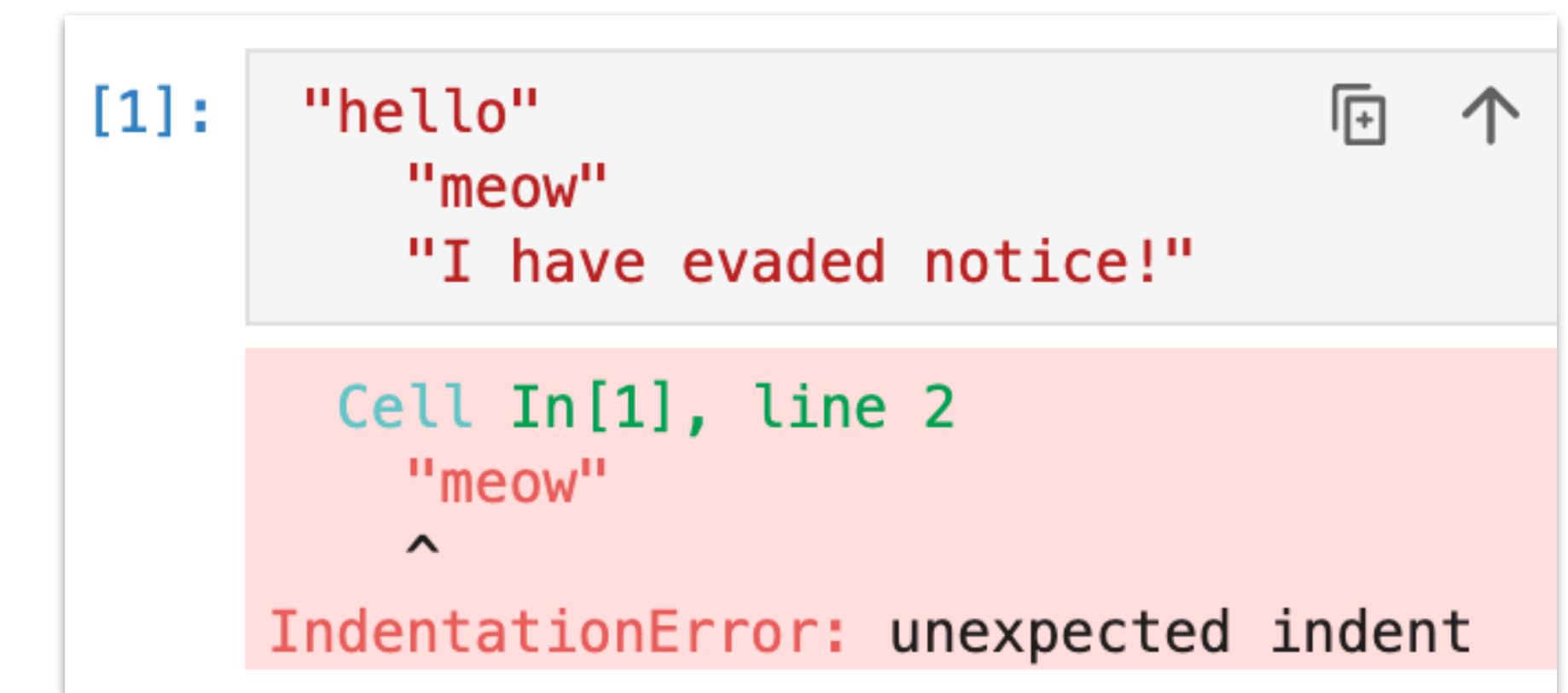
- Cells: block or section for writing code / notes / etc
- Kernel: executes code in cells (when you run a “cell”)



A screenshot of a Jupyter Notebook interface showing a cell execution. The top toolbar includes buttons for creating new cells (+), deleting (-), running cells (Run), and other notebook operations. The cell itself contains the text 'this is a cell'. Below the cell, the output area shows the command '[1]: print("Hello World")' followed by the resulting output 'Hello World'. The interface uses standard Jupyter styling for code cells and their outputs.

# 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



The screenshot shows a Jupyter Notebook cell with the following content:

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

Below the code, the output area shows:

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

The error message indicates that there is an unexpected indentation on the second line of the code cell.

# 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

- Integers: Whole numbers
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- Floats: Anything with decimals
  - e.g., 3.1, -10.2, 2.0
- 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?

# 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!

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 this example:

x + y

How could you fix it?

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x + int(y + z)

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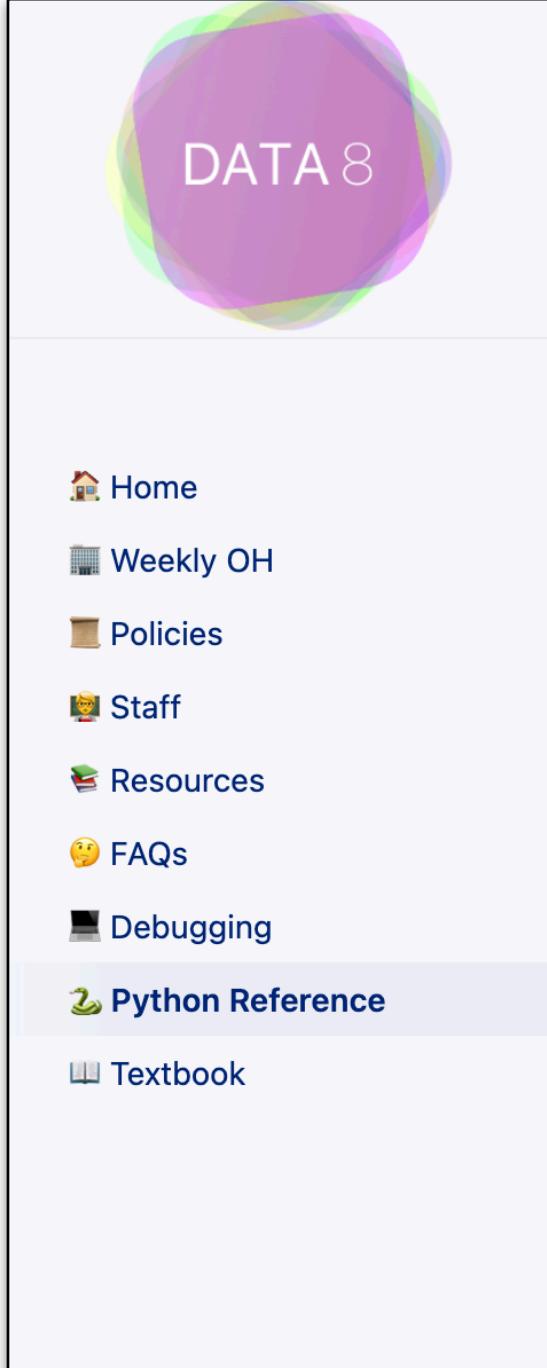
What would the source of the error in this example:

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

How could you fix it?

# Python Reference

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



The screenshot shows the Data 8 website interface. At the top right is a search bar labeled "Search Data 8" and navigation links for "OH Queue", "Textbook", and "Extensions". The main content area has a title "Detailed Python Reference Sheet". Below it is a note about contributions and a "TABLE OF CONTENTS" section. The sidebar on the left contains links: Home, Weekly OH, Policies, Staff, Resources, FAQs, Debugging, Python Reference (which is highlighted), and Textbook.

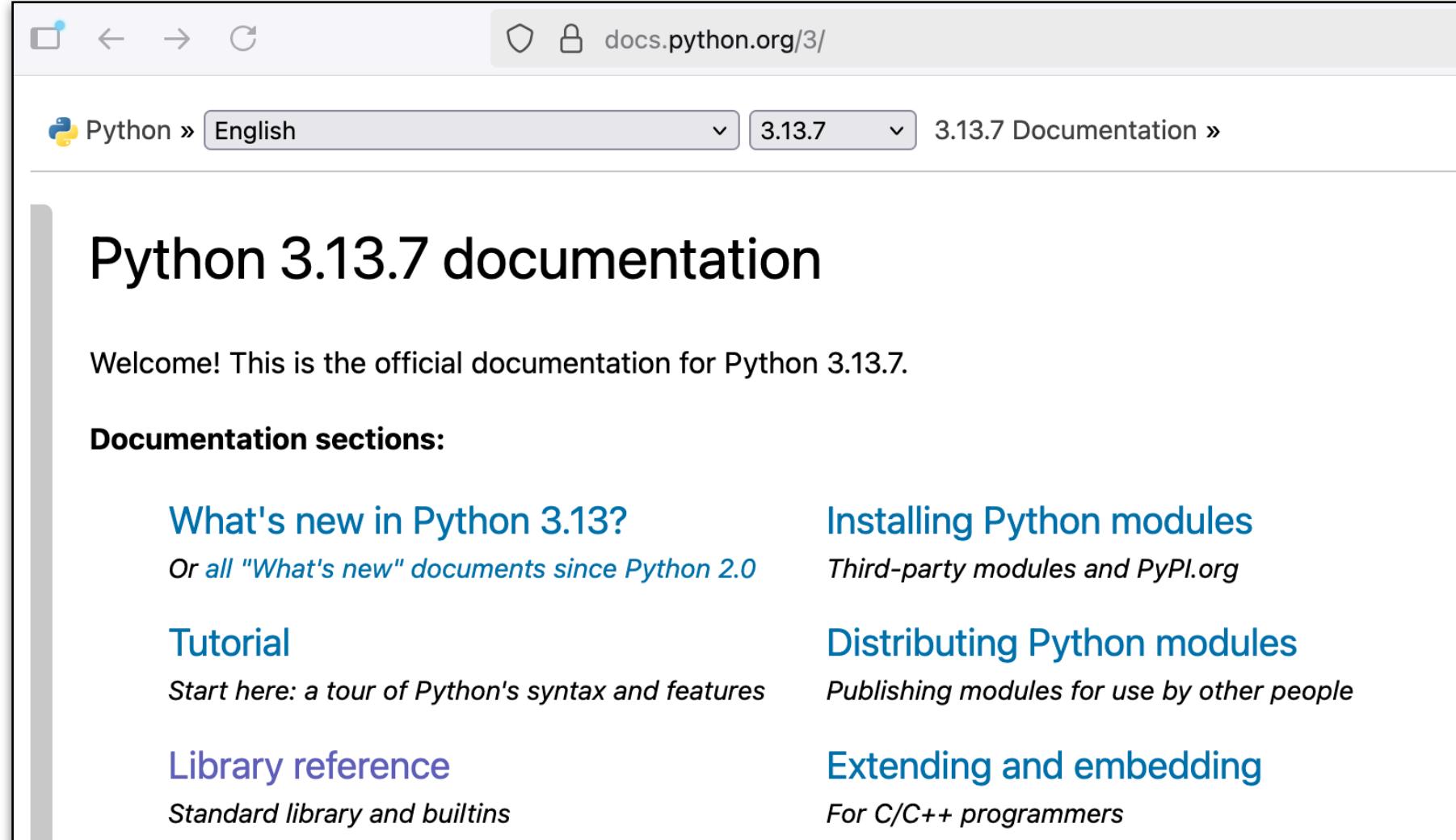
## Detailed Python Reference Sheet

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 Python 3.13.7 documentation page. The browser address bar shows "docs.python.org/3/". The page title is "Python 3.13.7 documentation". A welcome message states "Welcome! This is the official documentation for Python 3.13.7." Below it is a "Documentation sections:" heading with several links: "What's new in Python 3.13?", "Tutorial", "Library reference", "Installing Python modules", "Distributing Python modules", and "Extending and embedding".

## Python 3.13.7 documentation

Welcome! This is the official documentation for Python 3.13.7.

**Documentation sections:**

<a href="#">What's new in Python 3.13?</a> <small>Or all "What's new" documents since Python 2.0</small>	<a href="#">Installing Python modules</a> <small>Third-party modules and PyPI.org</small>
<a href="#">Tutorial</a> <small>Start here: a tour of Python's syntax and features</small>	<a href="#">Distributing Python modules</a> <small>Publishing modules for use by other people</small>
<a href="#">Library reference</a> <small>Standard library and builtins</small>	<a href="#">Extending and embedding</a> <small>For C/C++ programmers</small>

# Next Class

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