

Age of the Universe Workshop

Below are instructions some resources for after the workshop. If you have any questions feel free to email us at ageoftheuniverse.uoft@gmail.com.

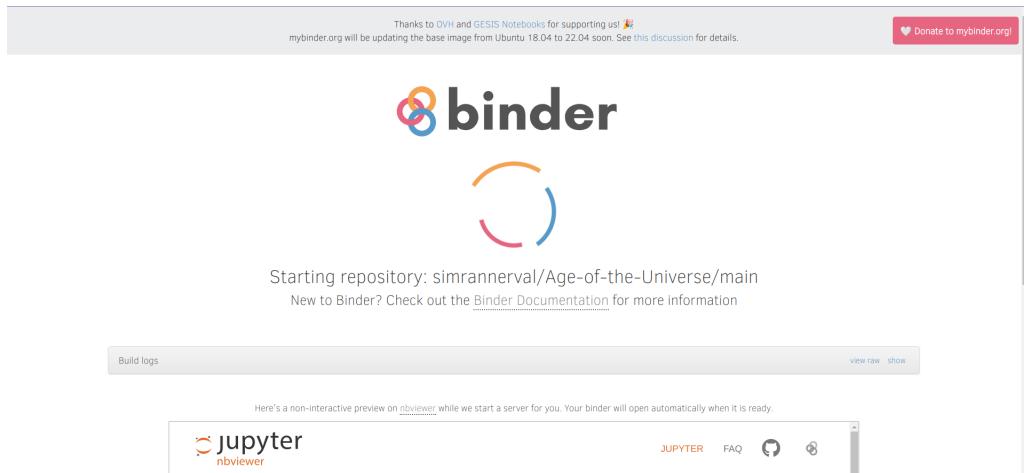
Opening the Activities

Binder

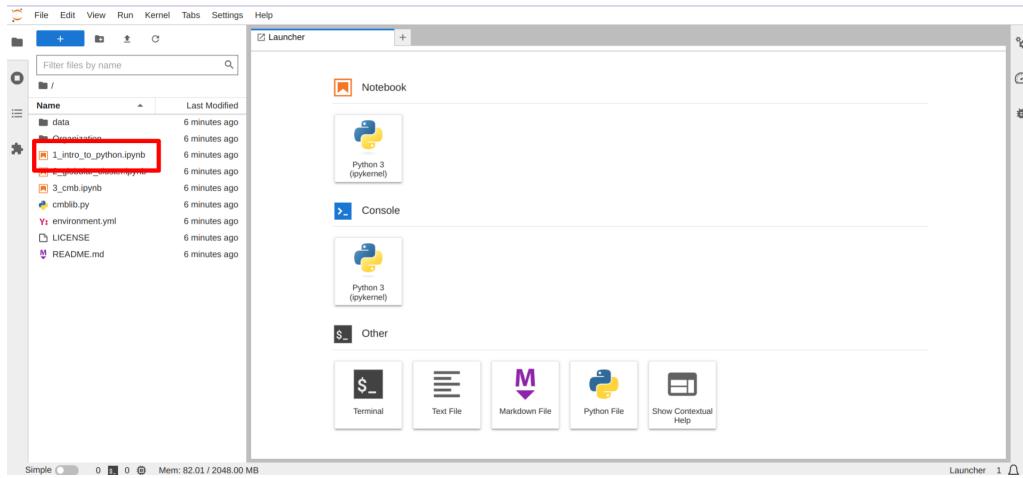
1. Go to: <https://github.com/simrannerval/Age-of-the-Universe>
2. Click the “launch binder” shown in the red box below:



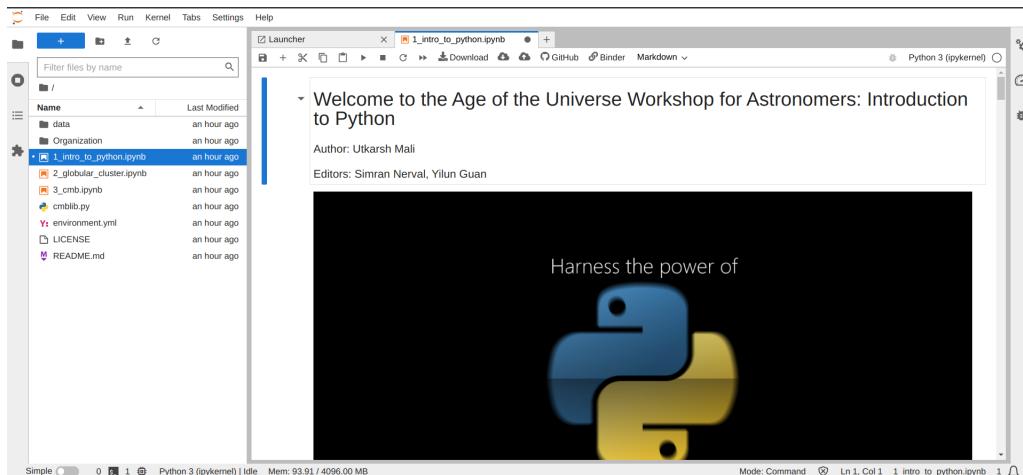
3. This will take a while to load the first few times. The screen should look like the image below:



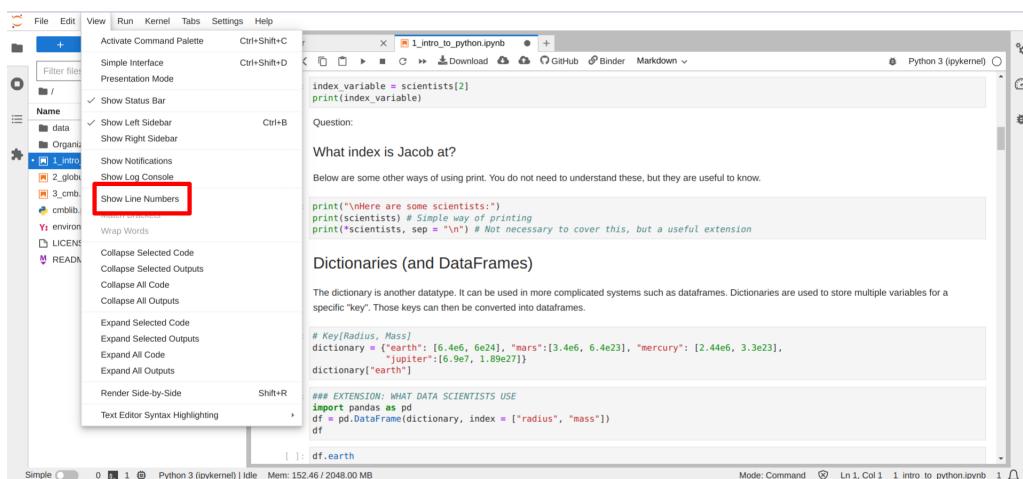
4. Once it is finished loading, the screen will look like this image below. Please click on one of the notebooks, such as 1_intro_to_python.ipynb shown in the red box:



5. The Jupyter Notebook should open and look like the image below:



6. Then go to “View” and click “Toggle Line Numbers” as shown in the red box below:



- Then there should be line numbers in the left of the cells as shown in the red box below:

The screenshot shows a Jupyter Notebook interface. On the left, a sidebar lists files: 1_intro_to_python.ipynb (selected), 2_globular_cluster.ipynb, 3_cmb.ipynb, cmlib.py, environment.yml, LICENSE, and README.md. The main area displays a code cell with line numbers. The first two lines are: 1 index_variable = scientists[2] 2 print(index_variable). Below this, a question asks "What index is Jacob at?". A note follows: "Below are some other ways of using print. You do not need to understand these, but they are useful to know." Three examples are shown: 1 print("There are some scientists:") 2 print(scientists) # Simple way of printing 3 print(*scientists, sep = "\n") # Not necessary to cover this, but a useful extension. The code cell continues with a section titled "Dictionaries (and DataFrames)". It shows a dictionary definition and its conversion into a DataFrame. The line numbers 1, 2, 3, 4 are highlighted in red around the dictionary assignment and its values. The bottom status bar indicates "Mode: Command" and "Ln 1, Col 1 1_intro_to_python.ipynb 1".

```

1 index_variable = scientists[2]
2 print(index_variable)

What index is Jacob at?

Below are some other ways of using print. You do not need to understand these, but they are useful to know.

1 print("There are some scientists:")
2 print(scientists) # Simple way of printing
3 print(*scientists, sep = "\n") # Not necessary to cover this, but a useful extension

Dictionaries (and DataFrames)

The dictionary is another datatype. It can be used in more complicated systems such as dataframes. Dictionaries are used to store multiple variables for a specific "key". Those keys can then be converted into dataframes.

1 # Key[Radius, Mass]
dictionary = {"earth": [1.4e6, 6e24], "mars": [3.4e6, 6.4e23], "mercury": [2.44e6, 3.3e23],
              "jupiter": [1.9e7, 1.89e27]}
4 dictionary["earth"]

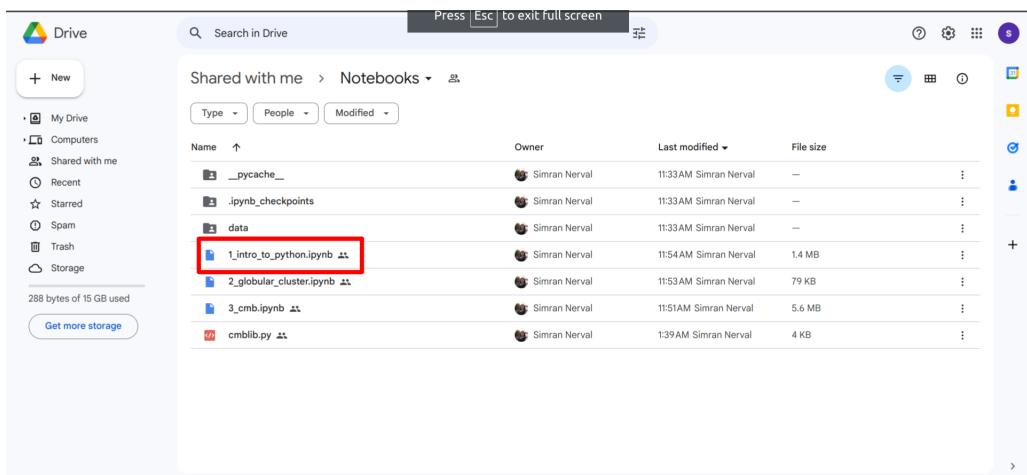
1 #### EXTENSION: WHAT DATA SCIENTISTS USE
2 import pandas as pd
3 df = pd.DataFrame(dictionary, index = ["radius", "mass"])
4 df

1 df.earth

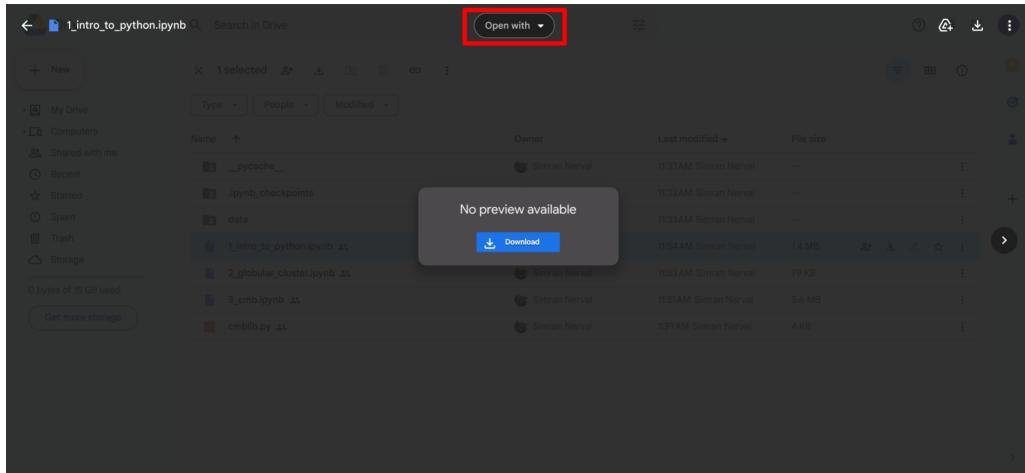
```

Google Colaboratory

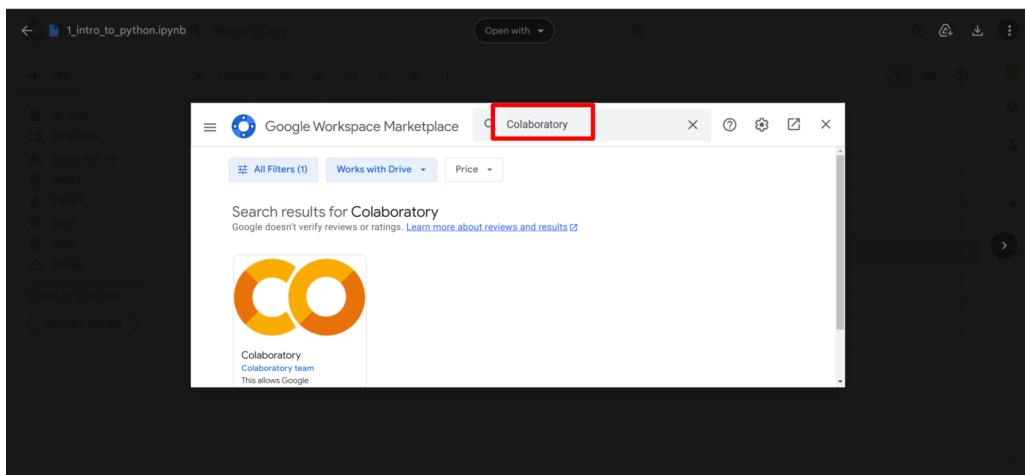
- Go to: https://drive.google.com/drive/folders/1Q1yhHJ4PLaH54HEavygXHgNa4tUgsWjd?usp=drive_link
- The screen will look like this image below. Please click on one of the notebooks, such as 1.intro_to_python.ipynb shown in the red box:



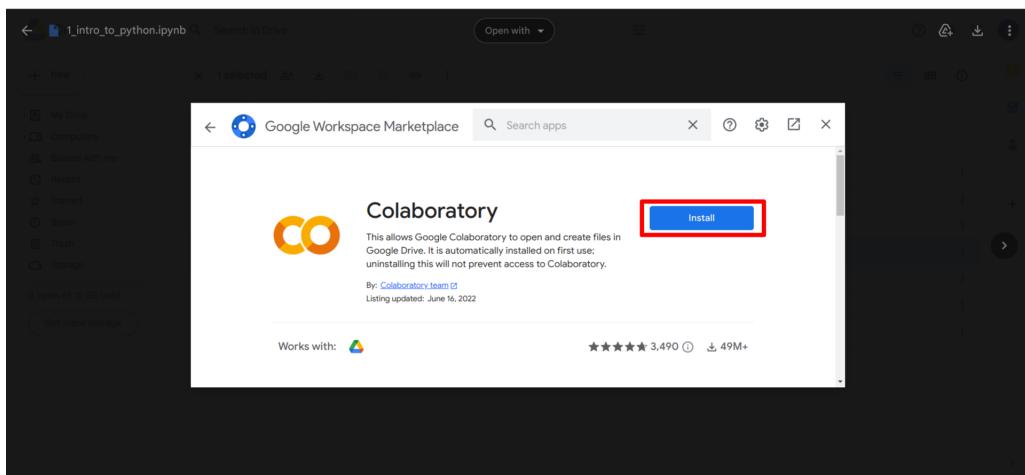
- The Jupyter Notebook will open like the image below, click "Open with" shown in the red box:



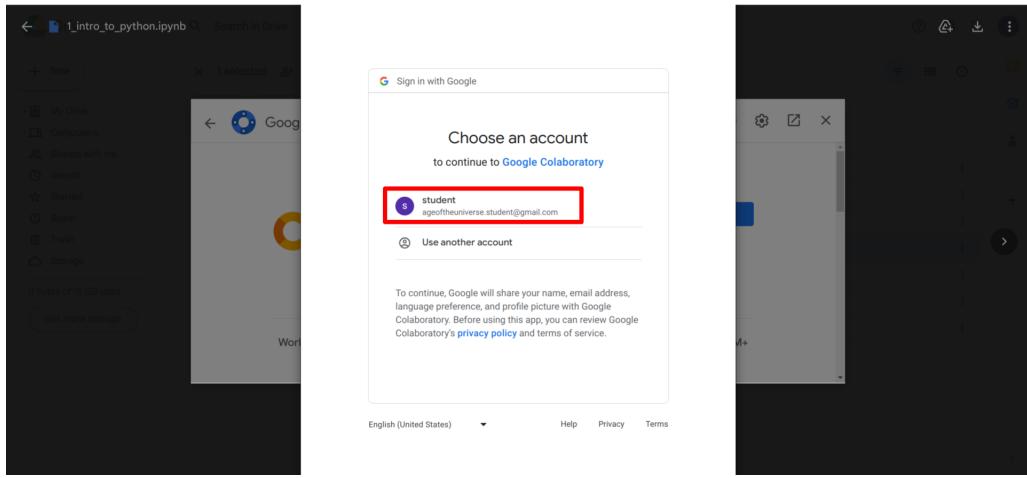
4. Then click “Google Colaboratory” or if you don’t have it installed, search for it as shown in the red box below:



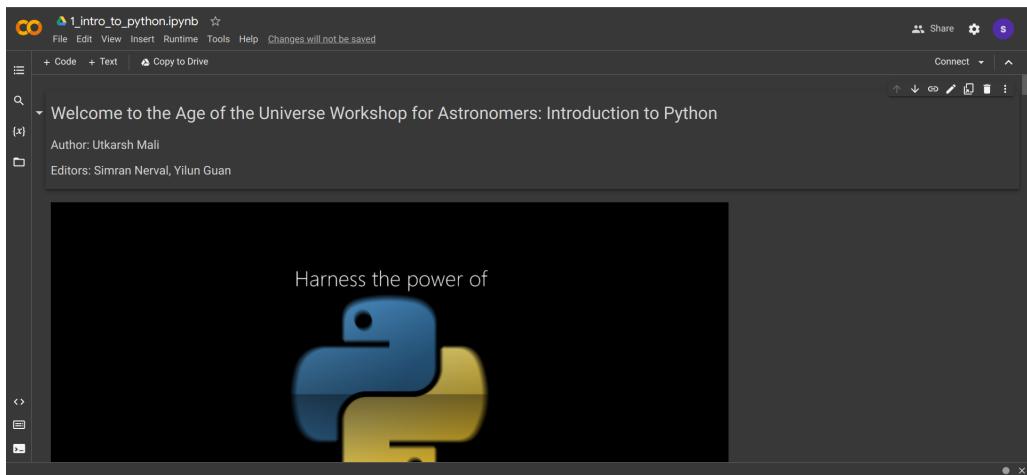
5. Then click “Install”:



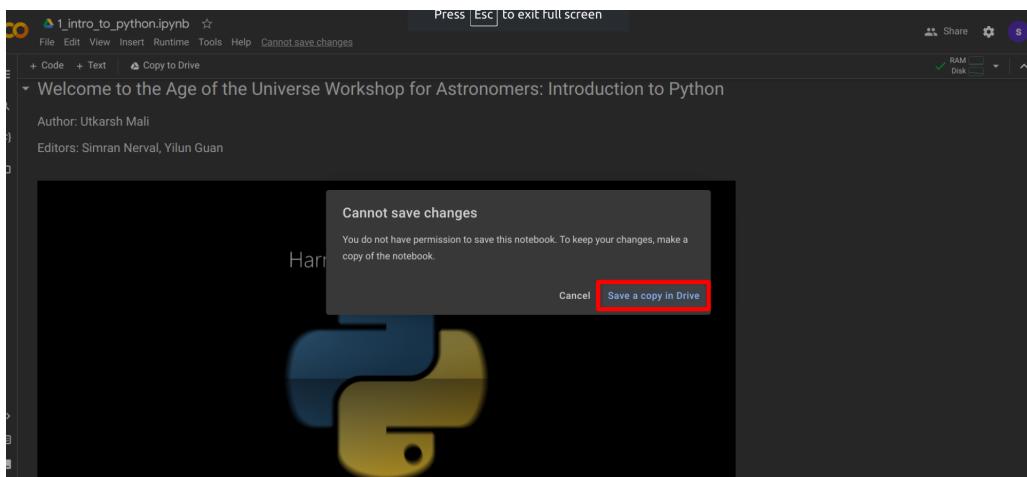
6. If you are not logged into your Gmail, you then need to click on your account:



7. Once the notebook is opened, it should look like the image below:



8. When you go to save your notebook it will prompt you to save a copy in your own drive as shown below:



After the Workshop

After you have attempted all of the questions, here are instructions on how to get to the solutions. Also, if you enjoyed coding, here are some instructions for getting Python set up on your own computer, as well as resources for learning how to code! There are also some resources for more astrophysics activities and mentorship opportunities.

Opening the Solutions

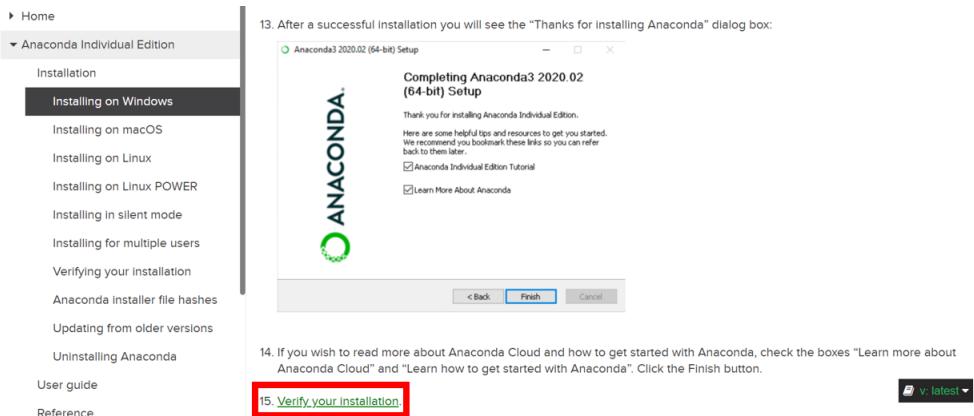
Follow steps “Opening the Activities”, but click the solution sets such as 1_intro_to_python_solutions.ipynb. You can do this with either the Binder or Google Colaboratory options.

Installing Python and Launching Jupyter Notebook

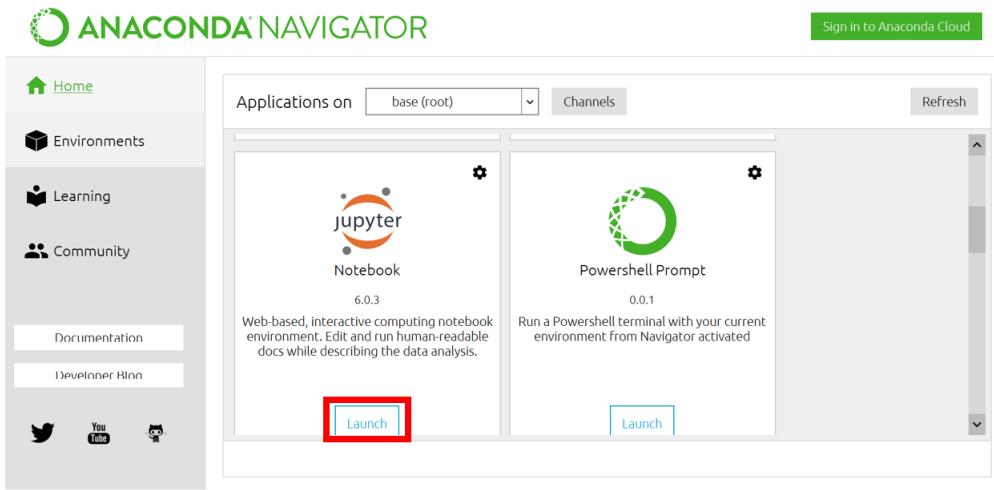
1. Go to: <https://docs.anaconda.com/anaconda/install/>
2. Click the install link for your computer (Windows, macOS, or Linux) as shown in the image below:



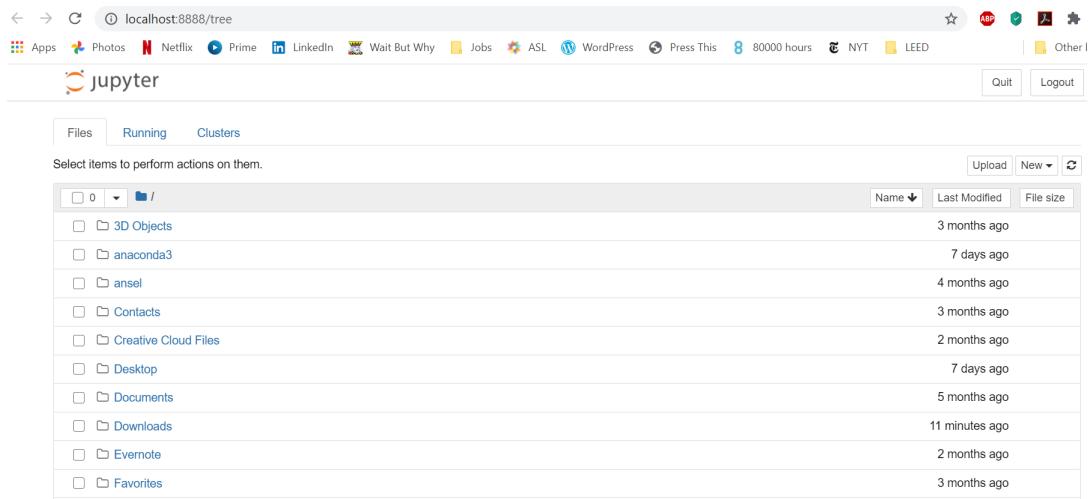
3. Follow the instructions and ensure to also follow the “Verify your Installation” instructions shown in the example image below for Windows in the red box:



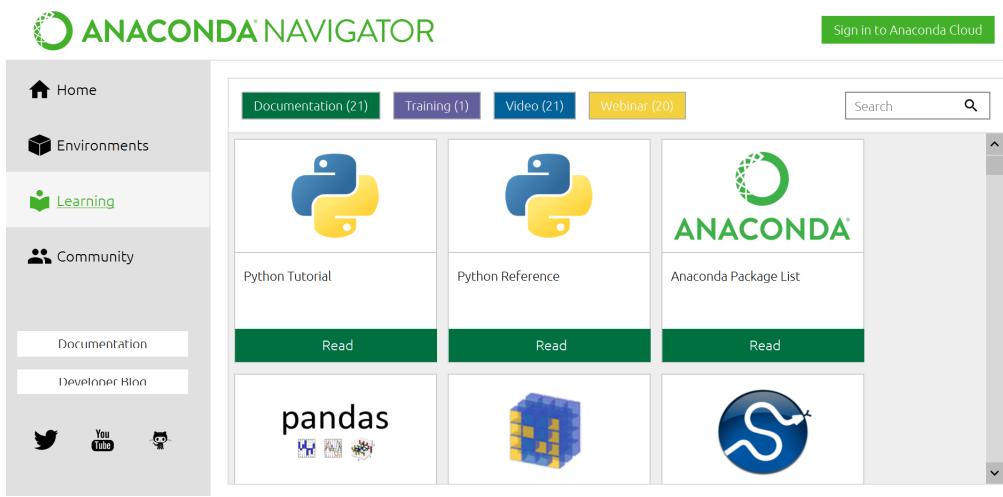
4. Once you have installed Anaconda, you can then launch the Anaconda Navigator. From here you will be able to launch Jupyter Notebook as shown in the red box below:



5. Once you click the launch button, it will open in your web browser, and you can navigate through your computer's files to open the notebook you wish to work on as shown in the image below:



You will also notice a bunch of other applications other than Jupyter Notebook that are available to launch from the navigator. For example, you will see JupyterLab, which is the next-generation environment of the Jupyter Notebook. You will also see R studio, which is a development environment for R, a language that is very useful for statistics. Note the Learning tab on the left hand menu. If you click that tab, you will see a page like the one below. This section has loads of learning to code resources, but to start you will probably only need to look at the Python tutorial and Python reference documents.



Resources for Diversity in STEM

- <https://500queerscientists.com/>
- <https://astro-outlist.github.io/#outlist>
- <https://womeninengtech.ca/sector-resources/>
- <https://scwist.ca/resources/youth-resources/>
- <https://www.particlesforjustice.org/resources>
- <https://www.crrf-fcrr.ca/en/community-networks/network-of-anti-racism-organizations>

Resources to Learn Coding

- <https://www.learnpython.org/>
- <https://www.codecademy.com/catalog/language/python>
- <https://www.udemy.com/course/free-python/>
- <https://developers.google.com/edu/python/>

Resources to Learn More Astrophysics and Physics

- List of Resources & Prizes for High-school Students from the Canadian Association of Physicists:
<https://www.cap.ca/programs/resources-for-high-school-students-and-parents/>
- List of STEM activities, you can filter by many things such as grade:
<https://science.gsfc.nasa.gov/astrophysics/eduresources>
- This link has many resources for public lectures, activities, summer camps etc:
<https://www.kavlifoundation.org/astrophysics-0>
- List of astronomy activities: <https://mo-www.cfa.harvard.edu/OWN/projects.html>
- Free virtual planetarium, can be used in the browser or downloaded onto your computer:
<http://stellarium.org/>
- List of space activities : <http://stem-works.com/subjects/12-space/activities>
- Crash Course Astronomy:
https://www.youtube.com/watch?v=0rHUDWjR5gg&list=PL8dPuuaLjXtPAJr1ysd5yGIyiSFuh0mIL&ab_channel=CrashCourse

- PBS Space Time: https://www.youtube.com/channel/UC7_gcs09iThXybpVgjHZ_7g
- Everyday Astronaut: https://www.youtube.com/channel/UC6uKrU_WqJ1R2HMTY3Llx5Q
- Scott Manley: <https://www.youtube.com/channel/UCxzC4EngIsMrPmbm6Nxvb-A>
- Kurzgesagt: <https://www.youtube.com/channel/UCsXVk37bltHxD1rDPwtNM8Q>
- SciShow space: <https://www.youtube.com/channel/UCrMePiHCWG4Vwqv3t7W9EFg>
- MinutePhysics: <https://www.youtube.com/channel/UCUHW94eEFW7hkUMVaZz4eDg>
- The Vintage Space: https://www.youtube.com/channel/UCw95T_TgbGHhTml4xZ9yIqg

Resources of Formal Mentorship Opportunities in STEM

- Girls SySTEM: <https://www.girlsystemmentorship.com/>
- hEr VOLUTION: <https://www.hervolution.org/>
- SickKids summer mentorship program for high school students:
<http://www.sickkids.ca/Research/kidsscience/programs/mentorship/index.html>
- Science fairs across Canada with scientist mentors: <https://youthscience.ca/for-students/>
- STEM mentorship program for high school students:
<https://www.stemfellowship.org/receive-mentorship/>
- Sunnybrook summer mentorship program for high school students:
<https://sunnybrook.ca/research/content/?page=sri-ed-summ-ultra>
- TRIUMF high school programs (particle physics): <https://www.triumf.ca/for-public/high-school-programs>
- Perimeter Institute physics summer school for high school students:
<https://www.perimeterinstitute.ca/outreach/students/programs/international-summer-school-young-physicists>

Resources of Informal Ways to Access Mentorship in STEM

- If you live near a university, look into the research happening there. If something interests you, reach out to the professor leading that research to see if they have any opportunities for you – the worst that will happen is they will say no.
- Check out Citizen Science, a way for everyday citizens to get involved in awesome science:
<https://www.nationalgeographic.org/encyclopedia/citizen-science/>
- Lists of projects can be found at the following sites:
 - <https://www.nationalgeographic.org/idea/citizen-science-projects/>
 - <https://www.zooniverse.org/projects>
- Specific Citizen science projects
 - Galaxy Zoo: <https://www.zooniverse.org/projects/zookeeper/galaxy-zoo/>
 - List of astronomy citizen science projects:
<https://www.go-astronomy.com/citizen-science-astronomy.htm>
 - ATLAS citizen science project (particle physics): <https://atlas.cern/resources/education/citizen-science>
- Look for local science centres and observatories to see if they have any opportunities for jobs or internships so you can learn more.

Final Note

A lot of coding, even for professional programmers, is debugging your code, so don't get discouraged if your code isn't doing what you want it to do right away! Make up small projects for yourself, keep practicing, and in no time you will be proficient at coding.

