Introduction to Coding in Python

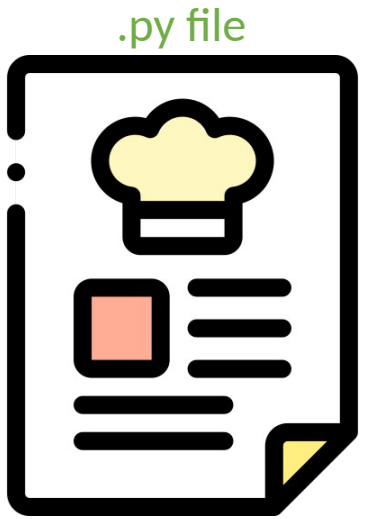
Dr. Sarah Groves

Setting up your computer for this class

- You should have:
  - Anaconda/miniconda installed (with Python interpreter)
  - VS Code installed (or an IDE you like)
  - Git/GitHub account
- Today we will add:
  - A folder location to organize your files (code files and data files for this class)
  - VS Code extensions:
    - Jupyter notebook extensions
    - Optional extensions: CSV viewer
  - Python packages needed for this class

How do coding tools fit together?

- Writing code ≠ running code
- Think of coding like running a **restaurant**
  - .py files
  - Jupyter notebooks
  - VS Code (IDE)
  - Python interpreter
  - Terminal/Command Prompt
  - Anaconda & environments
  - GitHub and git
- Your code = the recipe
  - It describes ingredients and steps, but a recipe does not cook itself!





Folder

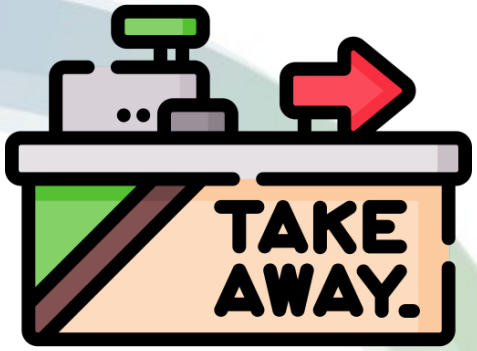
Organization: The recipe book

- Pick one location to make a folder for this class (Documents? UVA Box? Home?)
  - Each lab will have its own subfolder that we will put in this folder
  - Any extra data/files from Canvas should go here
- Think about what you want to name your files!
- You will open this folder every time you work on this class!



Python interpreter: The Chef

- The chef reads the recipe line by line and executes each instruction
- Different chefs exist:
  - Python 3.7
  - Python 3.9
  - Python 3.11 …
- Same recipe with different chef → slightly different outcomes!



Terminal & Command Prompt: The Order Counter

- The terminal is where orders are placed

```
python analysis.py
```

Means "Chef Python, make the analysis.py recipe"

- We can access the terminal through stand-alone apps (terminal, command prompt) or *within VS code*
  - Like different windows at the same order counter

The Restaurant: The Big Picture

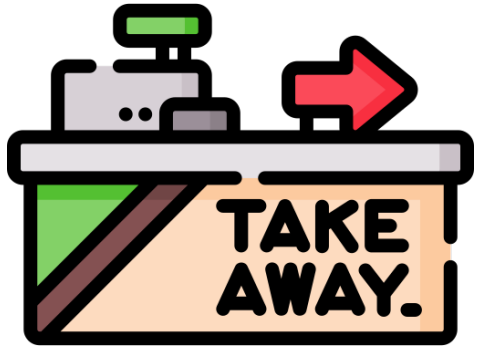
You write recipes (code)…



… and put them in a recipe book (folder)…



… which you can send to the order counter (terminal)…



I need an analysis.py, stat!

…which tells the chef (Python) what to cook

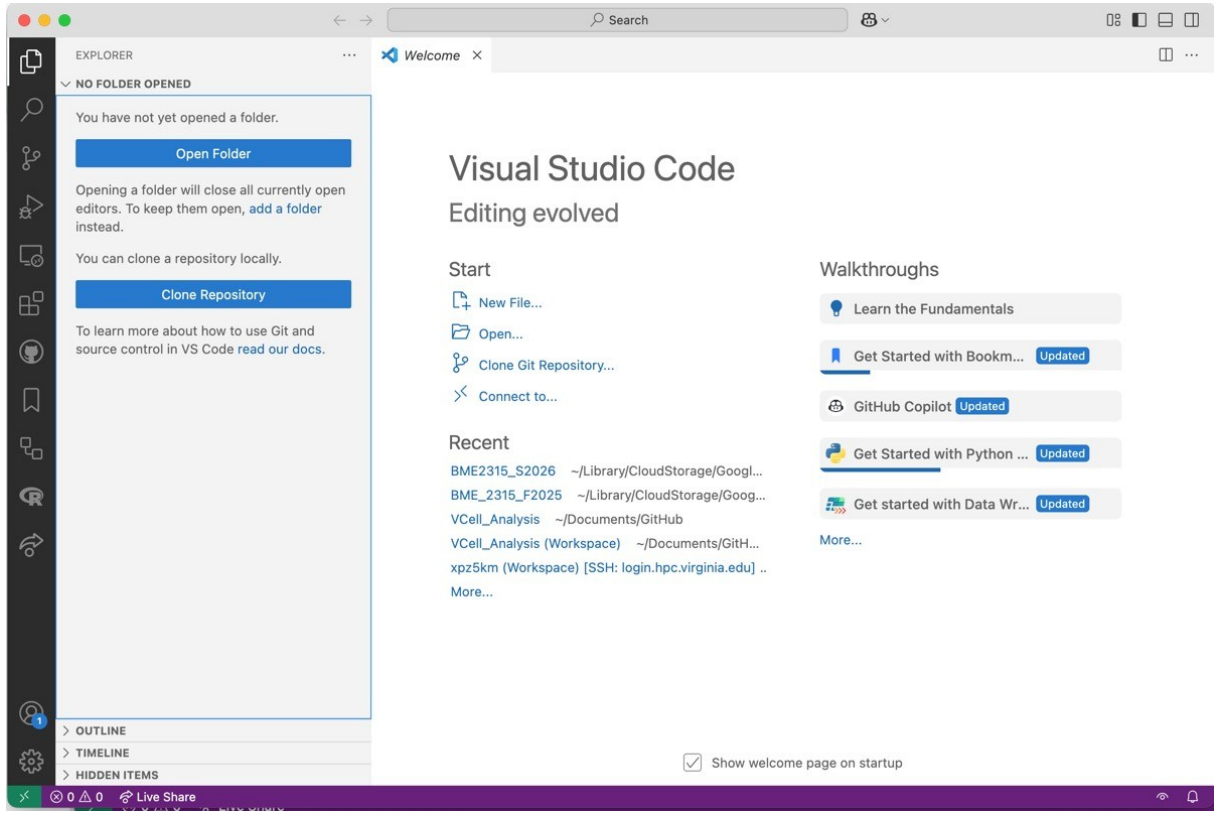


The Restaurant (VS Code)

All of this happens inside the restaurant, VS Code!

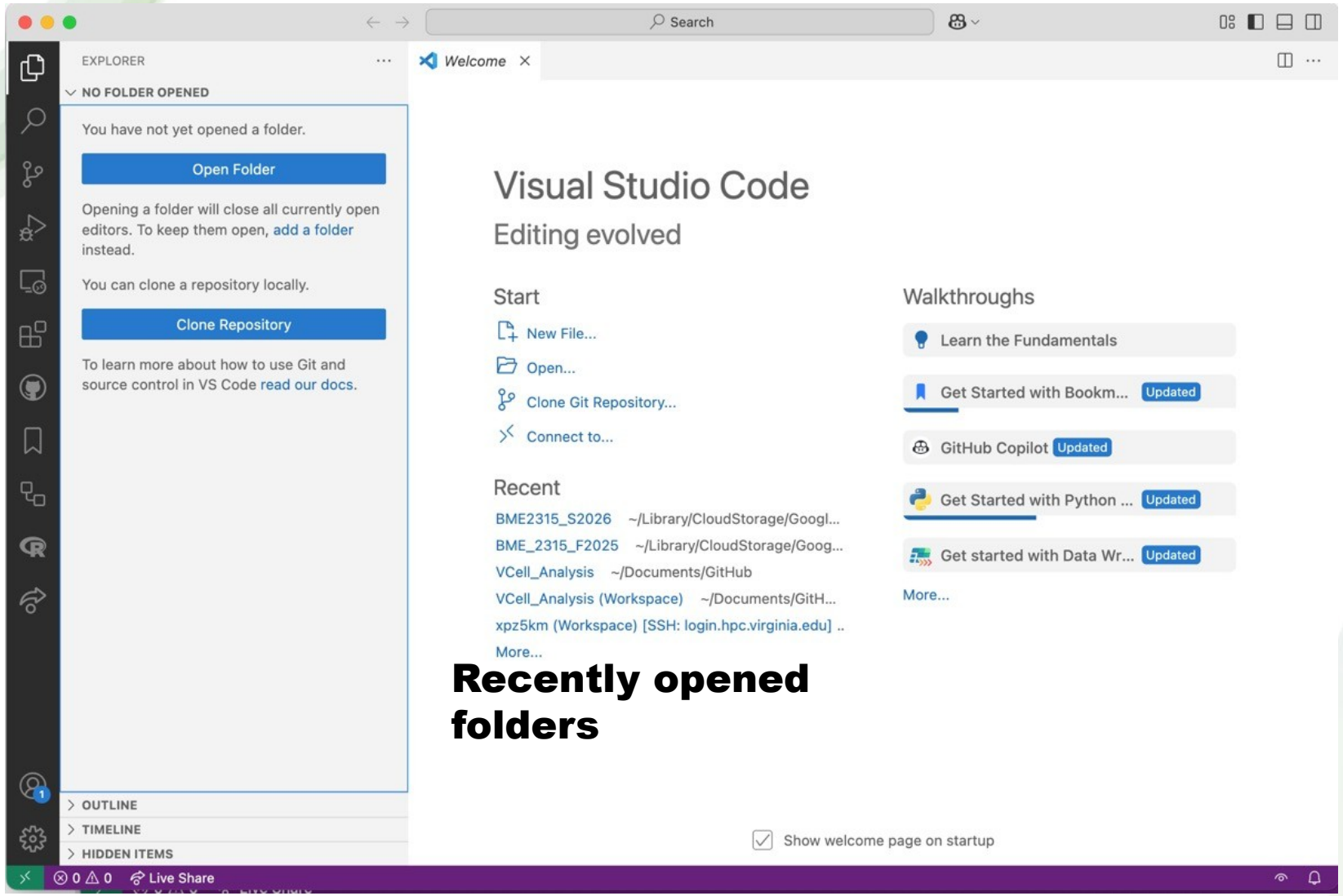
VS Code & Integrated Development Environments: The Restaurant

- VS code is a place to work on code (write recipes), view data files (peek in the kitchen), and run your code through a terminal (tell the chef what to cook)
- Integrated: many tools in one place
- Development: place to build code
- Environment: workspace



VS Code IDE

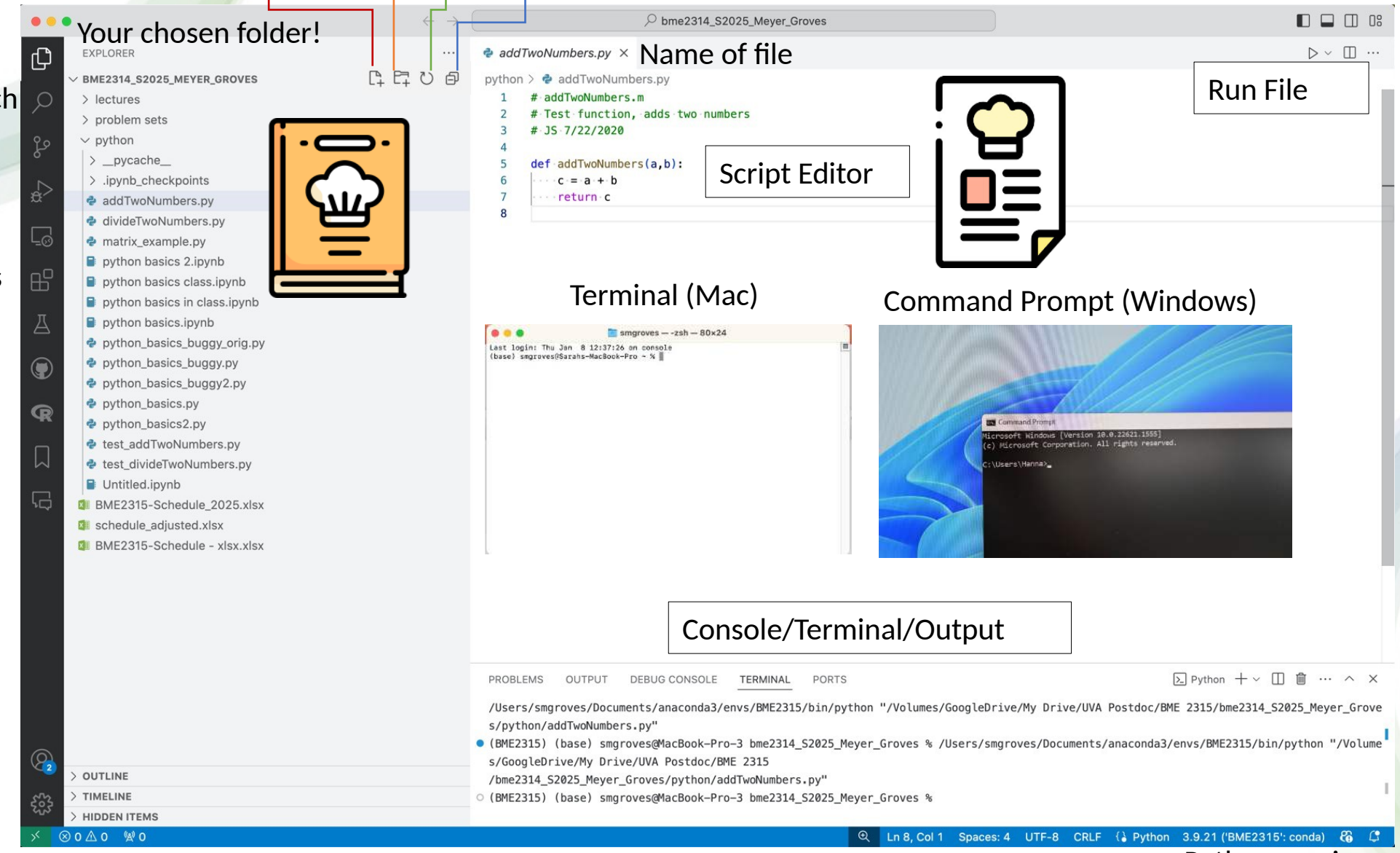
Welcome



Recently opened folders

Always start by opening your class folder from VS code!

VS Code IDE


Add a file
Add a folder
Refresh
Collapse all folders
Search or run a command
File Explorer
Search
Extensions
Your chosen folder!
Name of file
Run File
Script Editor
Terminal (Mac)
Command Prompt (Windows)
Console/Terminal/Output
Python version
EXPLORER
BME2314_S2025_MEYER_GROVES
lectures
problem sets
python
__pycache__
.ipynb_checkpoints
addTwoNumbers.py
divideTwoNumbers.py
matrix_example.py
python basics 2.ipynb
python basics class.ipynb
python basics in class.ipynb
python basics.ipynb
python_basics_buggy_orig.py
python_basics_buggy.py
python_basics_buggy2.py
python_basics.py
python_basics2.py
test_addTwoNumbers.py
test_divideTwoNumbers.py
Untitled.ipynb
BME2315-Schedule_2025.xlsx
schedule_adjusted.xlsx
BME2315-Schedule - xlsx.xlsx
OUTLINE
TIMELINE
HIDDEN ITEMS
bme2314_S2025_Meyer_Groves
addTwoNumbers.py
python > addTwoNumbers.py
# addTwoNumbers.m
# Test function, adds two numbers
# JS 7/22/2020
def addTwoNumbers(a,b):
c = a + b
return c
smgroves — -zsh — 80×24
Last login: Thu Jan 8 12:37:26 on console
(base) smgroves@Sarahs-MacBook-Pro ~ %
Command Prompt
Microsoft Windows [Version 10.0.22621.1555]
(c) Microsoft Corporation. All rights reserved.
C:\Users\Hanna>
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
PORTS
Python
/Users/smgroves/Documents/anaconda3/envs/BME2315/bin/python "/Volumes/GoogleDrive/My Drive/UVA Postdoc/BME 2315/bme2314_S2025_Meyer_Groves/python/addTwoNumbers.py"
(BME2315) (base) smgroves@MacBook-Pro-3 bme2314_S2025_Meyer_Groves % /Users/smgroves/Documents/anaconda3/envs/BME2315/bin/python "/Volumes/GoogleDrive/My Drive/UVA Postdoc/BME 2315
/bme2314_S2025_Meyer_Groves/python/addTwoNumbers.py"
(BME2315) (base) smgroves@MacBook-Pro-3 bme2314_S2025_Meyer_Groves %
Ln 8, Col 1
Spaces: 4
UTF-8
CRLF
Python
3.9.21 ('BME2315': conda)

Let’s practice!

STEPS 1-2 from Setup checklist

Make or choose a **folder location** for this class on your computer (NOT IN DOWNLOADS PLEASE).

Open **VS Code** (or another editor). If you have a PC + Anaconda, open VS code THROUGH **ANACONDA NAVIGATOR.**

Stand your name card up on its edge when you are done. Raise your hand for help!



Anaconda:
The supplier & pantry
Conda environments:
The kitchens

- Anaconda is the supplier that includes Python and scientific libraries
  - The package manager gives you a stocked pantry
- Conda environments = separate kitchens
  - The *base* environment is the default
  - You can make as many environments as you want. This is useful for organizing projects.
  - Each kitchen can have different chefs (Python versions) and different pantries
  - Ensures there are no “ingredient conflicts”
- VS code works in ***one kitchen at a time***

“This *special* package requires python 3.7”

`conda create …`



`conda activate …`

The Restaurant: The Big Picture



Anaconda supplies the ingredients…

…to different kitchens (environments)…

I need an analysis.py from the **blue** kitchen!

Orange kitchen, get me a statistics.py!

You write recipes (code)…



… and put them in a recipe book (folder)…



… which you can send to the order counter (terminal)…





…which tells the chef (Python) what to cook







…with different chefs (Python versions)…





The Restaurant (VS Code/IDE)

VS Code IDE



Command palette: Command/Control + Shift + P

Configures the right version of Python for the entire IDE

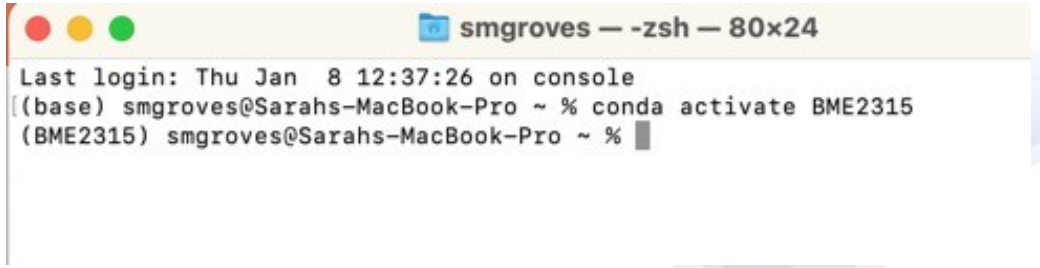
Do this once!

Terminal



The *base* env is already activated

I am activating a special env (BME2315)



“conda activate uu”
“source activate uu”

Configures the right version of Python for this **specific** terminal session

Do this when installing packages

Importing packages (adding food to the pantry)

- *conda* and *pip* are two major "warehouses"
  - Most python packages are hosted on Python Package Index (pypi) and can be installed with pip
  - Ensure the right conda environment is activated to add the package in the right location
  - If a package is not available through pip, try conda (or look at the install guide)

```
Last login: Thu Jan  8 13:59:41 on ttys002
(base) smgroves@Sarahs-MacBook-Pro ~ % conda activate BME2315
(BME2315) smgroves@Sarahs-MacBook-Pro ~ % pip install seaborn
Requirement already satisfied: seaborn in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-packages (0.13.2)
Requirement already satisfied: numpy!=1.24.0,>=1.20 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-pack
Requirement already satisfied: pandas>=1.2 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-packages (fro
Requirement already satisfied: matplotlib!=3.6.1,>=3.4 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-p
Requirement already satisfied: contourpy>=1.0.1 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-packages
Requirement already satisfied: cycler>=0.10 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-packages (fr
Requirement already satisfied: fonttools>=4.22.0 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-package
Requirement already satisfied: kiwisolver>=1.3.1 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-package
Requirement already satisfied: packaging>=20.0 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-packages
Requirement already satisfied: pillow>=8 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-packages (from
Requirement already satisfied: pyparsing>=2.3.1 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-packages
Requirement already satisfied: python-dateutil>=2.7 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-pack
Requirement already satisfied: importlib-resources>=3.2.0 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/sit
Requirement already satisfied: pytz>=2020.1 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-packages (fr
Requirement already satisfied: tzdata>=2022.7 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-packages (
Requirement already satisfied: zipp>=3.1.0 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-packages (fro
Requirement already satisfied: six>=1.5 in ./Documents/anaconda3/envs/BME2315/lib/python3.9/site-packages (from p
(BME2315) smgroves@Sarahs-MacBook-Pro ~ %
```

The Restaurant: The Big Picture



Anaconda

How could we share recipes with other restaurants?



Code



Local Folder



Terminal



Packages



Python







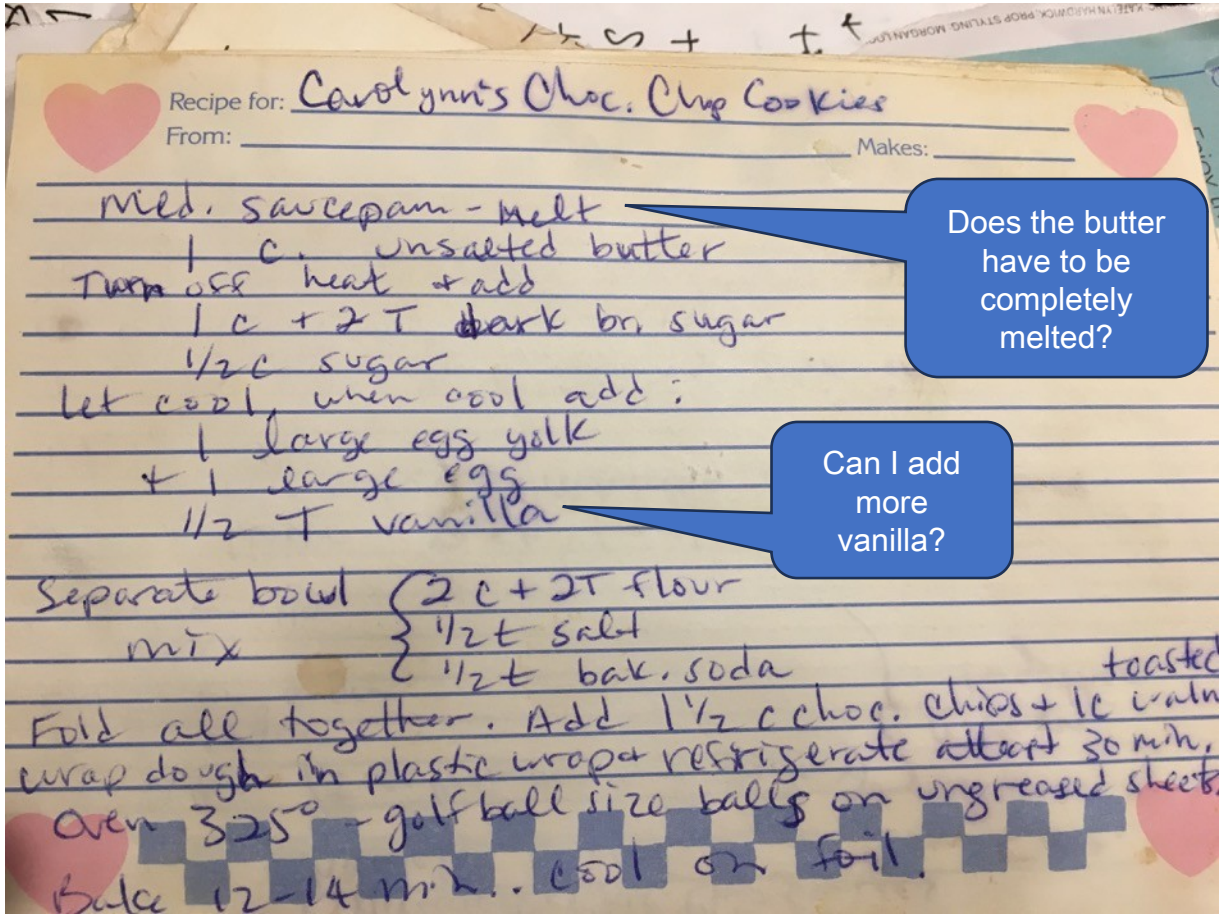


The Restaurant (VS Code/IDE)

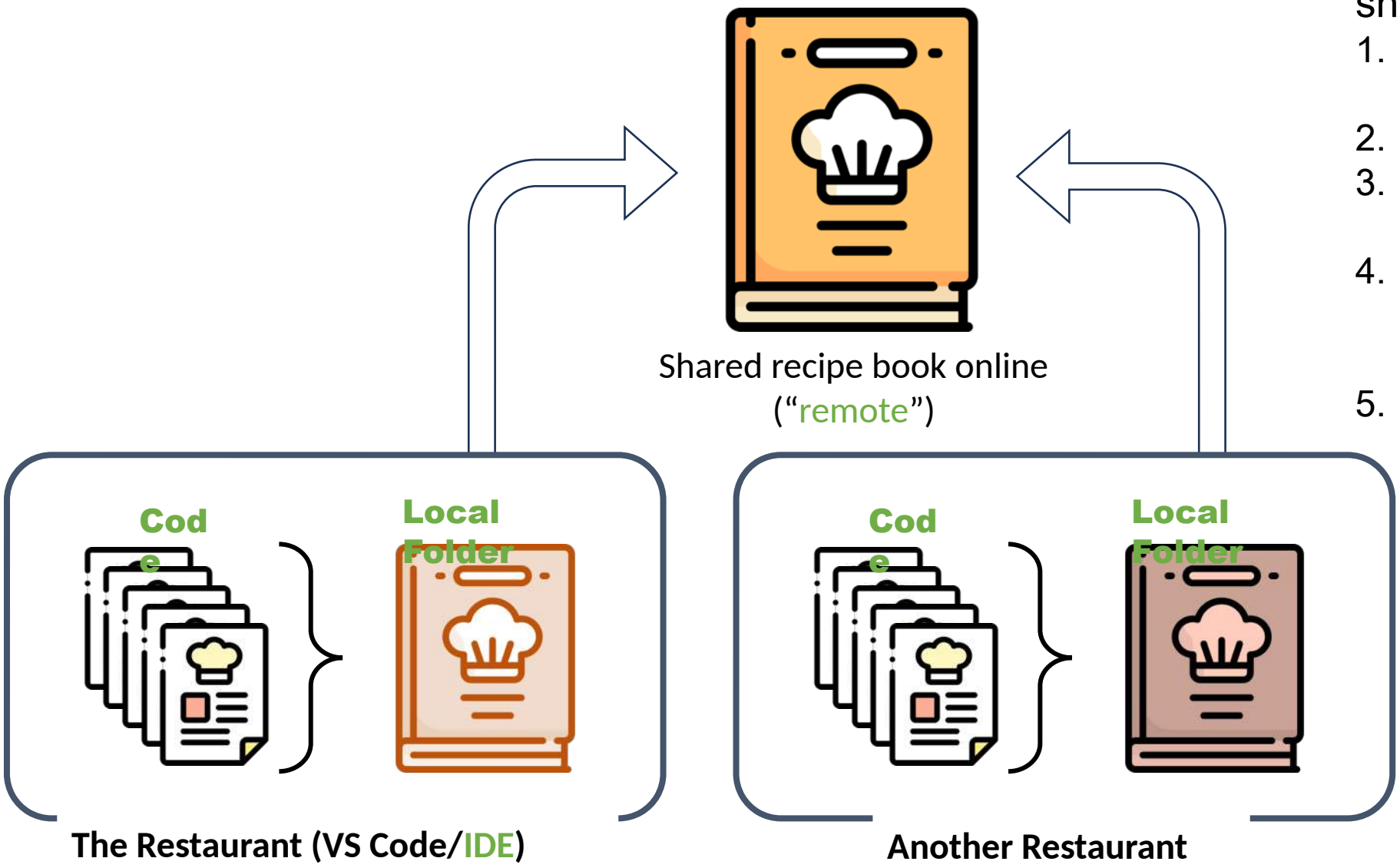
Conda

We could share recipes by…

- Telling them face to face
  - Good when you don't want to share a secret recipe
  - Bad for coding
- Handing them a copy or a picture
  - What if it's hard to read?
  - What if they want to update the recipe and send it back?
  - What if they want to see multiple iterations of the recipe (did they recipe-test?)
- Typing up the recipe and sending them the most recent version and past versions with notes about why things changed



Outside the restaurant: sharing recipes



How do we contribute to the shared recipe book online?

1. Get a local copy of the shared recipe book (“clone”)
2. Make changes (“commit”)
3. Add these changes back to the remote book (“push”)
4. Regularly check if anyone else made changes to the shared book (“pull”)
5. If someone made conflicting changes, figure out how to combine them (“merge”)

This is how GitHub works

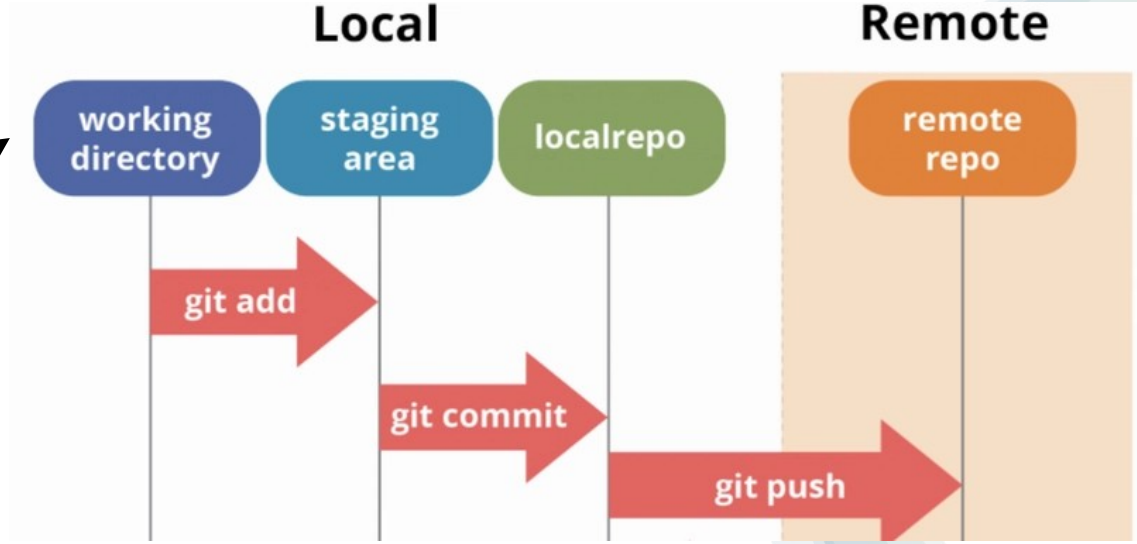
- Github hosts your code, git is the version control system
- In this class, we will use GitHub to **share code** (with partners and instructors), code **collaboratively**, and track **changes**

Remote, shared

GitHub

Local, individual

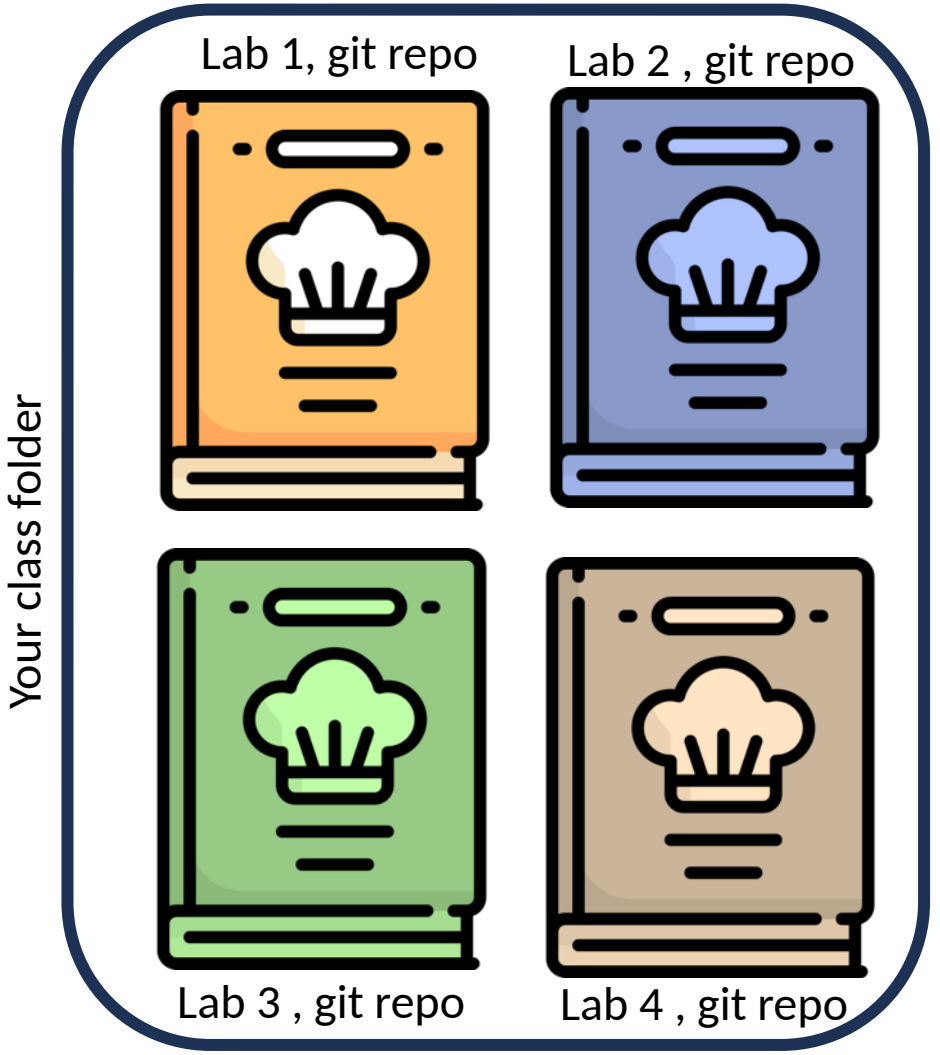
The “commit” process



https://livablesoftware.com/development-process-in-github-basic-infographic/

GitHub Repositories

- Entirely different recipe books
- In this class, I suggest using a different repository for each lab

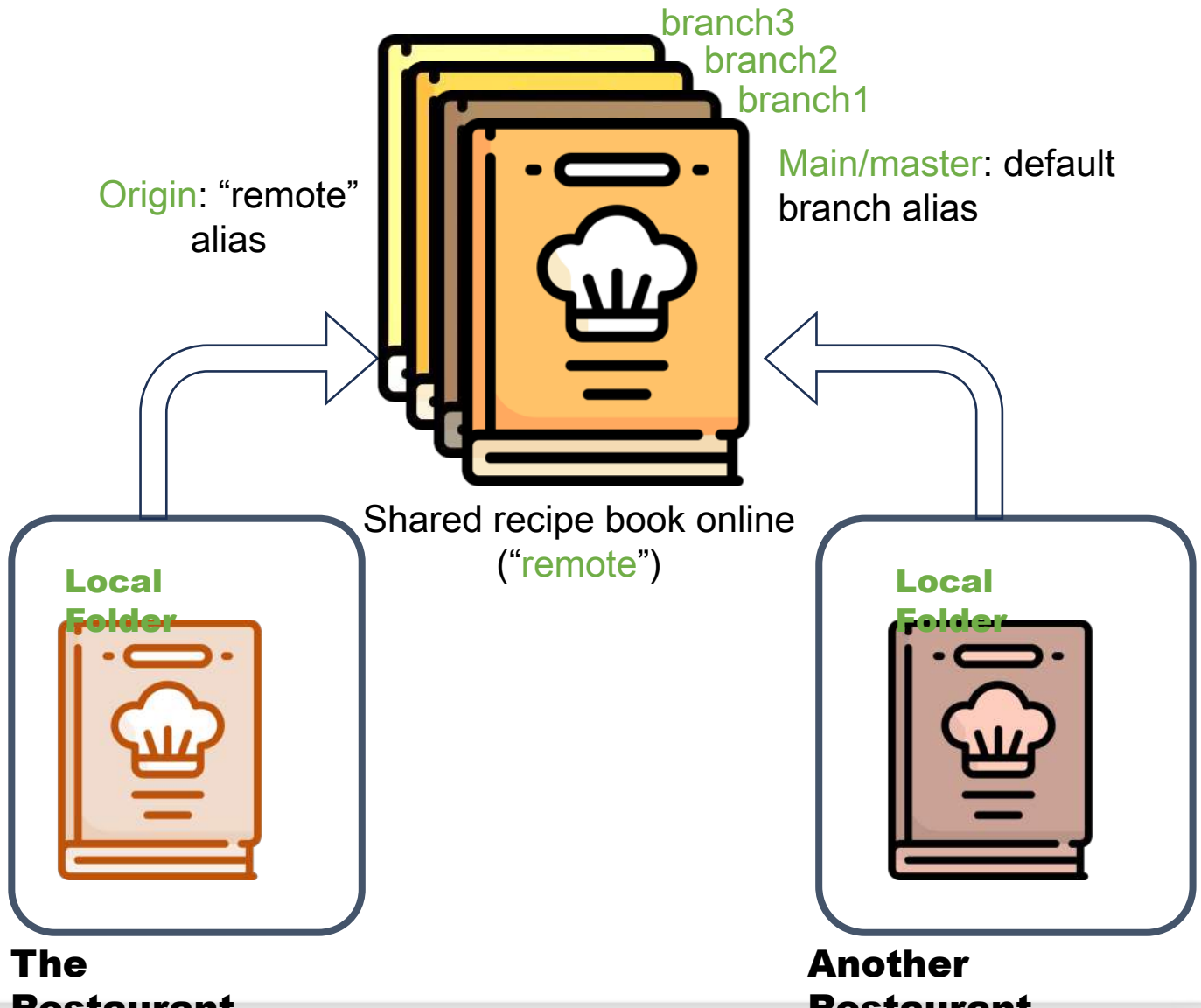


Do not NEST git repos!

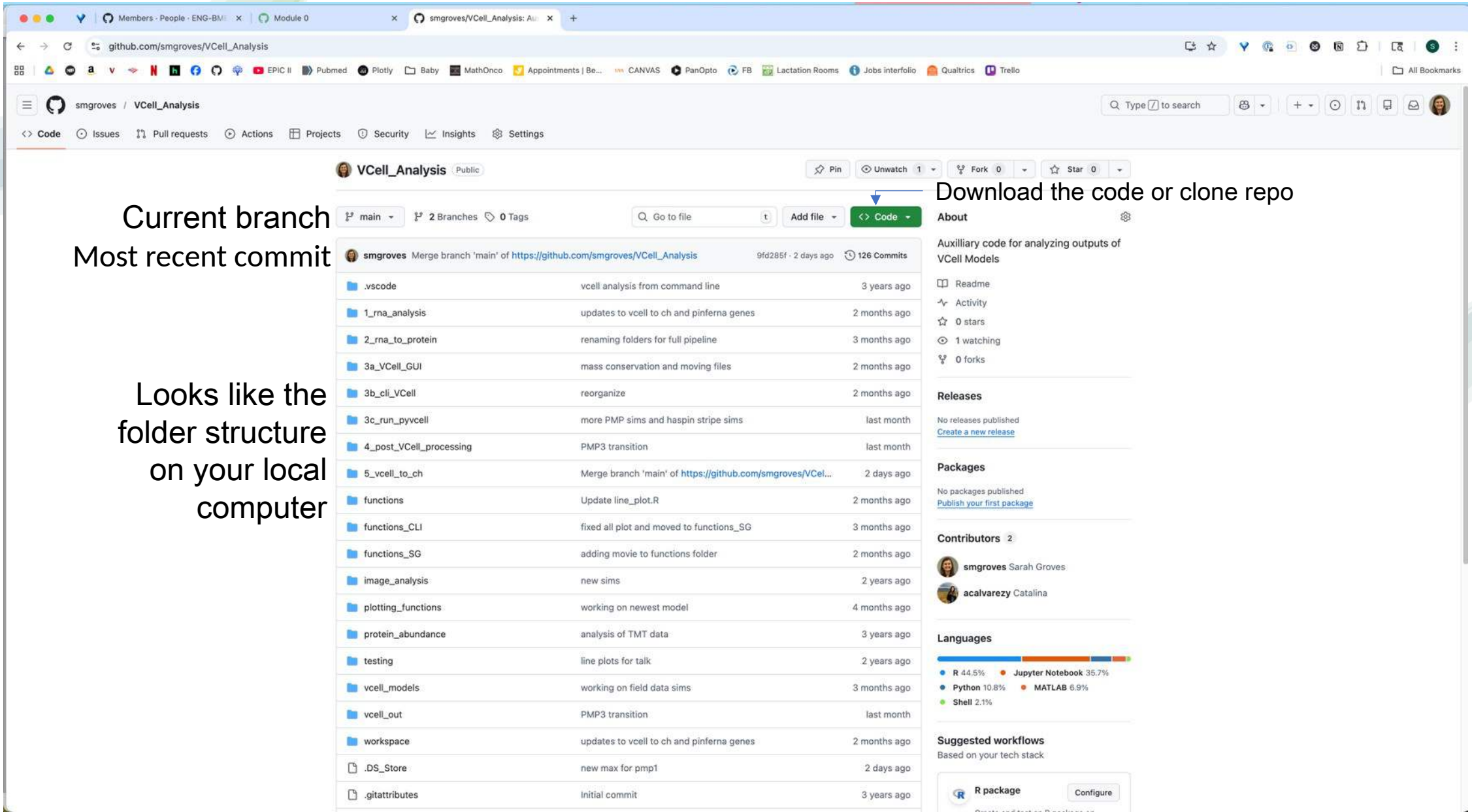
Do not git init your entire home directory

GitHub Branches

- Different remote versions of the same shared book
- In this class, we will use branches for individual work within a shared project (starting with Lab 1)



GitHub (remote, online)



LET'S PRACTICE! Getting set up with GitHub

Stand your name card on its edge when you are done.
Help your neighbors!
If you need a TA/instructor, raise your hand!

Complete Steps 3-7 in the checklist.

You will be forking my repo so that you have your own local copy AND your own remote copy. Then when you push/pull, you contribute to YOUR copy. But you can still pull from mine.

You should show completion of these steps before class on Thursday. That means you can complete the steps today and hand in the checklist at the end of class, meet with me before Thursday, or (if everything was successful) turn it in Thursday at the beginning of class.

On Friday/beyond: git init your own repo, add collaborators, and push and pull to your own repos

- You will pull content from the repo you are forking today
- I suggest making a new repo for each lab, add the appropriate content, and share with peers