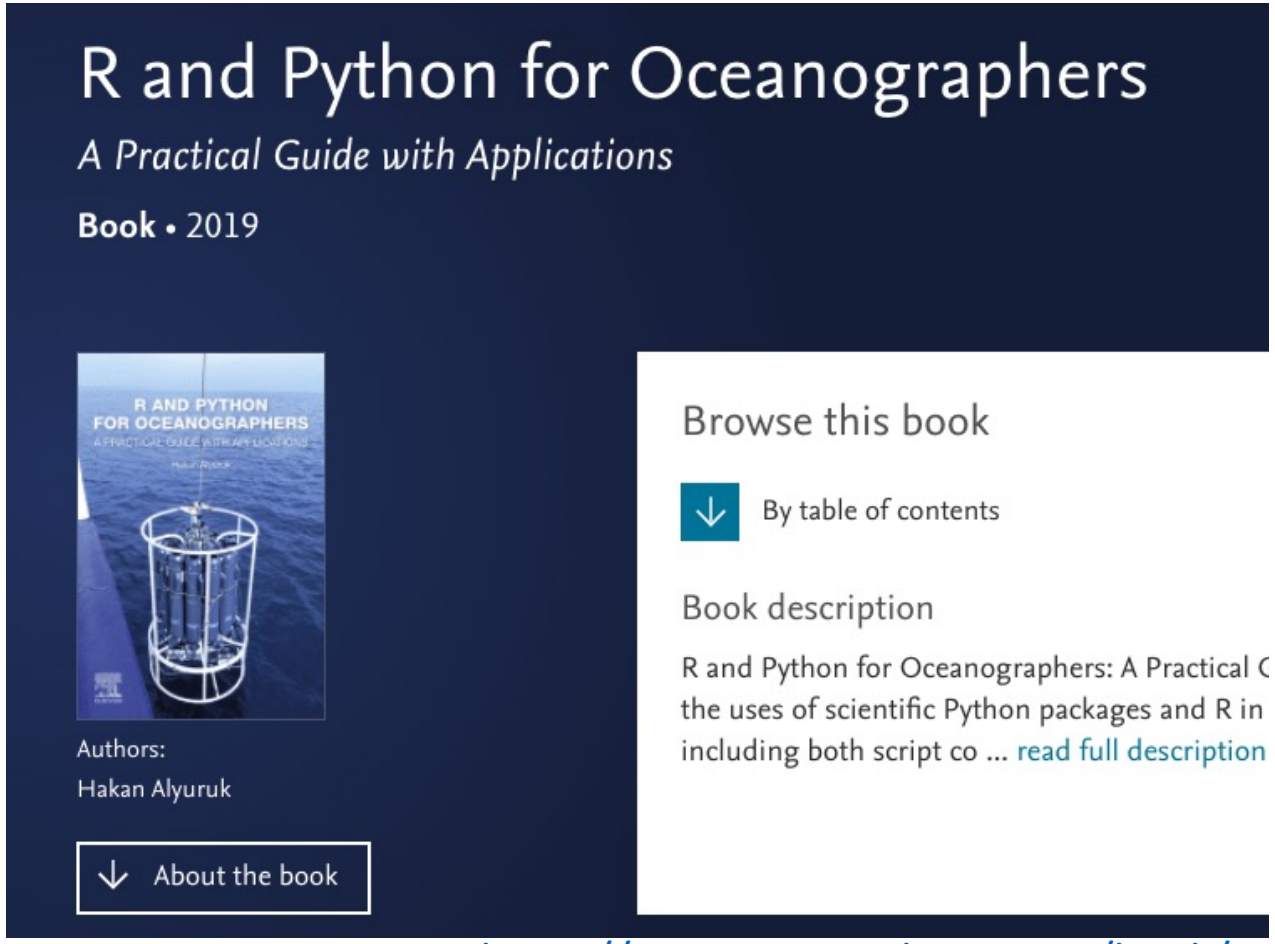
Intro to Python & HW4

Read R & Python for Oceanographers, Ch 1 (Python part only)



1.7 Introduction to Python

Python is an interpreted, general-purpose, object-oriented and high-level programming language. It was conceived by Guido van Rossum in the late 1980s, and its first implementation started in 1989. Python is developed as a successor of ABC language at Centrum Wiskunde & Informatica (CWI) in the Netherlands. In the development of Python, van Rossum also influenced from Modula-3. As a result, Python has been evolved as a new language that includes improvements over ABC and Modula-3 [3, 4].

Currently, the development of Python language is organized and supported by Python Software Foundation (PSF).

Some advantages of Python as a data science tool are:

- It is simple, readable, and easy to learn.
- Python interpreter can run on multiple platforms: Windows, Linux, and Mac OSX.
- It is possible to express functions with fewer codes compared to other languages.
- It is an open source language and can be freely used and distributed.
- There are many libraries for scientific computing.
- It is possible to use Python in combination with other languages such as C or C++.

https://www.sciencedirect.com/book/9780128134917/r-and-python-for-oceanographers

What is Python and why would we use it?

- Did anyone have frustrations with the last two Excel exercises (other than just downloading Argo data)?

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- Did anyone have frustrations with the last two Excel exercises (other than just downloading Argo data)?
- Python is a scripted language (we write code to make it do stuff)
- It's HIGHLY reproducible (Excel, not so much)
- Open source and free
- But ^ comes with some frustrations, too

Why use Python, Part II

- Free!
- Repeatable coding, you don't have to repeat a whole process with Excel every time you get new data
- Used by top professionals, from YouTube coders to NASA researchers
- Can be applied to any field of science or engineering
- One of the most helpful and lucrative skills in science

Python vs. Jupyter vs. Colab

- **Python is a language** (analogous to English). You write code in Python (or text in English). You could write Python code (or English) anywhere—on a napkin, your notebook, in a text message, in a document on your computer.

Python vs. Jupyter vs. Colab

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- Python can do extremely sophisticated machine learning and very basic math. It is the backbone of many famous websites (Instagram, Spotify, Netflix, etc.)
- But it has very specific rules (grammar) that must be followed for it to work

Python vs. Jupyter vs. Colab

- Python is a language (analogous to English). You write code in Python (or text in English).
- **Jupyter is a program** in which you can execute Python code (continuing our analogy, it's like Microsoft Word). You open Jupyter on your computer in order to run Python code. Jupyter calls its files "notebooks."

Python vs. Jupyter vs. Colab

- Python is a language (like English). You write code in Python (or text in English).
- Jupyter is a program in which you can execute Python code (continuing our analogy, it's like Microsoft Word).
- **Colab is a free online website** that allows you to run notebooks in the cloud without downloading anything. You just need a browser. Sort of like Google Docs.

There are many ways to run Python

- The very hard way: using a text editor and running code from the command line
- The medium hard way: installing Python and its packages using the Python package installer (PyPI) and using Jupyter
- The medium way: installing Python and packages using a tool called Anaconda and using Jupyter notebooks for desktop programming (I recommend this)
- The easiest way: Google Colab. 100% in the cloud—all you need is a browser (I will teach this)

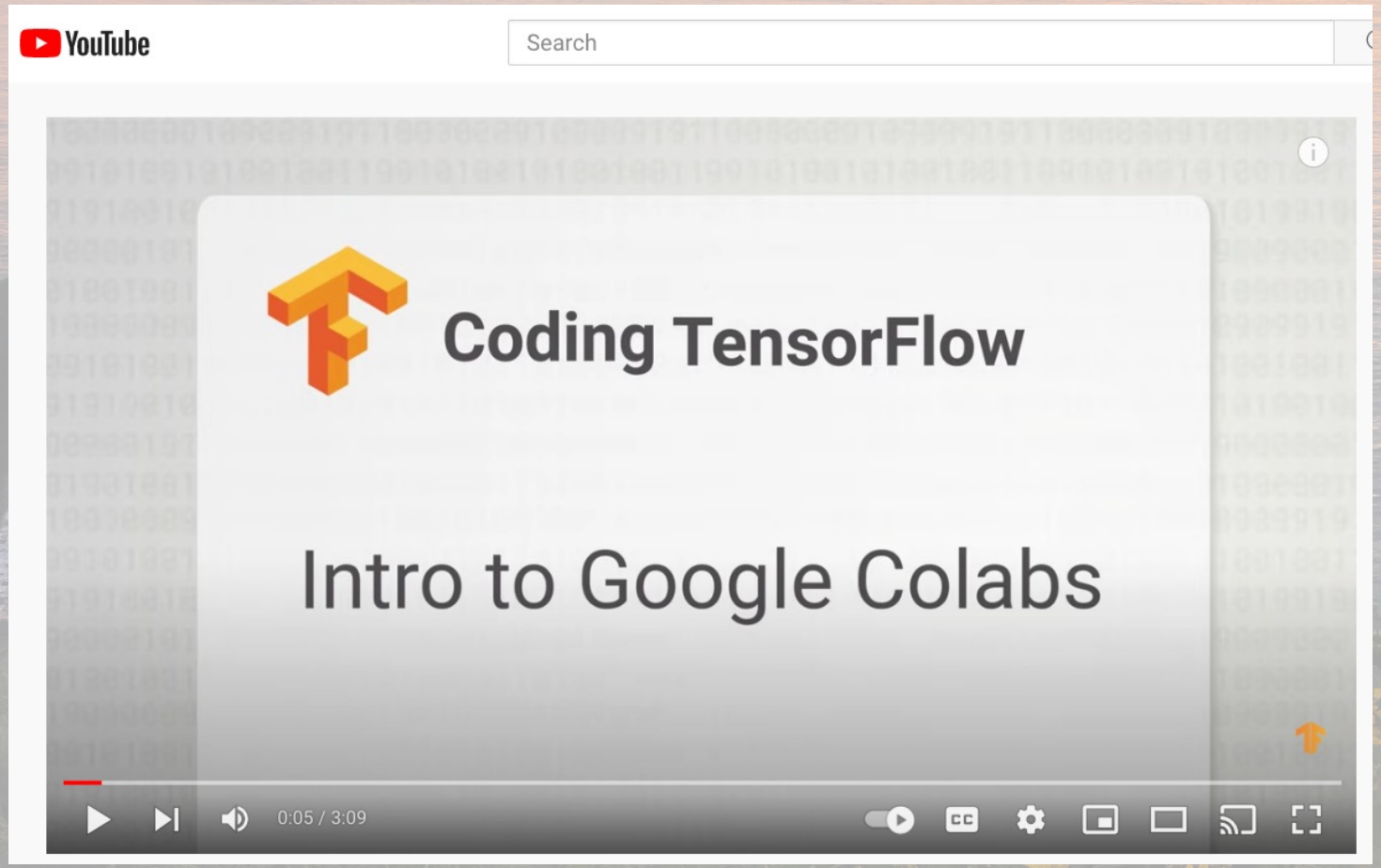
Colab creates new challenges

- Running Python on your computer means easy access to data files (e.g., BATS.xlsx would be right there)
- Running in the cloud means you have to tell Google where to find data—can be messy
- You have to be extra careful to save your work when working in a browser

Additional and somewhat confusing details

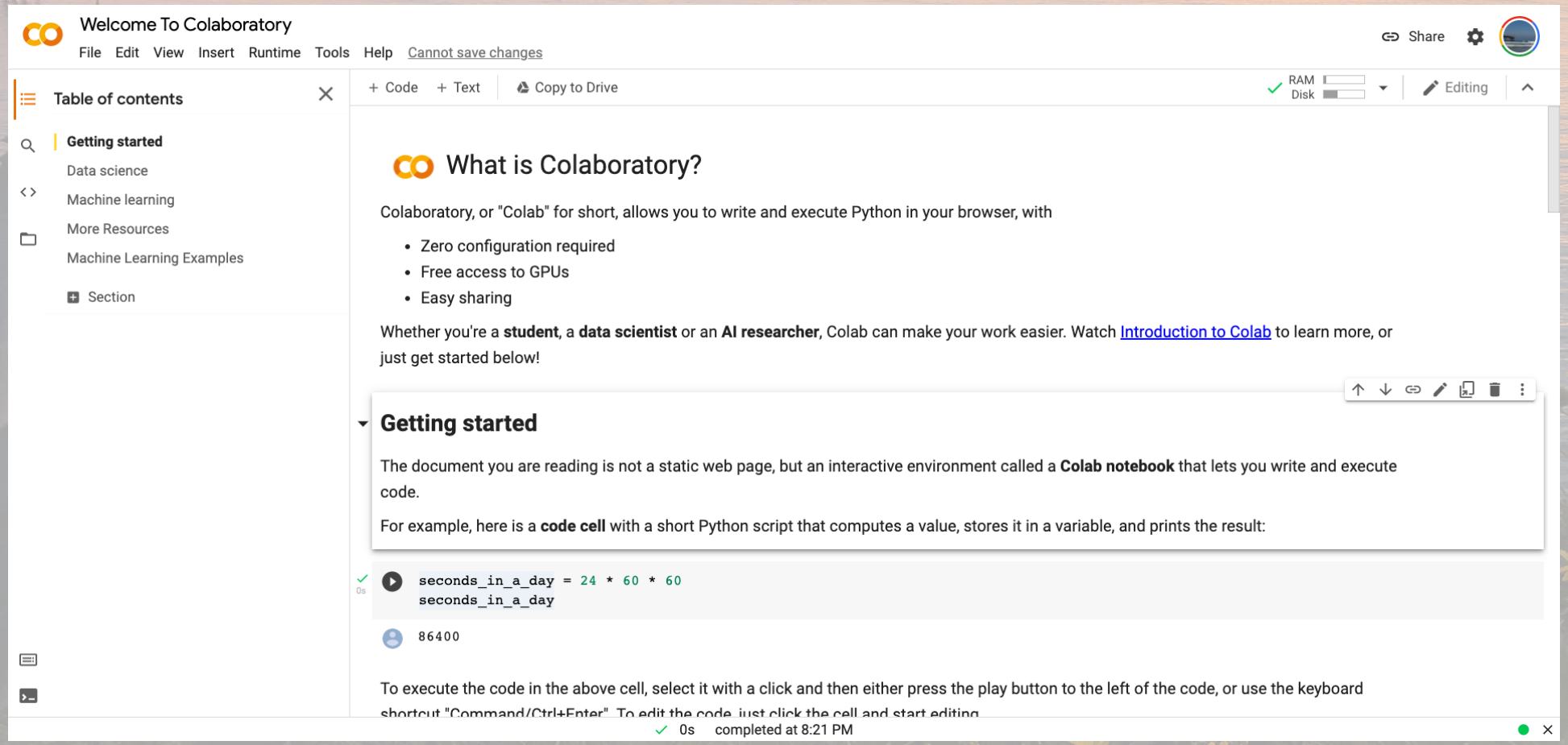
- Jupyter notebooks can execute code written in other languages, too, but we won't do that in this class
- Colab can only execute Python
- You can (in fact, are encouraged to!) download Python on your computer via Anaconda, but this can get a little complicated. We'll discuss it later this semester. Just use Colab for now, but don't count on using it in other Python-focused classes.

Intro to Colab



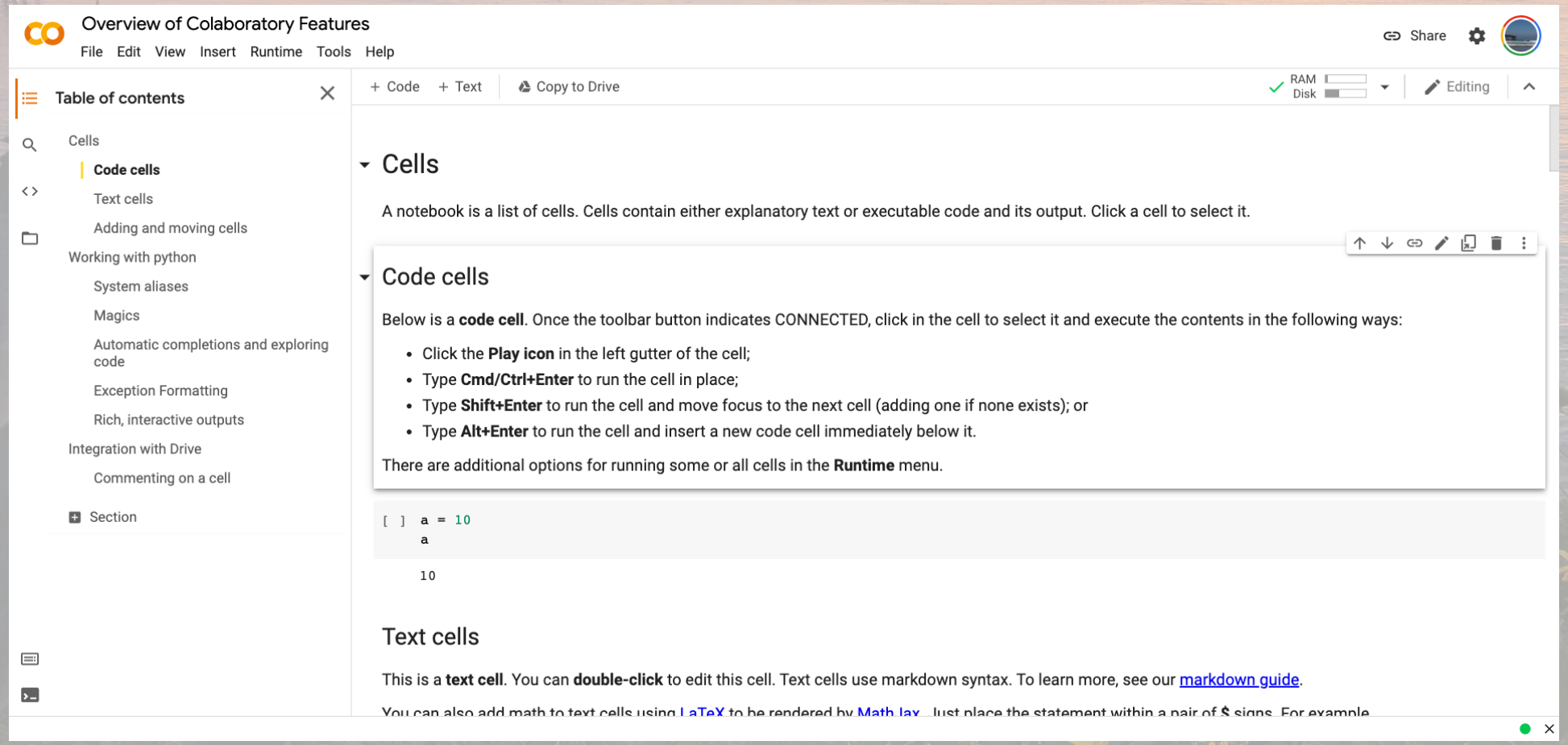
https://www.youtube.com/watch?v=inN8seMm7UI

Intro to Colab



https://colab.research.google.com/notebooks/intro.ipynb

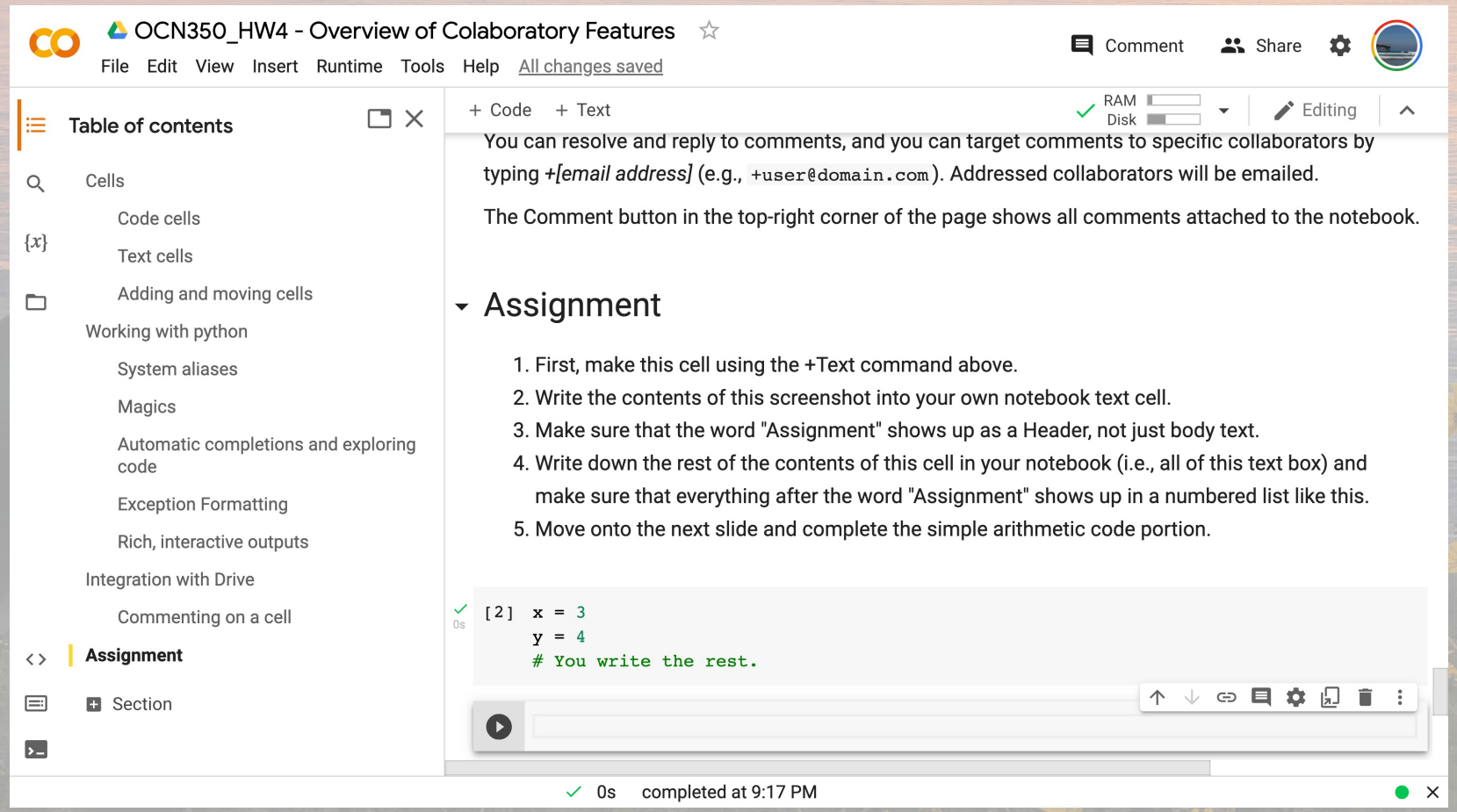
Intro to Colab



https://colab.research.google.com/notebooks/basic_features_overview.ipynb

Assignment:

Start with “Overview of Colaboratory Features” notebook from previous slide



See https://colab.research.google.com/notebooks/markdown_guide.ipynb for Markdown syntax

Requirements

1. To do this, you must have a Colab account (this only requires a normal Google/Gmail account and is completely free)
2. Go to https://colab.research.google.com/notebooks/basic_features_overview.ipynb
3. Save a copy in Drive (create a new OCN 350 folder in Drive; we'll use it a lot!)
4. READ and Run each of the cells (either by clicking the play arrow or by clicking "Shift + Return"
5. Add the portion described on previous slide to the bottom

Requirements (cont'd)

6. Add a code cell. Type the following:

```
x = 3
y = 4
z = '5'
a = x*y
b = y*z
```

7. Add two additional lines to print out the value of a and the value of b.

8. Add a Markdown cell and explain why a and b are what they are.

9. Calculate c = x^2 using Python's exponent notation (look it up) and print out the value of c to the screen

10. Calculate d = sqrt(y) using Python's exponent notation and print out the value of d to the screen.

Submission

- Save and submit the .ipynb file in Canvas

Final notes

- Notebooks are nice because you can add code, formatted text, and output (graphs, tables, printed values, etc.)
- But many other ways to write and execute code
- We'll use Jupyter notebooks (hosted by Colab) for ease of use and presentation, but many other great options

PJB-20190329_googleDoc_decode_16BitIMU_plotly.py > ...

```
87  def decoded_to_df(df, decoded):
88
89      i = 0
90      # rest vars
91      type_name = np.nan
92      time = np.nan
93      temp = np.nan
94      epoch = np.nan
95      wet = np.nan
96      Ax = np.nan
97      Ay = np.nan
98      Az = np.nan
99      lat = np.nan
100     lon = np.nan
101     text = np.nan
102     batt_mv = np.nan
103
104     try:
105
106         while(i < (len(decoded))):
107             type = (decoded[i]>>4)
108
109             # print("type = ", type)
110
111             # deal with padding if it exists
112             if (type == 0):
113                 type_name = 'Padding'
114                 i = i + 1
115                 # print("type = " + str(type_name))
116                 # print()
117                 continue
118
119             # grab time (wait until after dealing with padding)
120             time = (((decoded[i] & 0x0F) << 16) + (decoded[i+1] << 8) + decoded[i+2])/10.0
121
122             # decode data type
123
124             if (type == TEMP_DATA_TYPE):
```