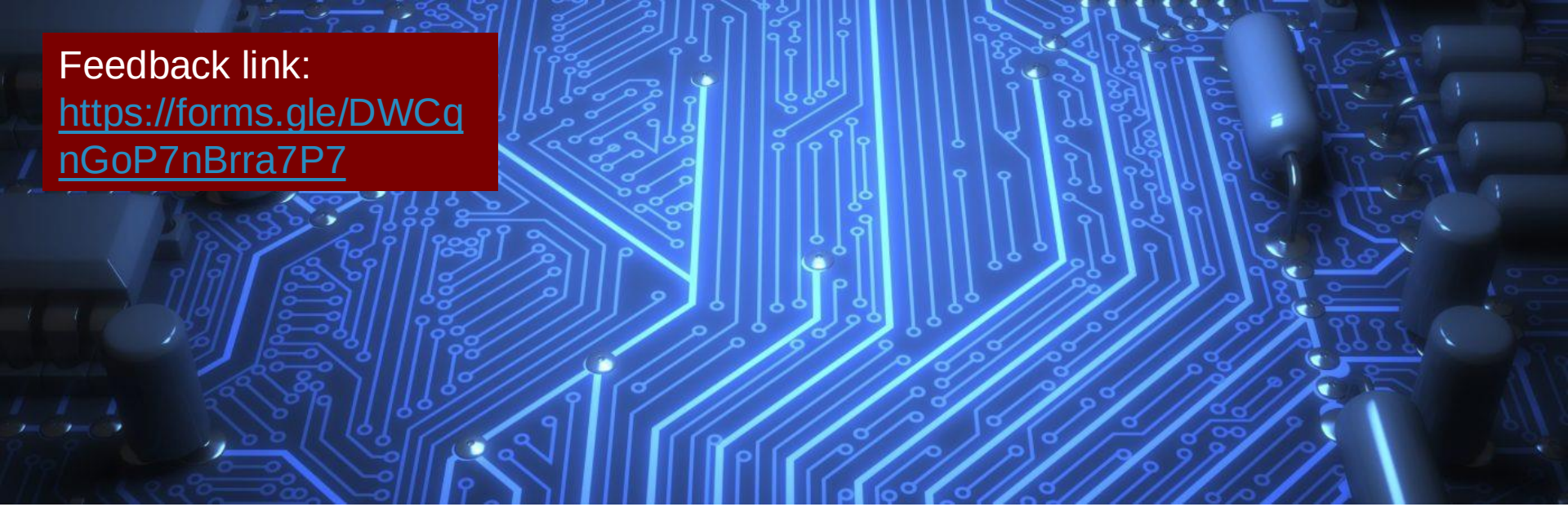


Feedback link:
https://forms.gle/DWCqnGoP7nBrra7P7

TERMINAL, GIT/GITHUB, LATEX/ZOTERO

MIT MANAGEMENT SLOAN SCHOOL

OPERATIONS RESEARCH CENTER

IAP 15.S60 Session 1
Lisa Everest

Today's Learning Objectives

- Describe the importance of reproducibility in coding projects
- Enter basic commands in terminal to navigate a file system, manipulate files, and run scripts
- Maintain proper version control for a coding project using git
- Collaborate on a coding project with Github
- Share your research work and maintain bibliographies through Latex and Zotero

Agenda

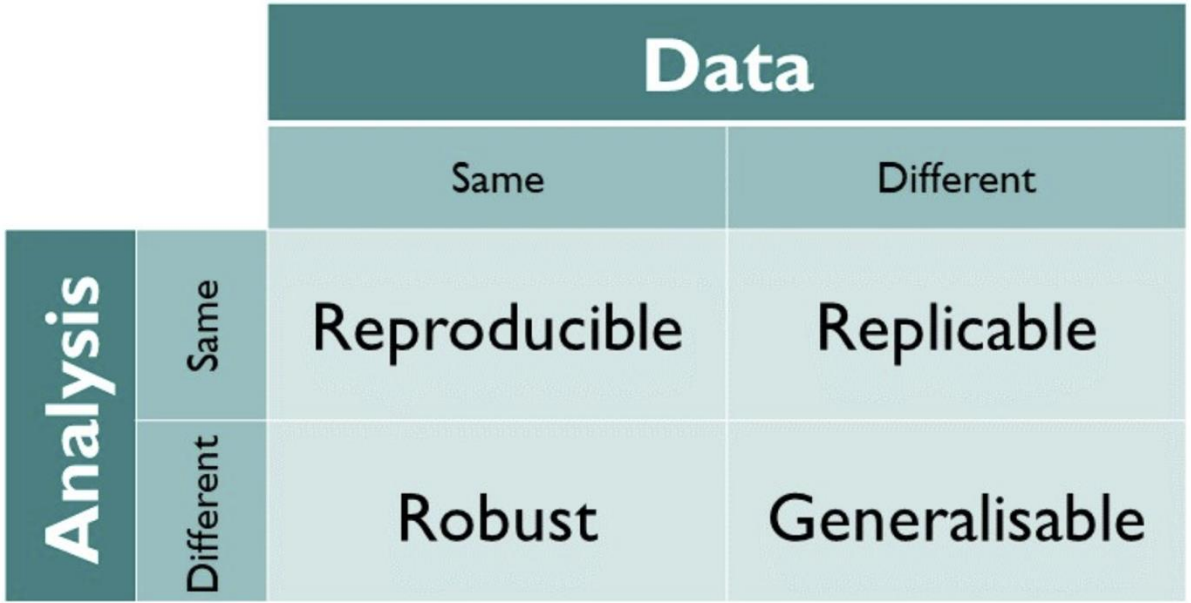
- Reproducibility and Terminal (30 mins)
- Git (1 hr)
- Break
- Github (1 hr)
- LaTeX and Zotero (30 mins)

Reproducibility

Motivation for today's class
Adapted from slides by Sam Gilmour and the Turing Way

What is reproducibility?

"The ability to obtain consistent results no matter the machine a project runs on."



One possible reproducibility nightmare

- Imagine you created a new optimization model and algorithm for a problem and ran many computational experiments without keeping in mind reproducibility.
- Months later, you finish writing your paper on it and stumble upon on a new model that was wayyyyy better and faster. Welp… **Time to re-run everything!**
  - Spend a day trying to get code set up to run again
  - But new results didn't match up with original results
  - Eventually, you track down a single parameter that had changed
  - Change the parameter and re-run everything again
  - Would take **weeks of work** and huge amounts of **cluster resources**

What is reproducibility good for?

Tools for reproducibility

- **Version control** – maintain a history of your project to better track changes and decisions
- **Testing** – simple tests to detect errors and changes in functionality when new features are added
- **Maintaining a reproducible computational environment** – for example, software and package versions
- Making code and data **open and available** when possible

Tools for Reproducible Research

Git - Version control system

- Command line tool
- Used to make and document local code changes (and communicate those changes with Github)

Github - Hosting platform for version control and collaboration

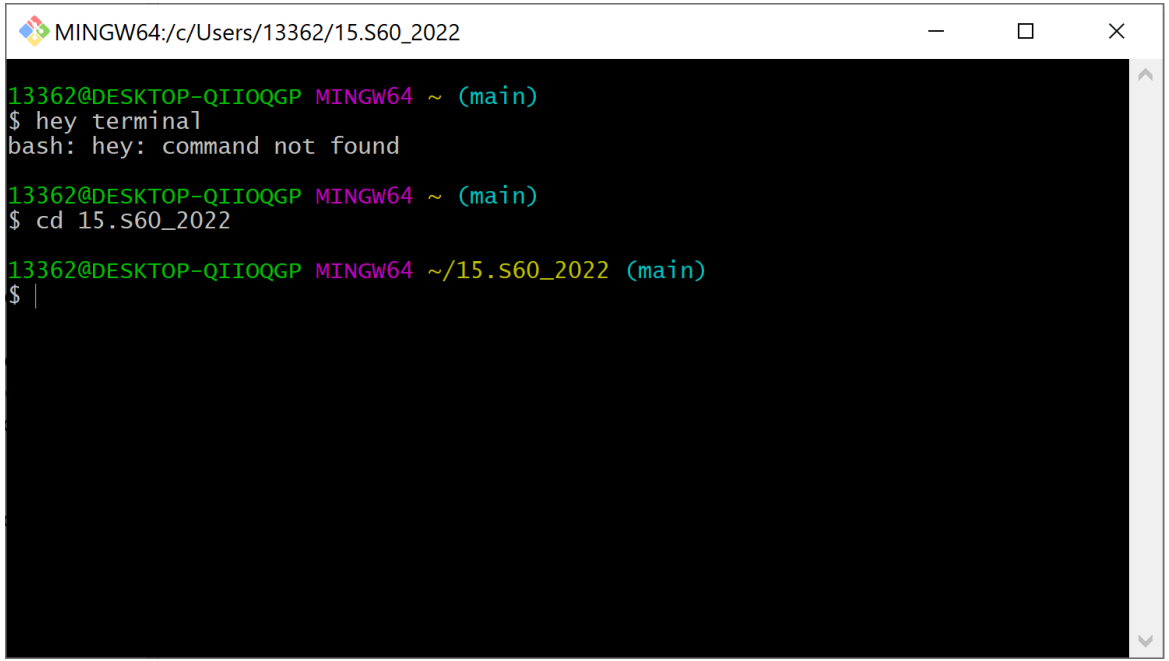
- Widely used by developers to store their projects
- Easily share code and data, privately and publicly

Terminal

Adapted from slides by Galit Lukin, Jackie Baek

What is the terminal?

The terminal/Unix shell is a text-based interface to interact with the computer.



Why use the terminal?

Repetitive tasks, like “delete all files in a directory ending in .csv”

Chain commands across programming languages sequentially

Athena

MIT MANAGEMENT SLOAN SCHOOL Engaging

Access to client servers and computing clusters with Secure Shell (SSH)

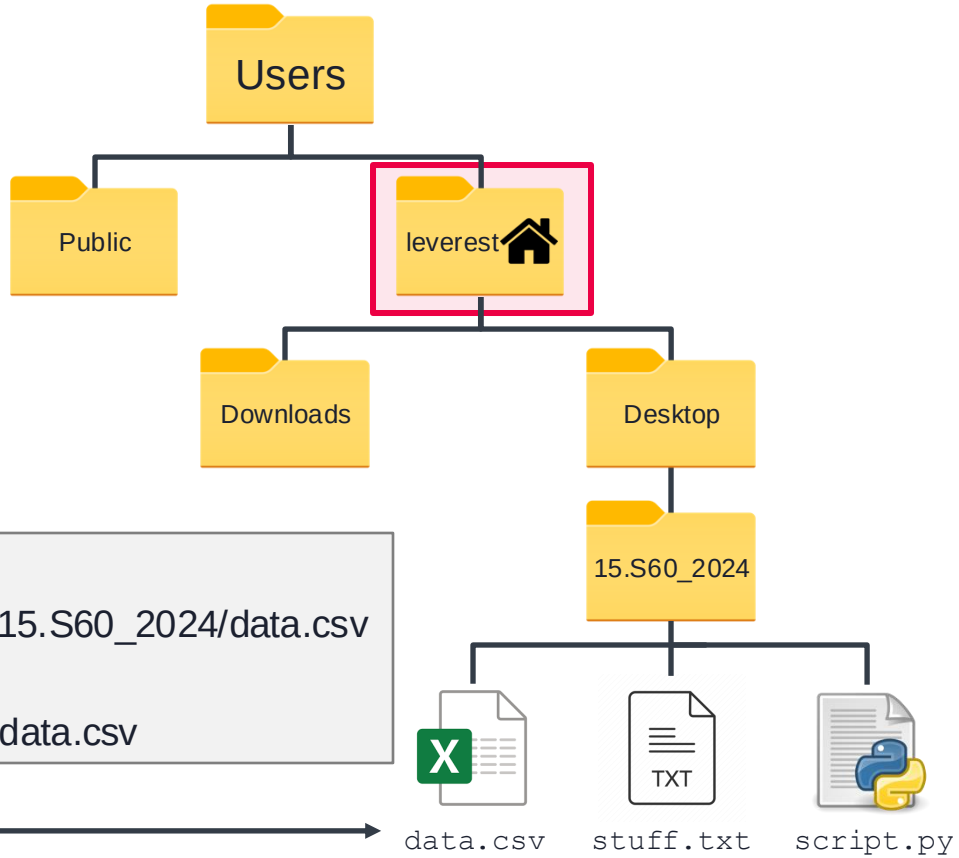
We must learn a few basic commands to interact!

Learning Objectives - Terminal

At the end of the session, students will be able to…

- Navigate directories and manipulate files using terminal commands
- Recognize scenarios when it is necessary or more efficient use the terminal rather than a graphical interface

Files and Directories



Working directory

Absolute path:
/Users/leverest/Desktop/15.S60_2024/data.csv
Relative path:
Desktop/15.S60_2024/data.csv

Terminal Basics

- We are using a shell called **bash.** This program will interpret and process the commands you input into the terminal.
- A typical command looks like:

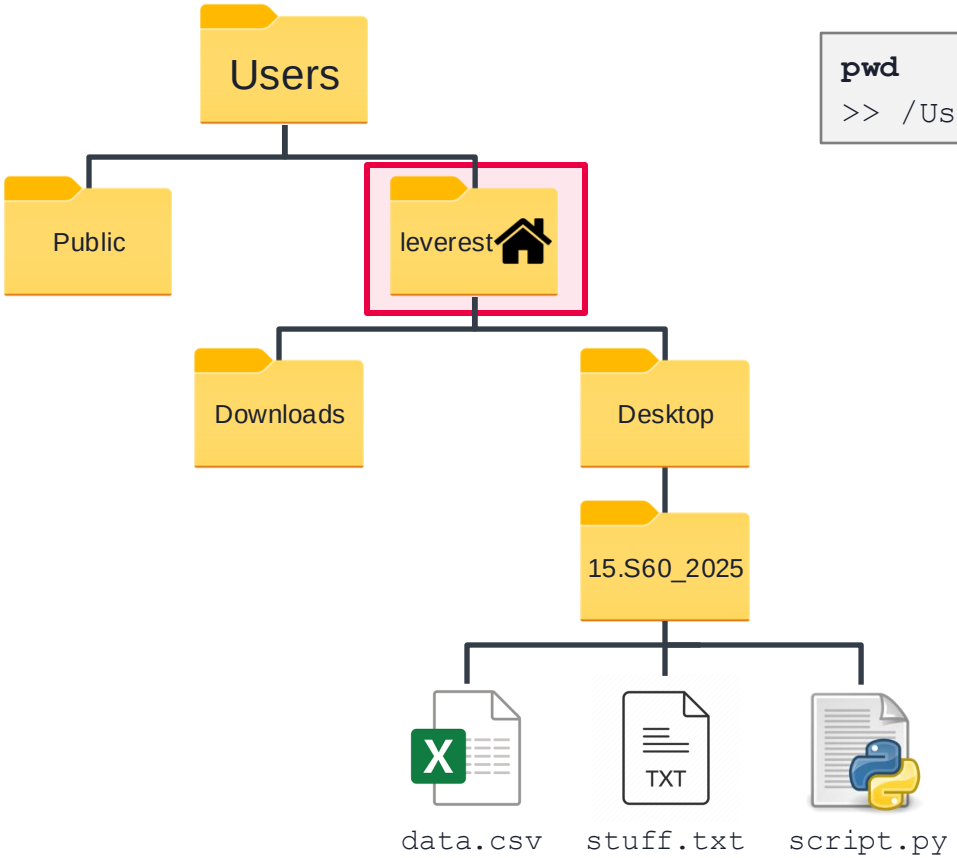
```
command <argument1> <argument2> …
```

To open:

- Mac users open Terminal
- Windows users open Git Bash (installed in the pre-assignment)

Navigating – Commands

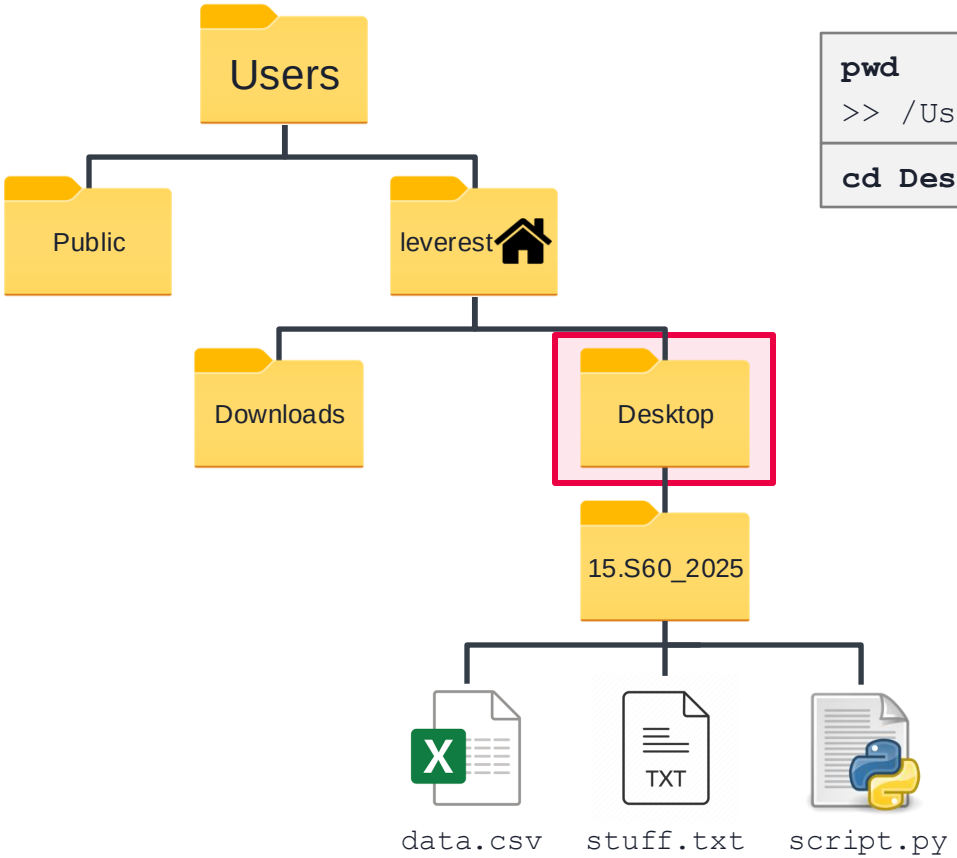
Working directory




```
pwd
>> /Users/leverest
```

Navigating – Commands

Working directory

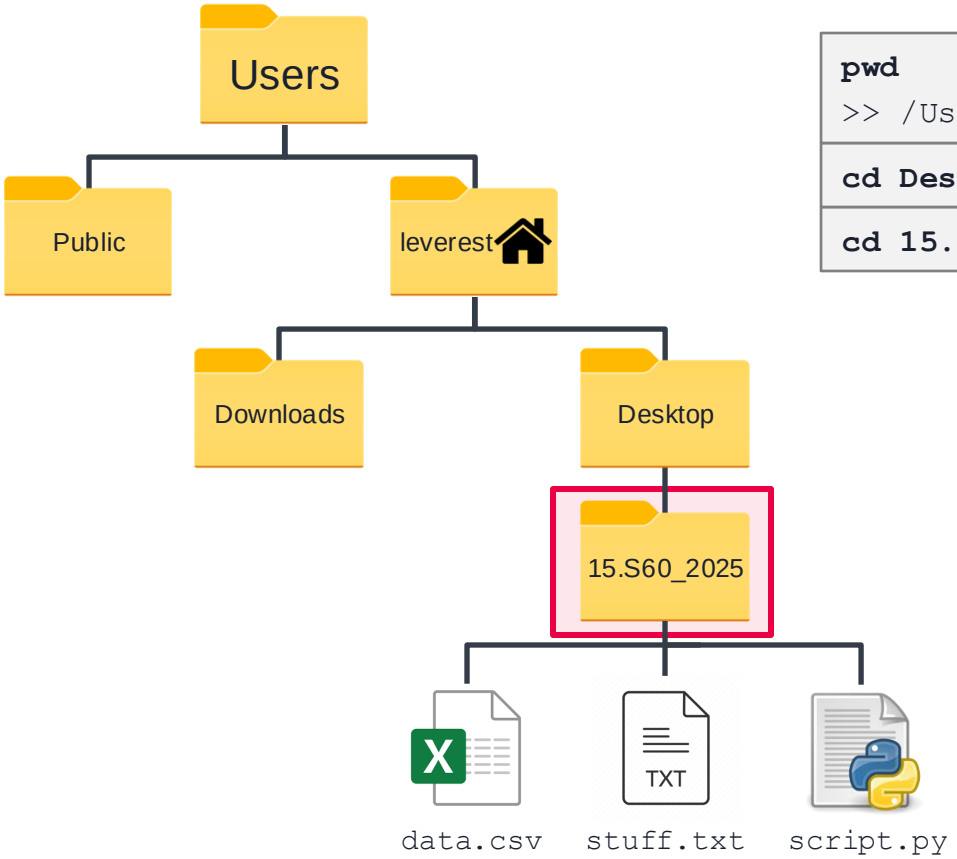



```
pwd
>> /Users/leverest
```

```
cd Desktop
```

Navigating – Commands

Working directory



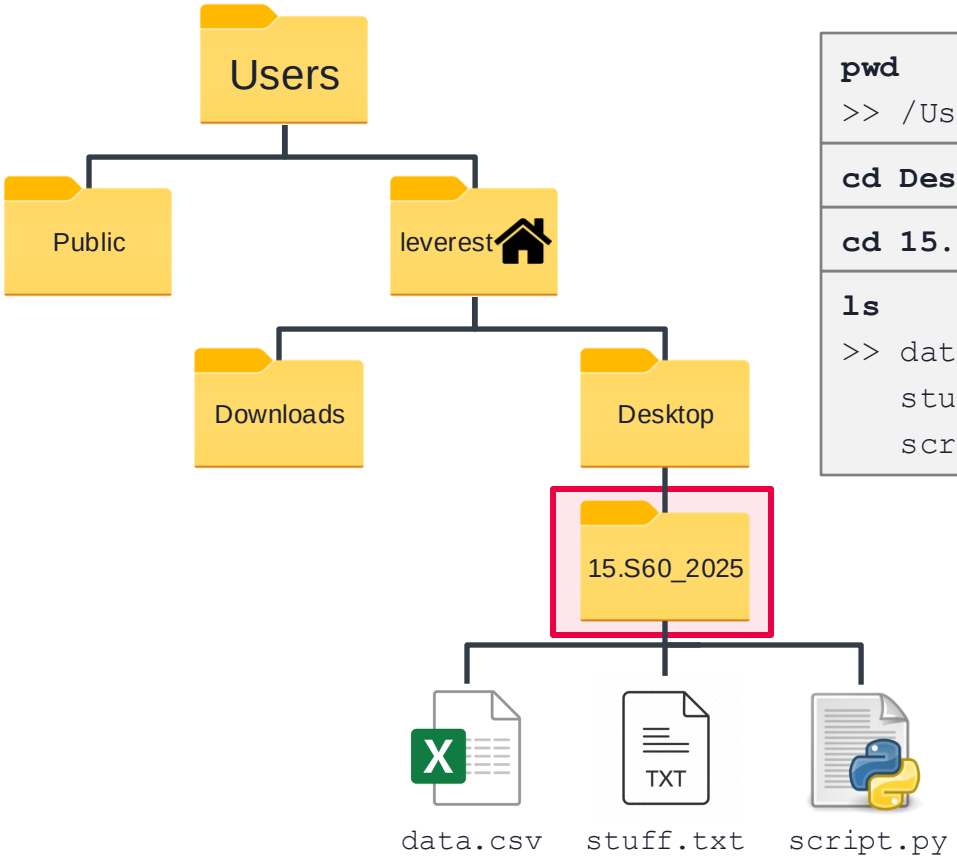

```
pwd
>> /Users/leverest
```

```
cd Desktop
```

```
cd 15.S60_2025
```

Navigating – Commands

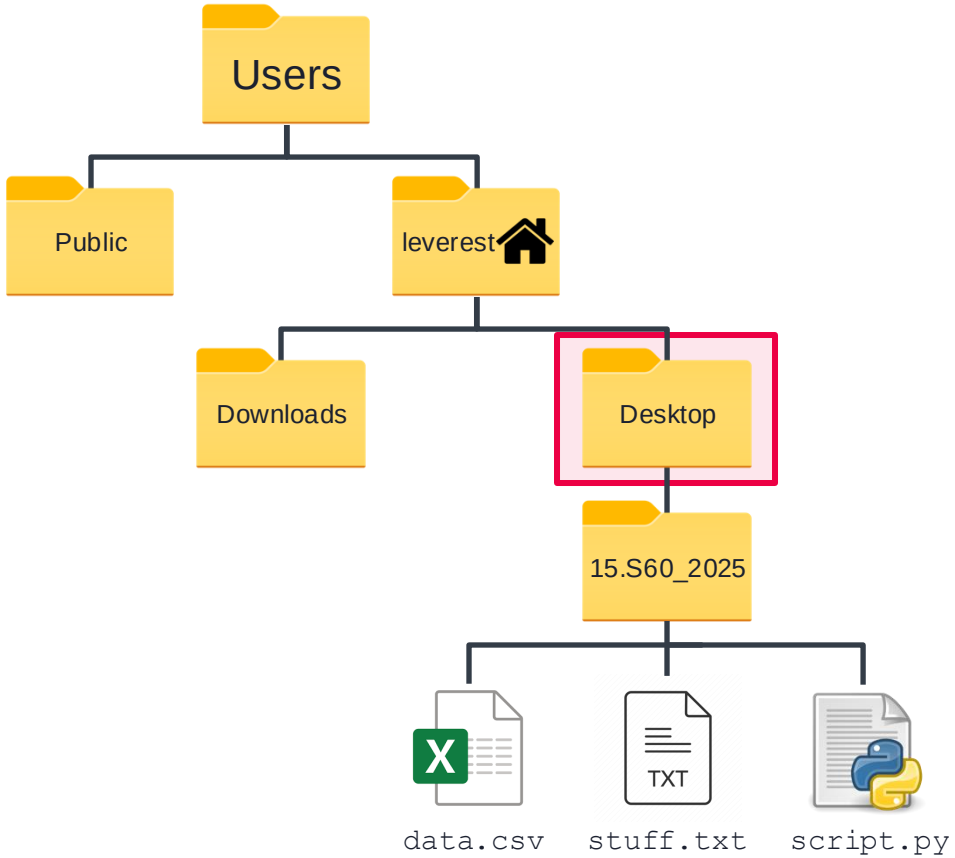
Working directory




```
pwd
>> /Users/leverest

cd Desktop

cd 15.S60_2025

ls
>> data.csv
   stuff.txt
   script.py
```

Navigating – Commands

Working directory



("Up" or "back" one level)

```
cd ..
```

Navigating – Commands

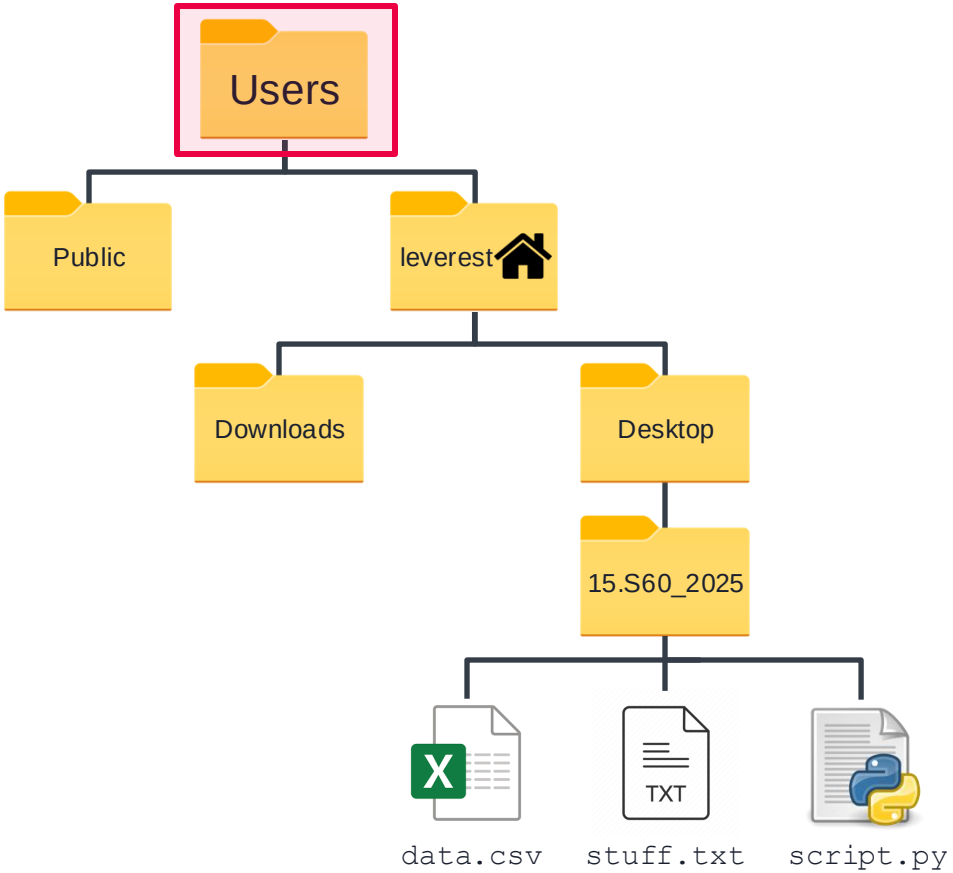
Working directory

(“Up” or “back” two levels)

```
cd ../..
```

(“Up” or “back” one level)

```
cd ..
```



Navigating – Commands

Working directory

(Back to home directory)

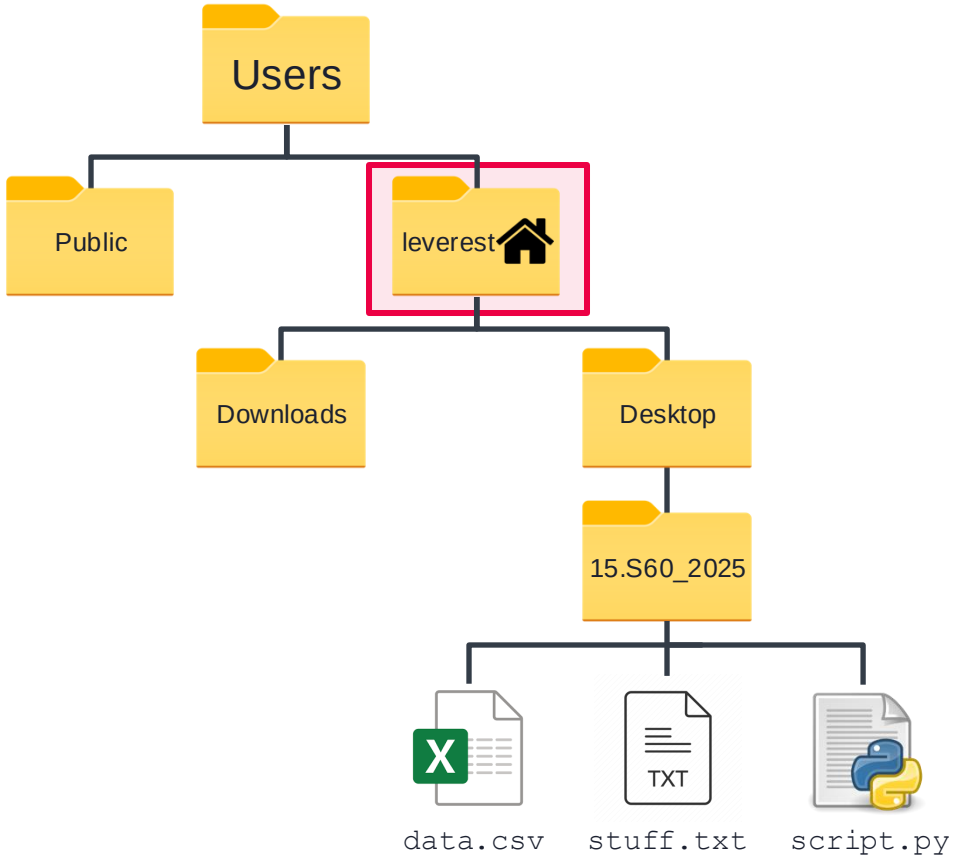
```
cd
```

(“Up” or “back” two levels)

```
cd ../..
```

(“Up” or “back” one level)

```
cd ..
```



Navigating – Commands

Print working directory	`pwd`
List contents of working directory	`ls`
List contents of specified directory	`ls <directory_name>`
Change to a new directory	`cd <directory_name>`
Return to “home” directory	`cd`
Open a file (analogous to double clicking)	`open <filename>`

Navigating – Commands 2

Reference current working directory	.
Reference parent of current working directory	. .
Reference home directory	~

- Navigate history of previous commands using up and down arrow keys
- Use tab to autocomplete commands and paths

File Manipulation – Commands

Create a new directory	`mkdir <directory_name>`
Create a new file	`touch <filename>`
Delete a file **(cannot be undone!)**	`rm <filename>`
Delete a directory **(cannot be undone!)**	`rm -r <directory_name>`
Edit file contents (Nano, vim are text editors)	`nano <filename>` `vim <filename>`
Print contents of a file	`cat <filename>`
Move or rename a file	`mv <source_filename> <target_filename>`

Demo – Navigation

1. Open Terminal (MacOS) or Git Bash (Windows)
2. Navigate to the class directory from the pre-assignment

```
cd 15.S60_2025
```

3. Pull the class Github to get any updates

```
git pull
```

4. Navigate to the class directory from the pre-assignment

```
cd 1_terminal_and_git
```

5. Print off the list of files in that directory

```
ls
```

6. Navigate back to your home directory

`cd` or `cd ~` or `cd ../..`

File Manipulation – Demo

We want to create a new directory called `mydirectory`, navigate to it, add a new file called `myfile.txt`, then add a line of text to the file.

1. Create and navigate to a new directory

```
mkdir mydirectory
cd mydirectory
```

2. Add and open a new file for editing

```
touch myfile.txt
nano myfile.txt
```

OR

```
vim myfile.txt
```

3. Add some text

Save (Ctrl+O), and exit Nano (Ctrl+X)

OR

Command interface (Esc), and save and exit (:wq)

Redirecting Outputs

Run a script

Send the output log to a file

(rather than the terminal)

```
python processStuff.py > outputfile.txt
```

Redirecting Outputs

Run a script

Send the output log to a file

(rather than the terminal)

Overwrite / create file

```
<command> > outputfile.txt
```

Append to file

```
<command> >> outputfile.txt
```

Redirecting Outputs - Demo

I can create a Julia script in `mydirectory` called `myscript.py`. I can then run it and direct the output to a file called `scriptoutput.txt`.

1. Create new text file

```
vim myscript.py
```

2. Print the contents of the directory and redirect the output

```
python myscript.py > scriptoutput.txt
```

3. Check the output:

```
cat scriptoutput.txt
```

Redirecting Outputs - Try it out

Create another text file in `mydirectory` called `newfile.txt`. Print the contents of `mydirectory` and direct the list to a file called `outputfile.txt`.

1. Print the contents of the directory and redirect the output

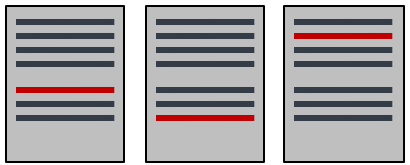
```
ls > outputfile.txt
```

2. Check the output:

```
cat outputfile.txt
```

More Terminal

There are many more things you can do in Terminal.



Simple pattern matching to find and sort files

`readdata.py` `makeplots.R`

Use multiple programming languages to run sequential processes

Shell scripts to automate chains of commands you use often

If you're interested, check out the tutorial here: https://swcarpentry.github.io/shell-novice/

Git

Adapted from slides by Galit Lukin and Jackie Baek
with activities from Turing Way and Software Carpentry

Learning Objectives – Git/Github

At the end of the session, students will be able to:

- Maintain a version control history with appropriate documentation
- Contribute to a project with shared code
- Share and contribute code to the broader community

Git and Github

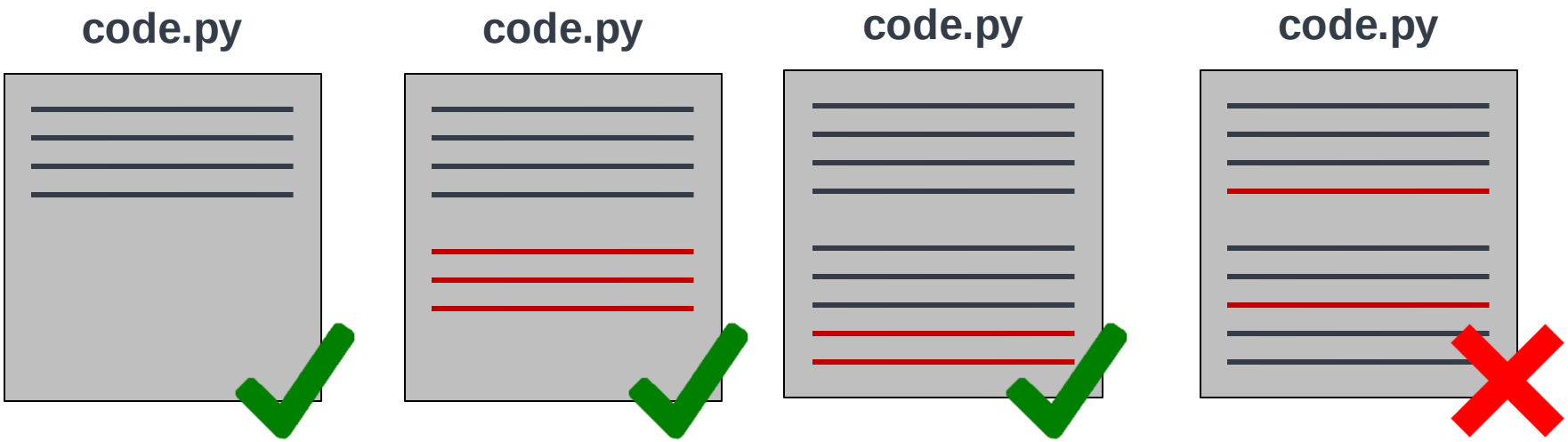
Github - Hosting platform for version control and collaboration

- Widely used by developers to store their projects
- Easily share code and data, privately and publicly

Git - The version control system itself

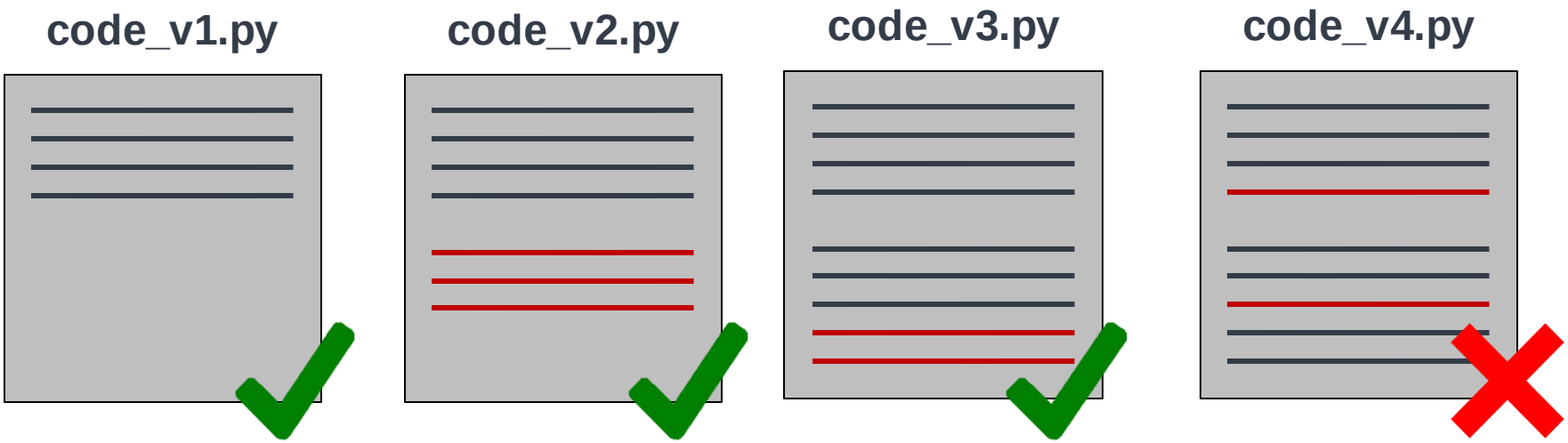
- Command line tool
- Used to make local code changes and communicate those changes with Github

Why use version control (Git)?



If only I could go back to a version that was working…

Why use version control (Git)?



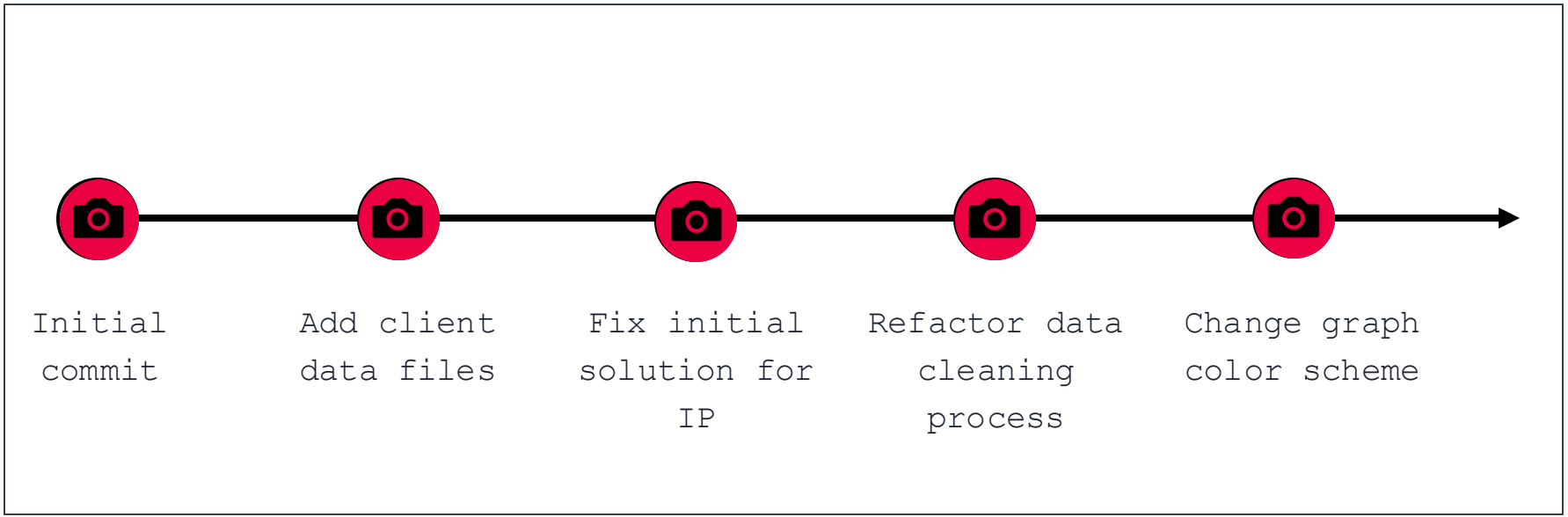
What changed between versions? Which version to go back to? What if it's been months since I worked on this? What if my project has many files?

High-Level Idea

repository (aka repo)

Benefits:

- Snapshot of entire repo, not one file
- Git stores commit messages
- Commits are lightweight
- Can go back to previous commits



Create a repository - Commands

1. Create a new directory for your repo

```
mkdir <directory_name>
```

---

2. Navigate to the directory

```
cd <directory_name>
```

---

3. Initialize repository (you only need to do this once for each repo you create)

```
git init
```

Initialize a Git Repo - Demo

Let's turn `mydirectory` into a git repo.

1. Navigate to a `mydirectory` if you aren't already there

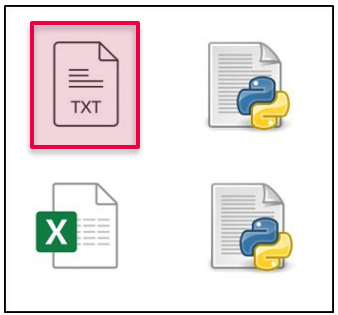
```
cd mydirectory
```

2. Initialize the git repo

```
git init
```

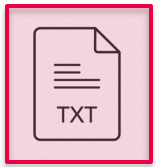
Add and commit

working directory



Local repository, plus your local changes

staging area

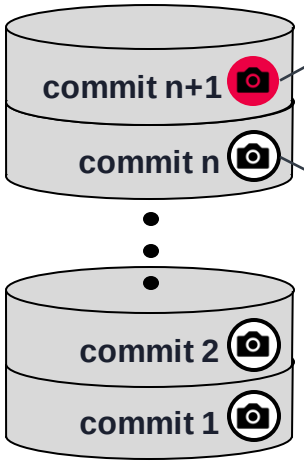


Your local changes that you want to get "permanently" added to local repository

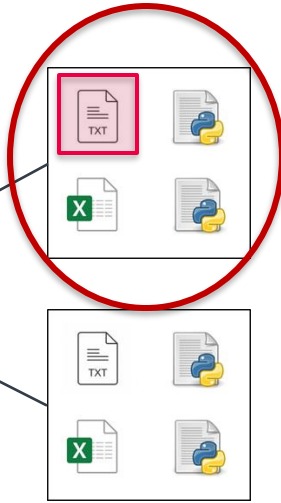
git add

git commit

local repository



newly-updated local repository



Add and commit - Commands

1. Make changes in working directory

---

2. Check the files in the staging area and any “untracked” changes (not yet added)

```
git status
```

---

3. As you change files:
working directory → staging area

```
git add <filename>
```

```
git add .
```
(adds all files)

---

4. Once you have added a new functionality/completed an update:
staging area → local repo

```
git commit –m “comment”
```

Add a short, intuitive comment describing the change in functionality
→ For reference later!

Question

In your opinion, which would be the most helpful commit message three months from now? **(somewhat subjective!)**

A.) `"Fix bug"`

B.) `"Add functions: cleanData, processData, runPredictions"`

C.) `"Add function to plot model results"`

D.) `"Write latest optimization model"`

Add and commit - Demo

Let's commit something to `mydirectory`! Run `git status` between each step to see the staging area.

1. Check the current status

```
git status
```

2. Add the file to the staging area

```
git add newfile.txt
git status
```

3. Commit the changes to the repository

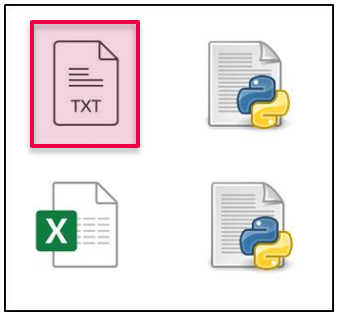
```
git commit -m "Add empty file"
git status
```

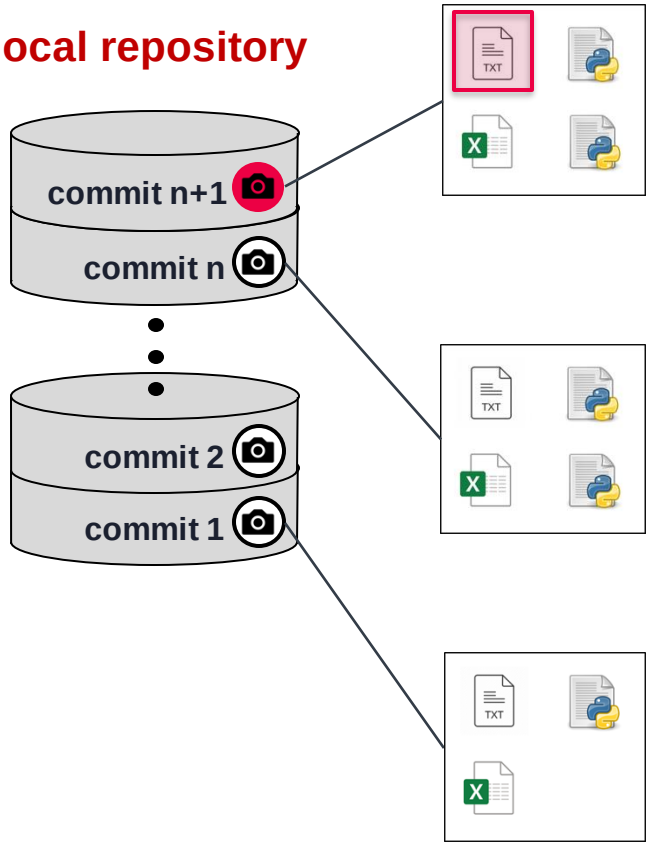
Reverting Changes

working directory

staging area

local repository

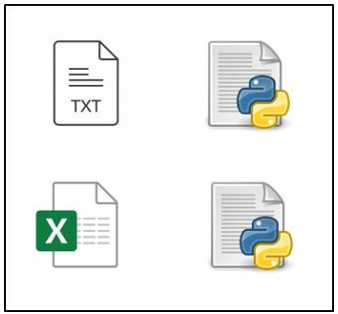


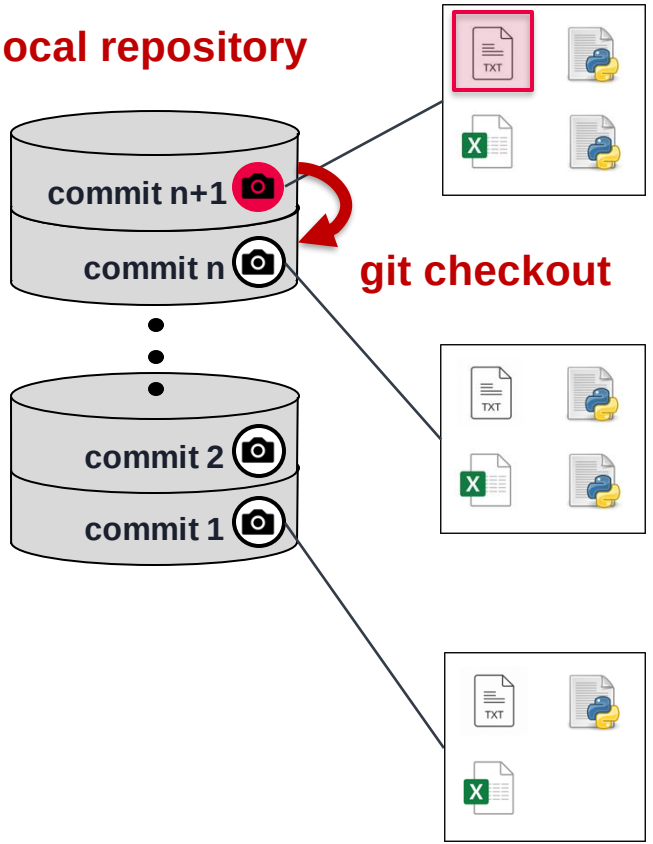


Reverting Changes

working directory

staging area

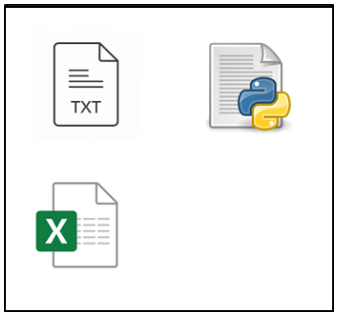


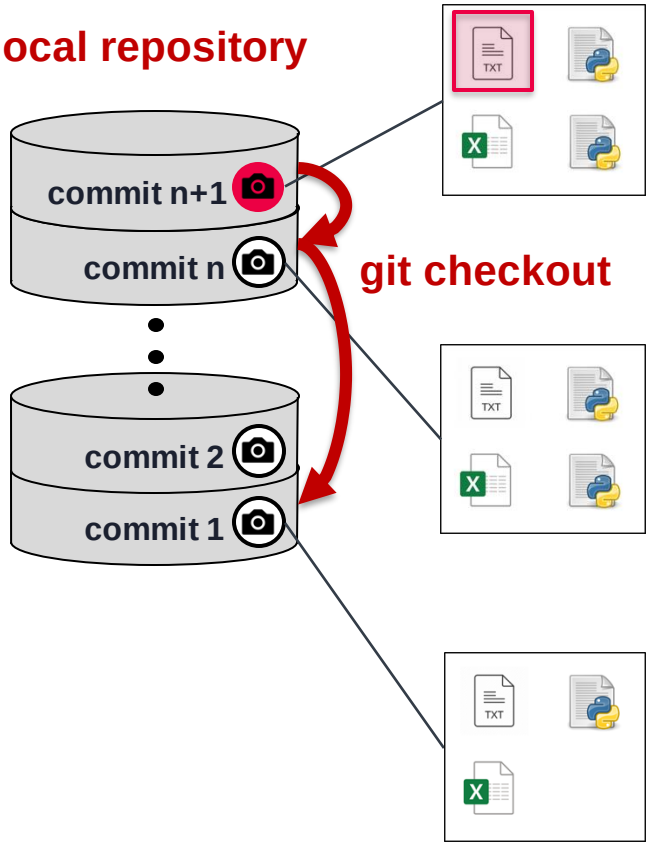


Reverting Changes

working directory

staging area





Reverting Changes - Commands

See log of commits, including SHA ID for each version

```
git log
```

Return to a previous version of a file from the commit history

```
git checkout <version_SHA>
```

```
git checkout <version_SHA> <filename>
```

See differences between two commits or differences in a specific file from two commits

```
git diff <version1_SHA> <version2_SHA>
```

```
git diff <version1_SHA:filename>
    <version2_SHA:filename>
```

Reverting Changes - Try it out

Add some text to `myfile.txt` and commit. Check the log of commits, look at the differences between our two commits so far, and then check out the first commit.

1. Edit and add some text to `myfile.txt` and commit changes.

```
nano myfile.txt
git add myfile.txt
git commit –m “Add some text”
```

2. View the log to see our commit history

```
git log
```

3. Find the differences between the two commits (The first 7 digits of the SHA id should be sufficient)

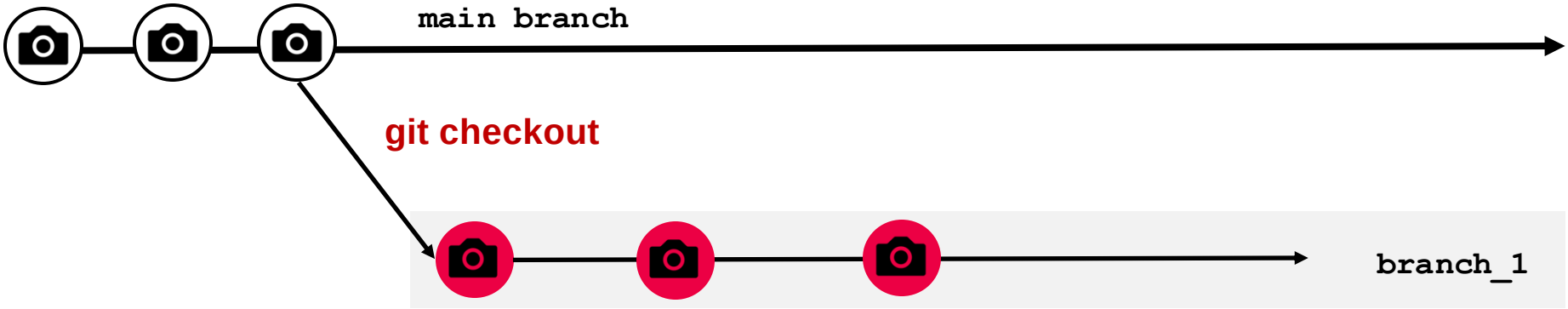
```
git diff 1093106 976686d
```

4. Check out the previous commit

```
git checkout 976686d
```

(Note this will put you in “detached HEAD” state, which you can get out of with: `git checkout main`

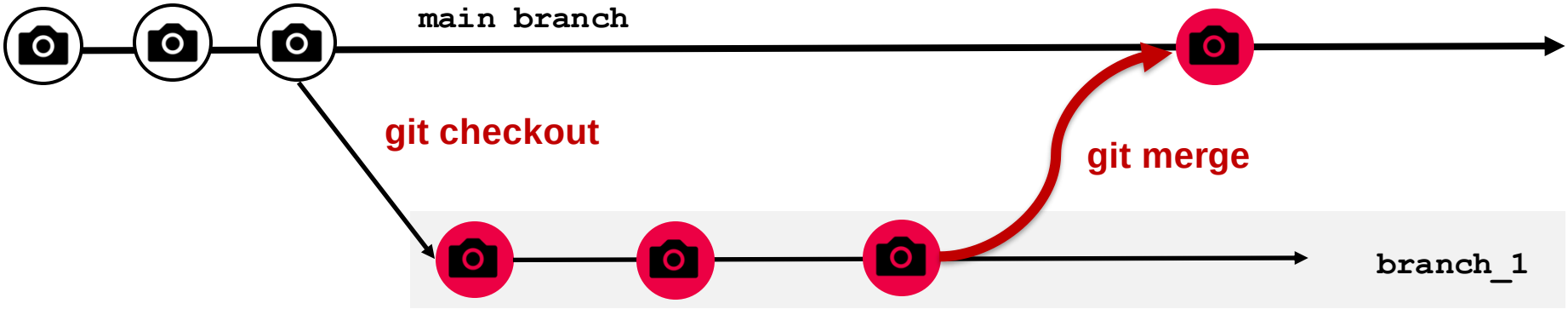
Branching



Suppose you run a process for a client every morning.
You want to make a change, but it will take a few days.
How can you work on the change AND run the stable version?

Branching

Branch when the intention is to eventually "merge" the branch back in with main



Suppose you run a process for a client every morning.
You want to make a change, but it will take a few days.
How can you work on the change AND run the stable version?

Branching and Merging - Commands

See all branches	`git branch`
Create and navigate to a new branch	`git checkout -b new_branch_name`
Switch between branches	`git checkout branch_name`
Merge two branches	`git checkout branch_receiving_changes` `git merge branch_giving_changes`
Delete a branch	`git branch -d branch_name`

Branching - Demo

Create a new branch called `my_branch`, add a file called `mynewfile.txt` to `my_branch` and commit, and look at the list of branches and log of commits.

1. Create and check out a new branch (one step)

```
git checkout -b my_branch
```

2. Add a new file to the new branch

```
touch mynewfile.txt
```

3. Add the new file to staging area and commit

```
git add mynewfile.txt
git commit –m “Add a second text file”
```

4. Display the branches, then look at the log of commits

```
git branch
git log
```

Best practice: check the status between adding and committing

```
git status
```

Merging - Demo

Navigate to the `main` branch, merge `my_branch` into main, and delete `my_branch`.

1. Navigate to the main branch

```
git checkout main
```

2. Merge `my_branch` into the main branch

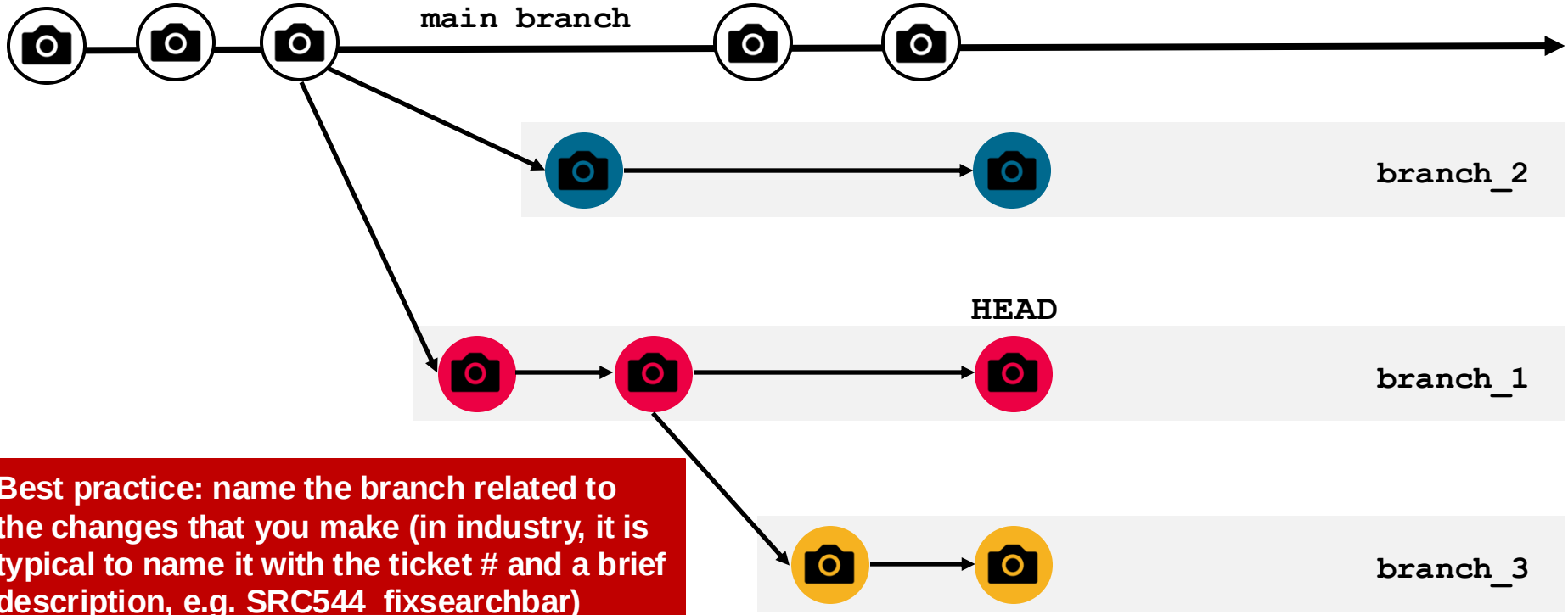
```
git merge my_branch
```

3. Delete `my_branch`

```
git branch -D my_branch
```

Multiple Branches

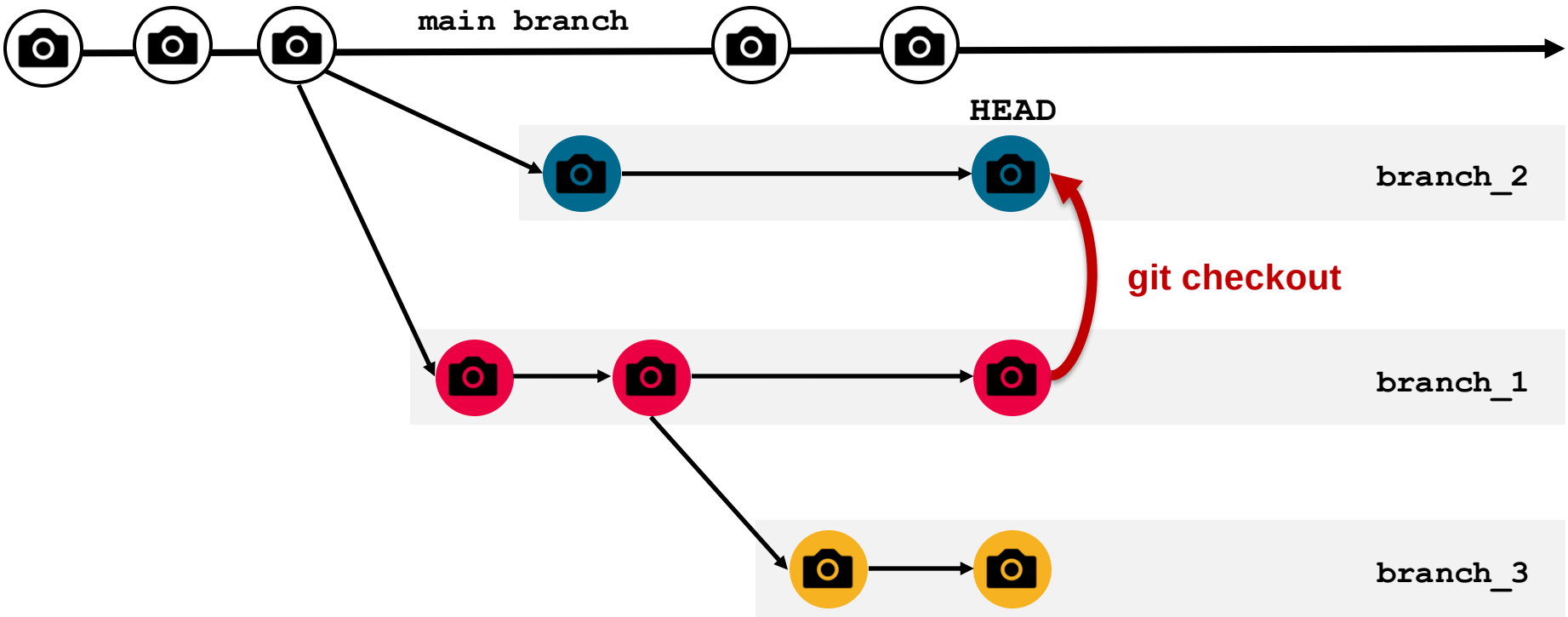
HEAD – the most recent commit on the current branch



Best practice: name the branch related to the changes that you make (in industry, it is typical to name it with the ticket # and a brief description, e.g. SRC544_fixsearchbar)

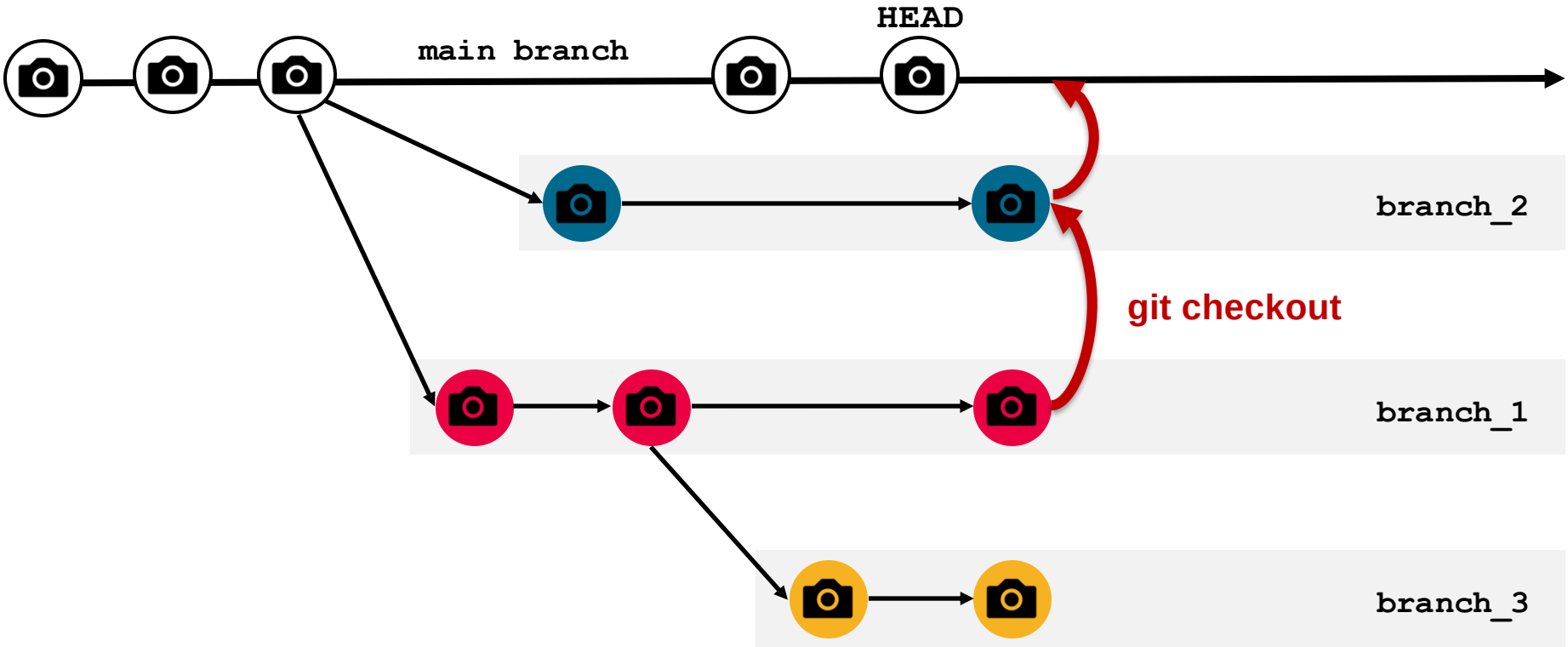
Multiple Branches

HEAD – the most recent commit on the current branch



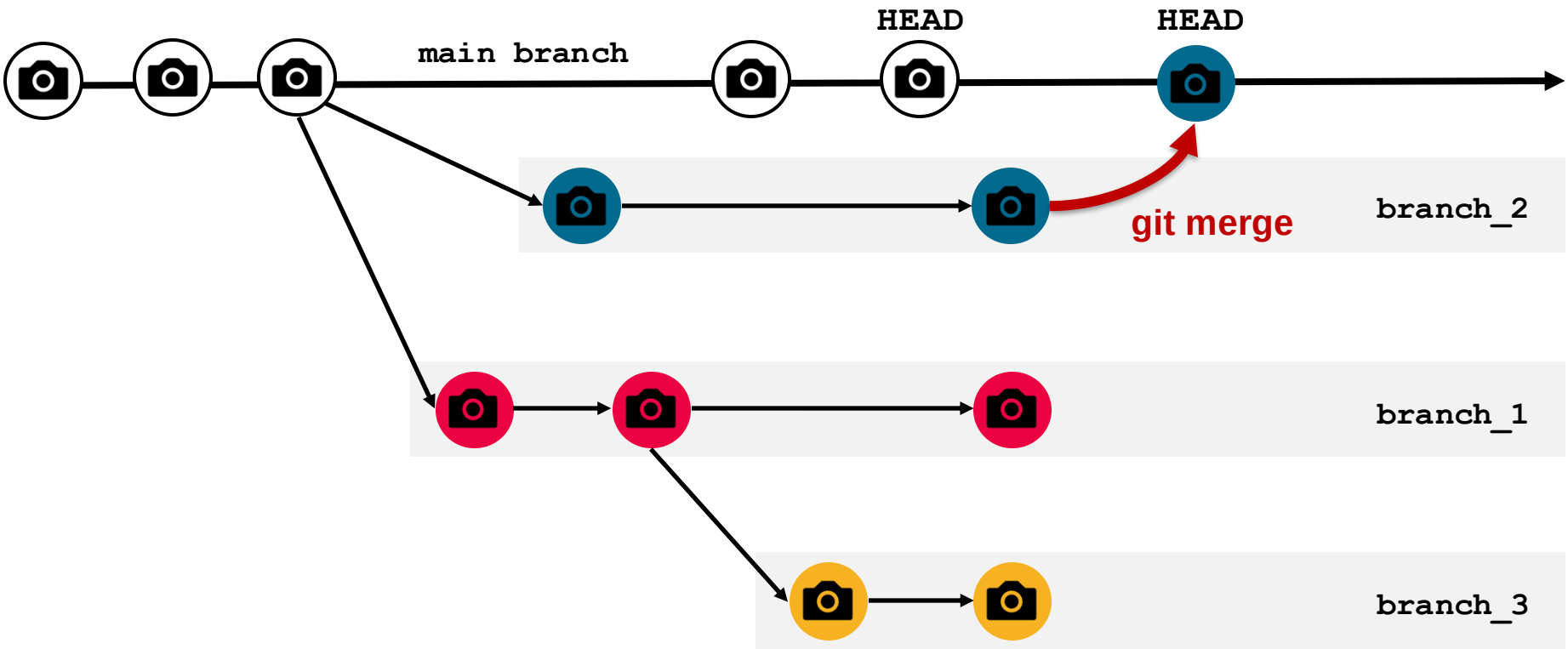
Multiple Branches

HEAD – the most recent commit on the current branch



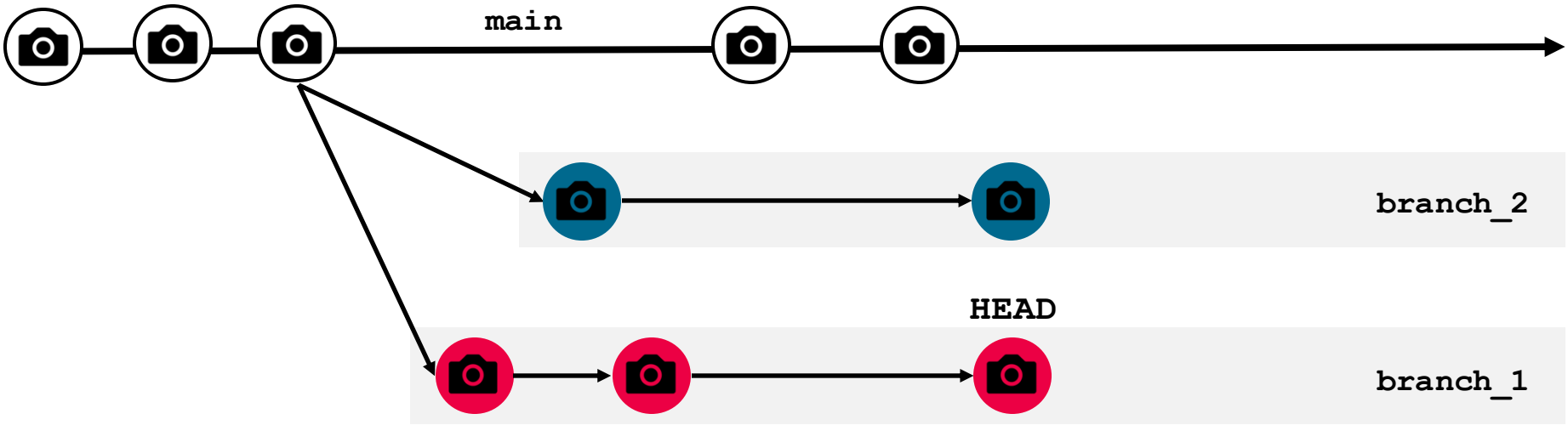
Multiple Branches

HEAD – the most recent commit on the current branch



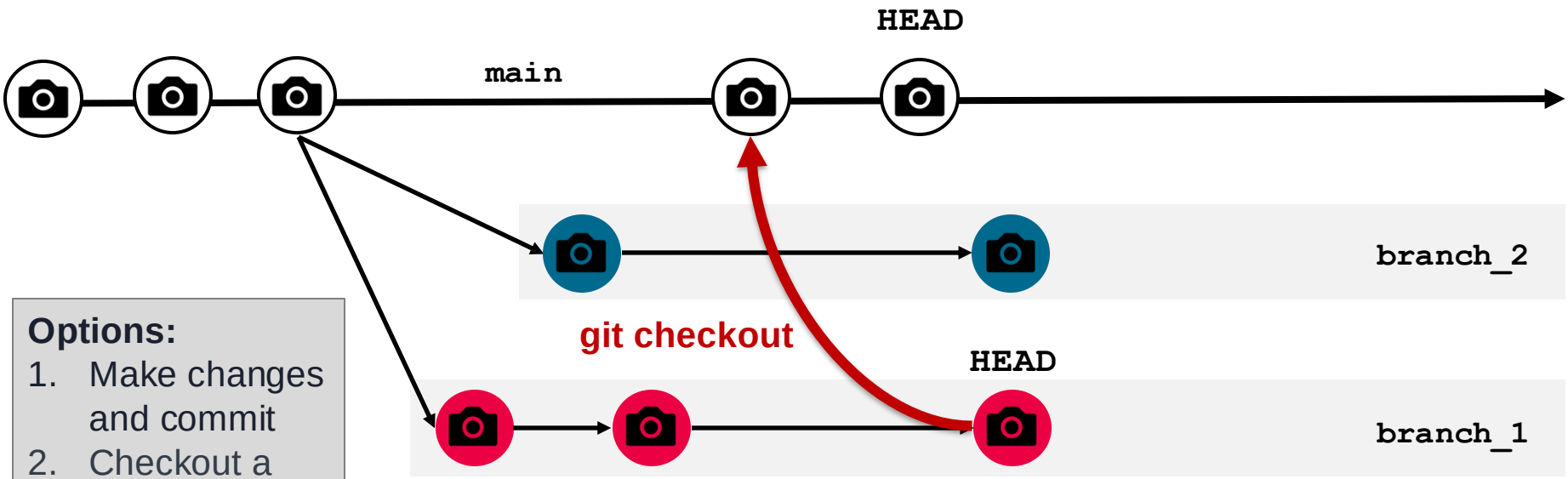
Aside: `'detached HEAD' state`

`HEAD` usually points at a branch directly. When you checkout a commit, `HEAD` instead points directly at that commit. This is a `'detached HEAD' state`. **That's okay!**



Aside: 'detached HEAD' state

`HEAD` usually points at a branch directly. When you checkout a commit, `HEAD` instead points directly at that commit. This is a `'detached HEAD' state`. **That's okay!**



Options:

1. Make changes and commit
2. Checkout a branch

Branching – Try it out

Checkout the `main` branch. Then checkout an earlier commit to enter a detached `HEAD` state. Create a new branch called `new_feature`. Check out the `main` branch.

1. Checkout main, view log, and checkout an earlier commit

```
git checkout main
git log
git checkout 976686d
```

2. Create a new branch from this commit

```
git checkout -b new_feature
```

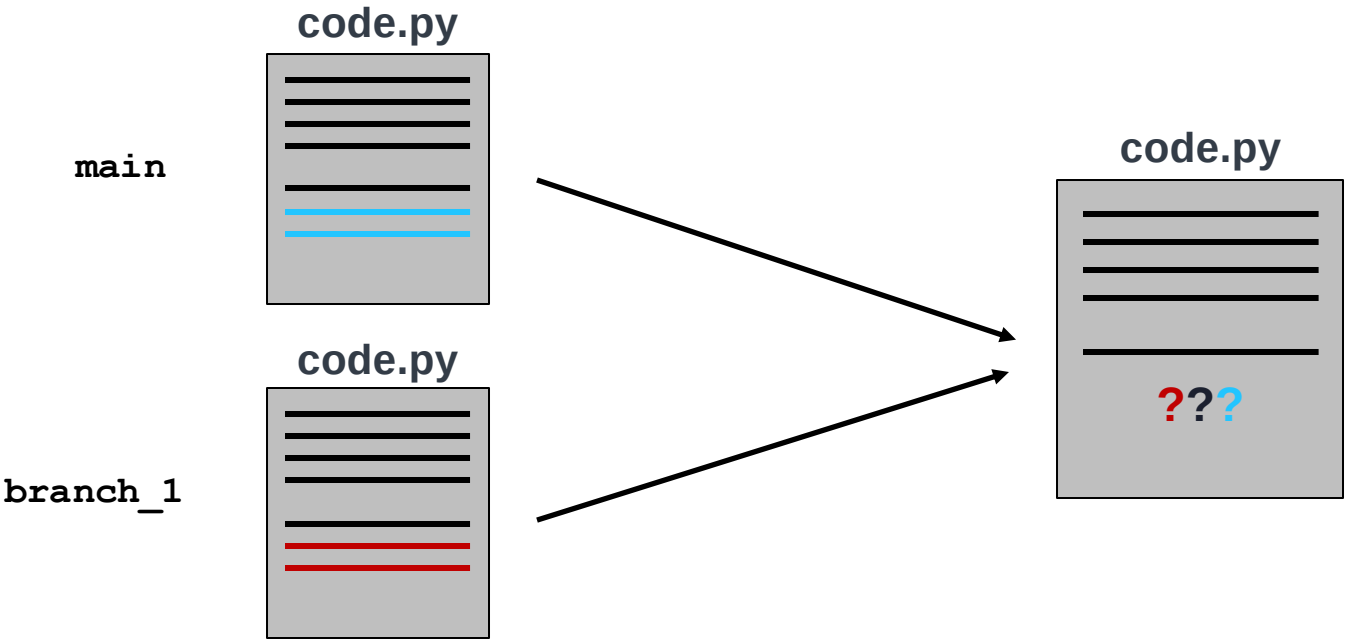
3. Display the branches, checkout main, then look at the log of commits

```
git branch
git checkout main
git log
```

'detached HEAD' state

Merge Conflicts

When merging changes, we may sometimes find that our branches conflict.



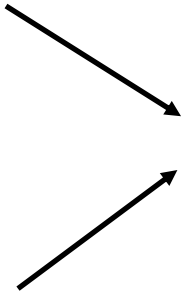
Merge Conflicts

HEAD

```
The first line of the file is the same
The second line is different
```

Commit `dabb4c8c`

```
The first line of the file is the same
See? It's different
```



```
The first line of the file is the same
<<<<<<< HEAD
The second line is different
=======
See? It's different
>>>>>>> dabb4c8c450e8475aee9b14b4383acc99f42af1d
```

When this happens, Git shows you exactly what the conflicts are and where they are located. It is up to you to reconcile the conflicts and commit them.

Merge Conflict – Demo (code along!)

Add text to `myfile.txt` in `main` and commit. Navigate to the `new_feature` branch, add different text to `myfile.txt`, and attempt to merge `new_feature` into `main`.

1. Add text to `myfile.txt` and commit to `main`

```
git checkout main
nano myfile.txt
git add myfile.txt
git commit –m “Add some text”
```

2. Add different text to myfile.txt in `new_feature` and commit

```
git checkout new_feature
nano myfile.txt
git add myfile.txt
git commit –m “Add different text”
```

Merge Conflict – Demo (code along!)

Add text to `myfile.txt` in `main` and commit. Navigate to the `new_feature` branch, add different text to `myfile.txt`, and attempt to merge `new_feature` into `main`.

3. Navigate to the `main` branch and merge `new_feature` branch

```
git checkout main
git merge new_feature
```

4. Resolve merge conflict

```
nano myfile.txt
```

5. Commit changes to `main`

```
git add myfile.txt
git commit –m “Resolve myfile conflict”
```

Question

Suppose you create a new branch and add a file, `branchfile.txt`, and commit. You then add a file, `mainfile.txt`, to the `main` branch and commit. When you try to merge, your branch to `main`, what do you expect to happen?

A.) Merge successful! Both files exist in `main`

B.) Merge successful! But `main` now holds only `branchfile.txt` but not `mainfile.txt`

C.) Merge conflict, you must resolve

Question

You add a file, `community.txt`, to the `main` branch and commit. You then create a new branch and add a file, `branchfile.txt`, and commit. You then delete `community.txt` from `main` and commit. You make changes to `community.txt` on the new branch. When you try to merge your branch to `main`, what do you expect to happen?

A.) Merge successful! And `branchfile.txt` exists in `main`

B.) Merge successful! But `branchfile.txt` does not exist in `main`

C.) Merge conflict, you must resolve

Git Wrap-Up

- Commit often, write descriptive messages, and keep each commit to one “atomic” task

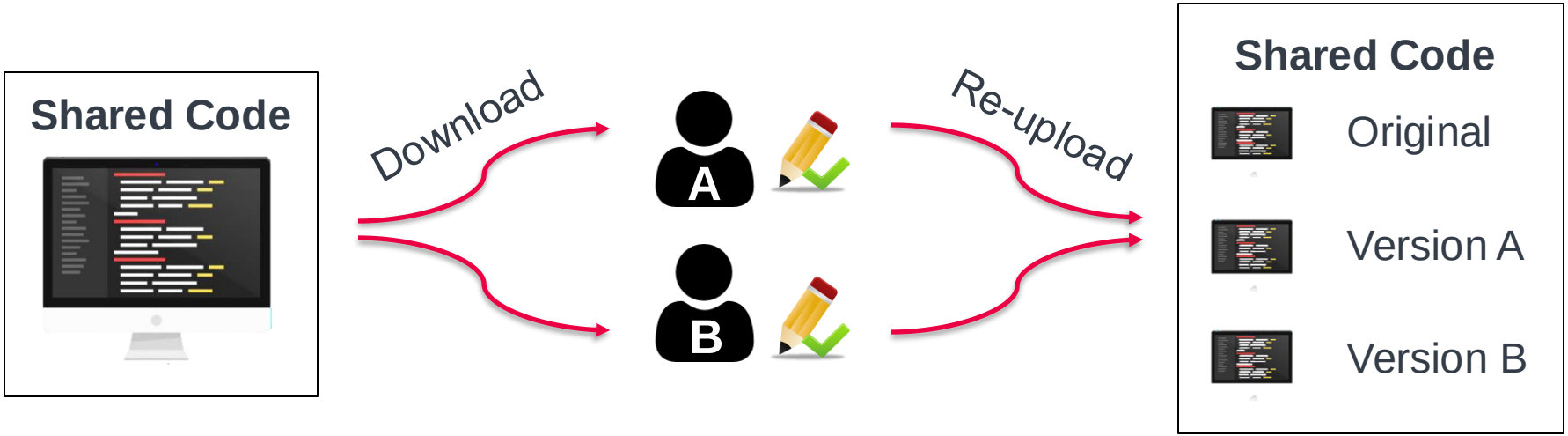
  → Almost anything can be undone, as long as it’s committed
- Take advantage of branching when you have new lines of development and don’t want to disrupt the functionality of the `main` branch
- Google is your friend (e.g. “How to undo commit in Git”.)

Github

Adapted from slides by Galit Lukin and Jackie Baek
with activities from Turing Way and Software Carpentry

Why use Github?

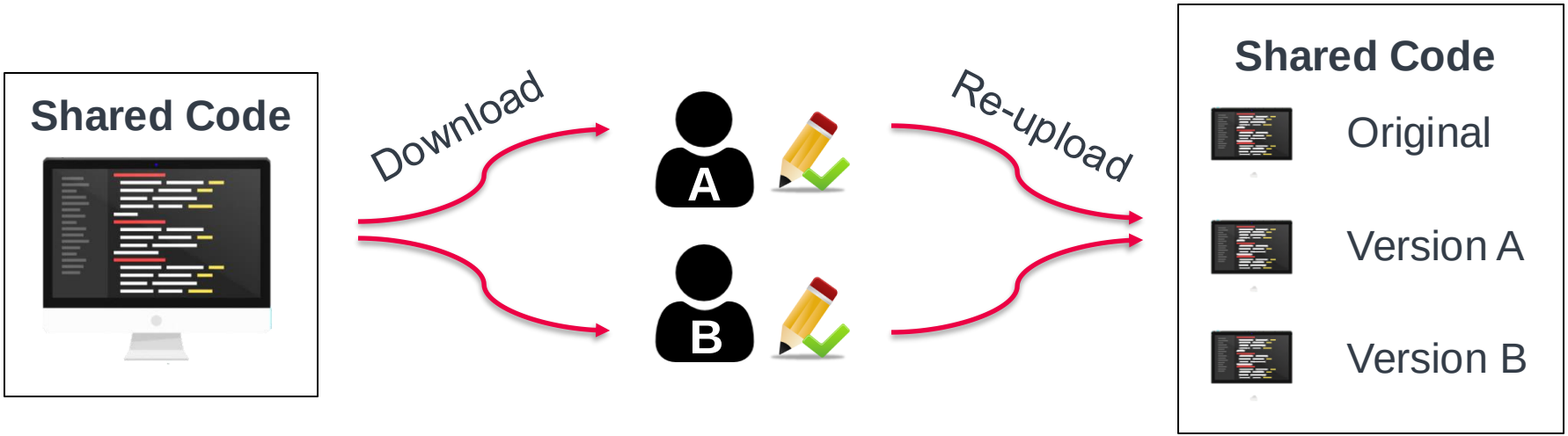
You're working on a research project with another graduate student and both have access to the code in a shared space, e.g. Dropbox.



What are some potential problems that could arise using this process?

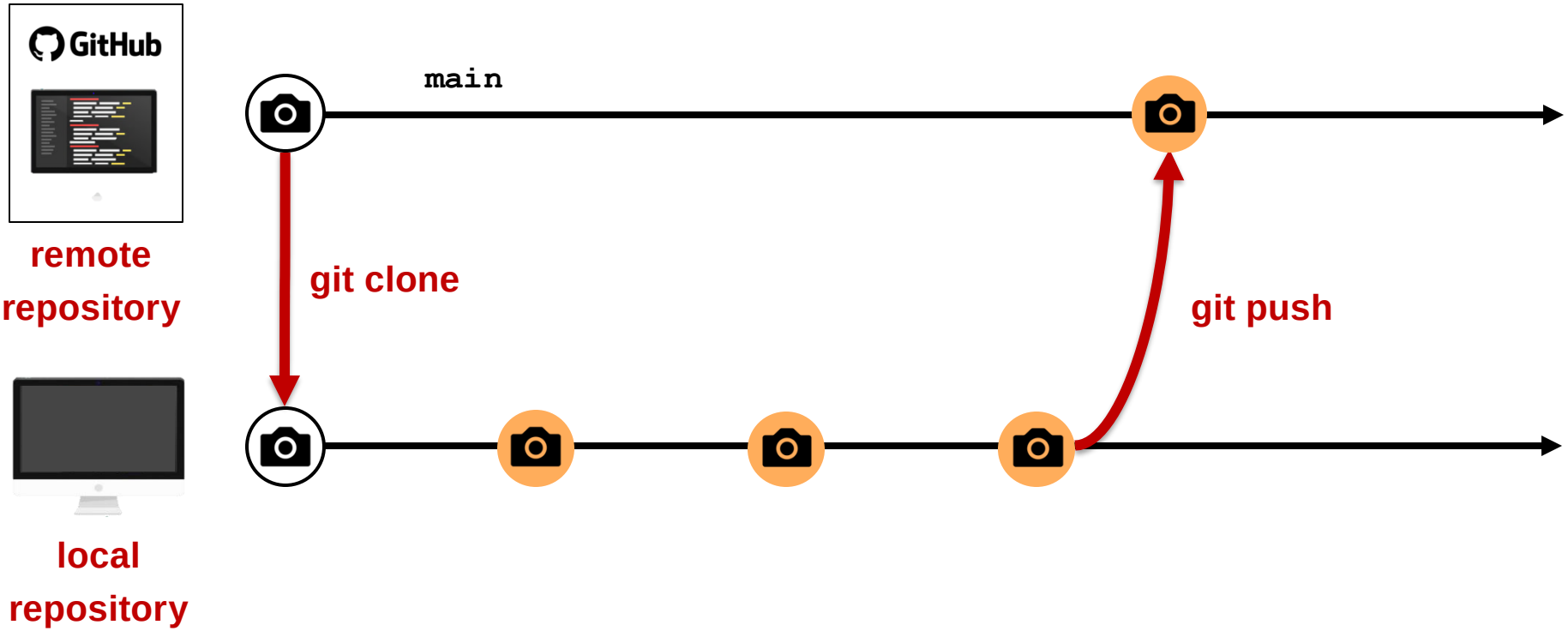
Why use Github?

You're working on a research project with another graduate student and both have access to the code in a shared space, e.g. Dropbox.



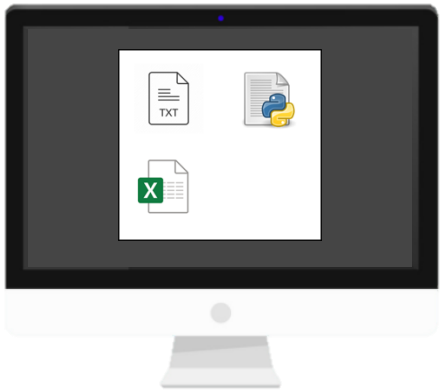
Potential issues: Documenting all changes, staying up to date with changes, overwriting others' work, conflicts between versions, etc.

High-Level Idea



Local and Remote Repositories

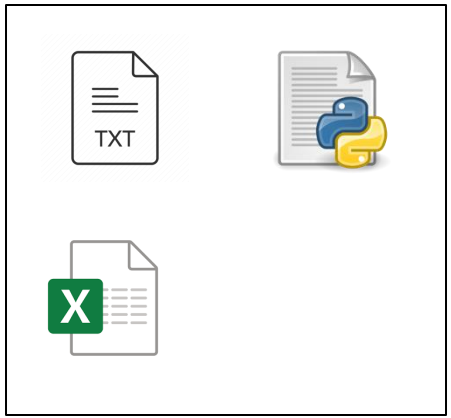
local repository



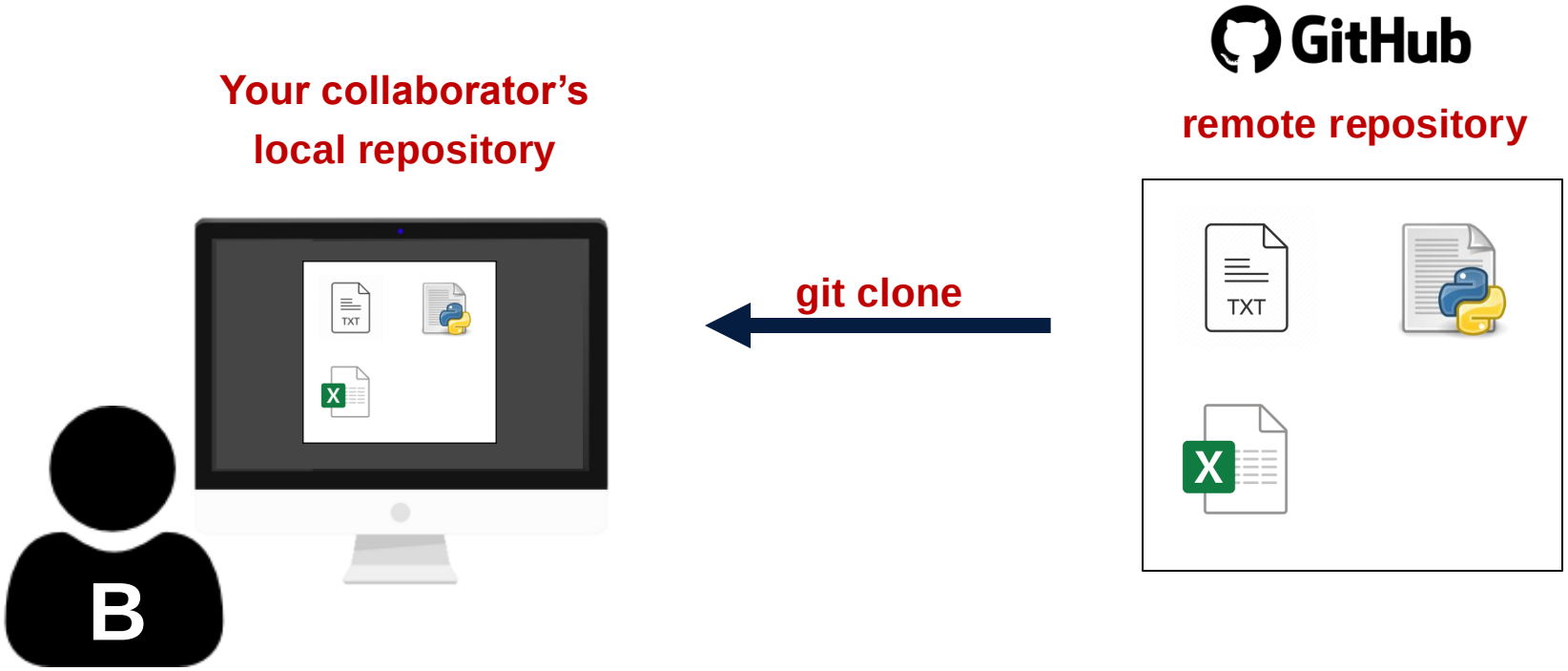
git remote add

GitHub

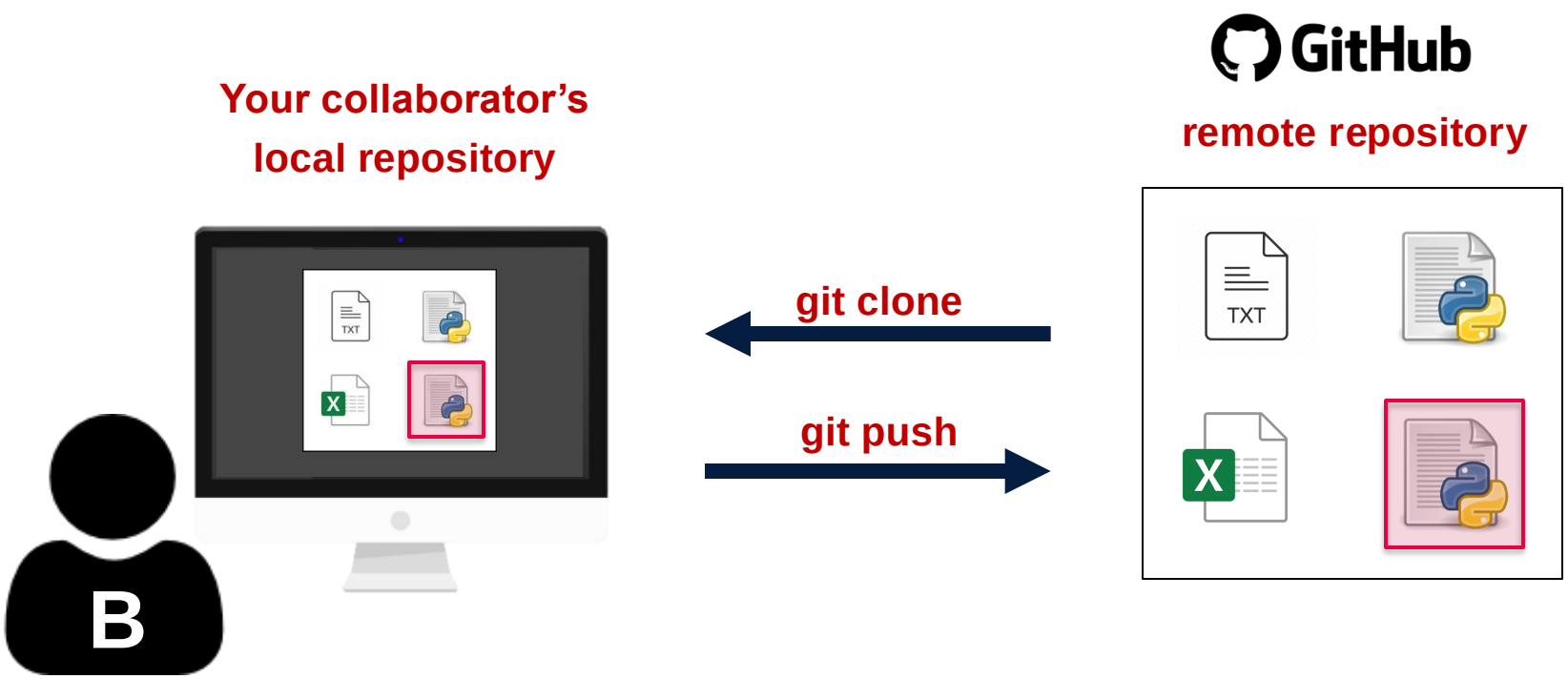
remote repository



Local and Remote Repositories

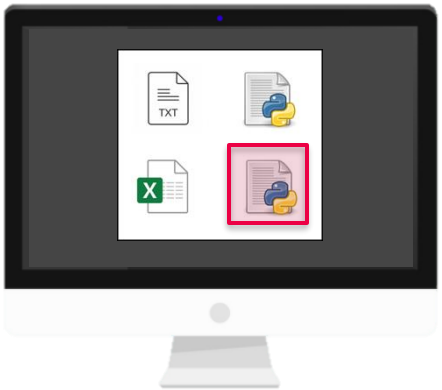


Local and Remote Repositories



Local and Remote Repositories

YOUR
local repository

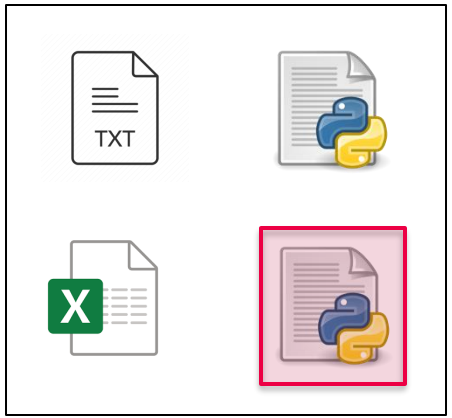


git pull

git push

GitHub

remote repository



Local and Remote - Commands

Add a remote connection to a Github repo for an existing local repo

```
git remote add origin <Github SSH>
```

Clone existing Github repo

```
git clone <Github URL>
```

Pull from Github repo to local repo

```
git pull
```

Push from local repo to Github repo

```
git push origin <branch_name>
```

Local machine's name for the remote repo (`origin` is usual convention)

Cloning a Github repo - Try it out

Clone the class repo into the location of your choice.

1. Navigate to wherever you cloned the repo (or already cloned the repo)

```
cd ~/courses/
```

2. Clone the Github repository to your machine or pull changes if you already cloned it

```
git clone https://github.com/leverest/15.S60_2025.git
```

- or -

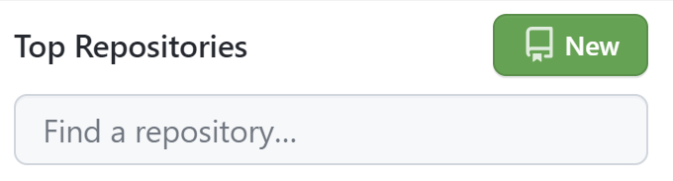
```
cd 15.S60_2025
git pull
```

3. Find it on your computer and check it out! You should see the module for this session (or change your directory and type `ls`)

Creating a Github repo through Github

Create your own repository in Github called `myrepo` (we'll walk through this together).

1. Go to github.com and login
2. Click "New" in the top left by your list of repositories and fill in details



3. Clone the Github repository to your machine **[skip this step for now]**

```
git clone https://github.com/<username>/<reponame>.git
```

Creating a Github repo for existing local repo

Create a remote connection for `myrepo`

1. Navigate to the existing repo (from the Git part of class)

```
cd mydirectory
```

2. Add a remote connection

```
git remote add origin <Github HTTPS>
```

3. Push to upstream to Github

```
git push -u origin main
```

Pushing to Github - Demo

Create a new file `mynewfile.txt`, add some text, commit locally and push changes to Github.

1. Create a new file and add a line of text

```
touch localfile.txt
nano localfile.txt
```

2. Commit the changes locally

```
git add localfile.txt
git commit –m “Add file to local repo”
```

3. Push the changes to Github

```
git push origin main
```

Merge conflicts with Github

Your collaborators may have pushed new changes to Github while you've been working on your own changes locally.

Best practices:

- Pull from Github often, even when you aren't making changes to the remote repo
- Pull right before you push your changes
- Resolve merge conflicts as they arise when you pull

For example,

```
git commit –m "Fix bug"
git pull
git push origin main
```

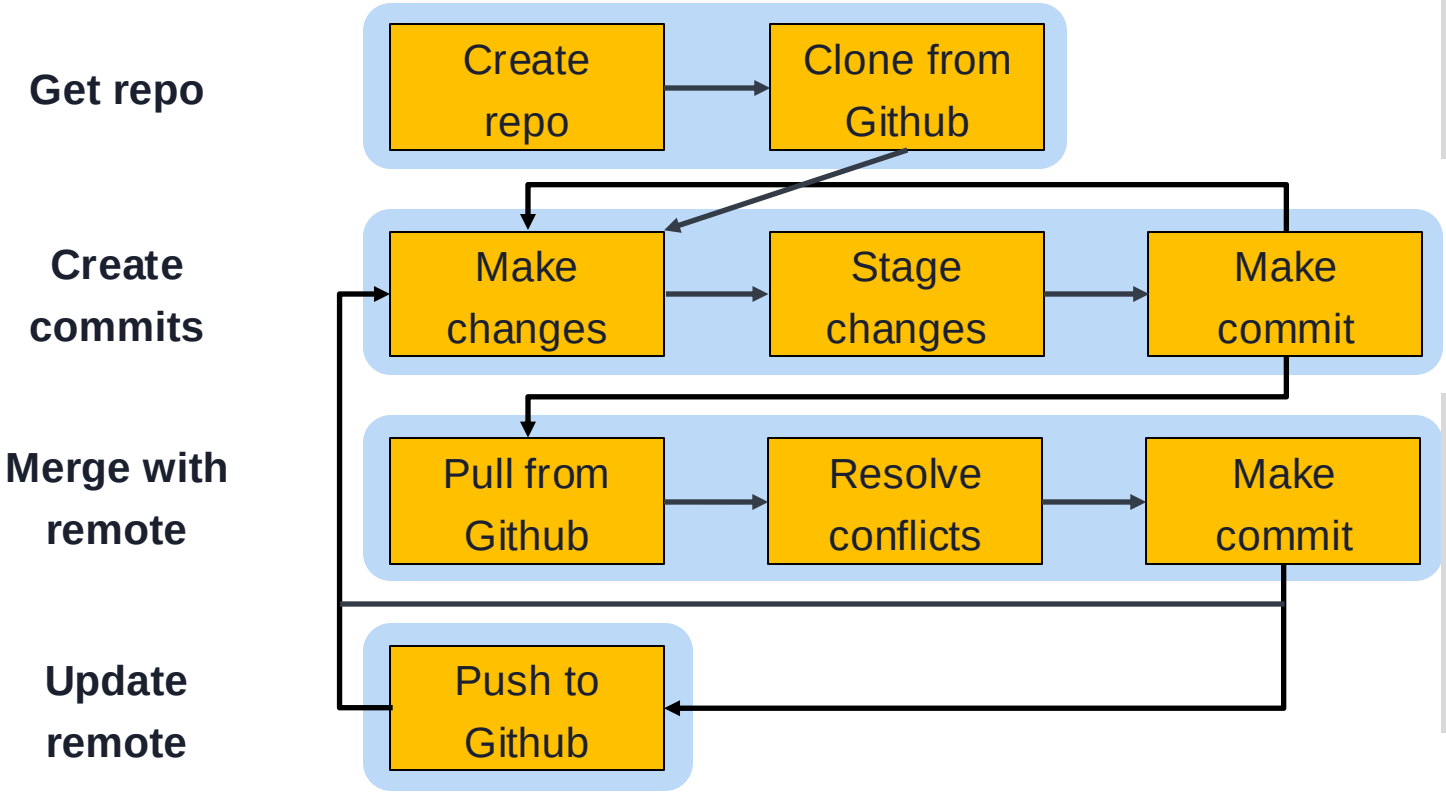
Basic Workflow (Option 1)

Create a new local branch called `new_branch`, add some text to `newfile.txt` on `new_branch` and commit, merge the changes into `main`, pull any new changes from Github, and push to Github.

Step-by-step:

```
git checkout -b new_branch
nano mynewfile.txt
git add mynewfile.txt
git commit –m “Adding a text file”
git checkout main
git merge new_branch
git pull
git push origin main
```

Basic Workflow (Option 1)



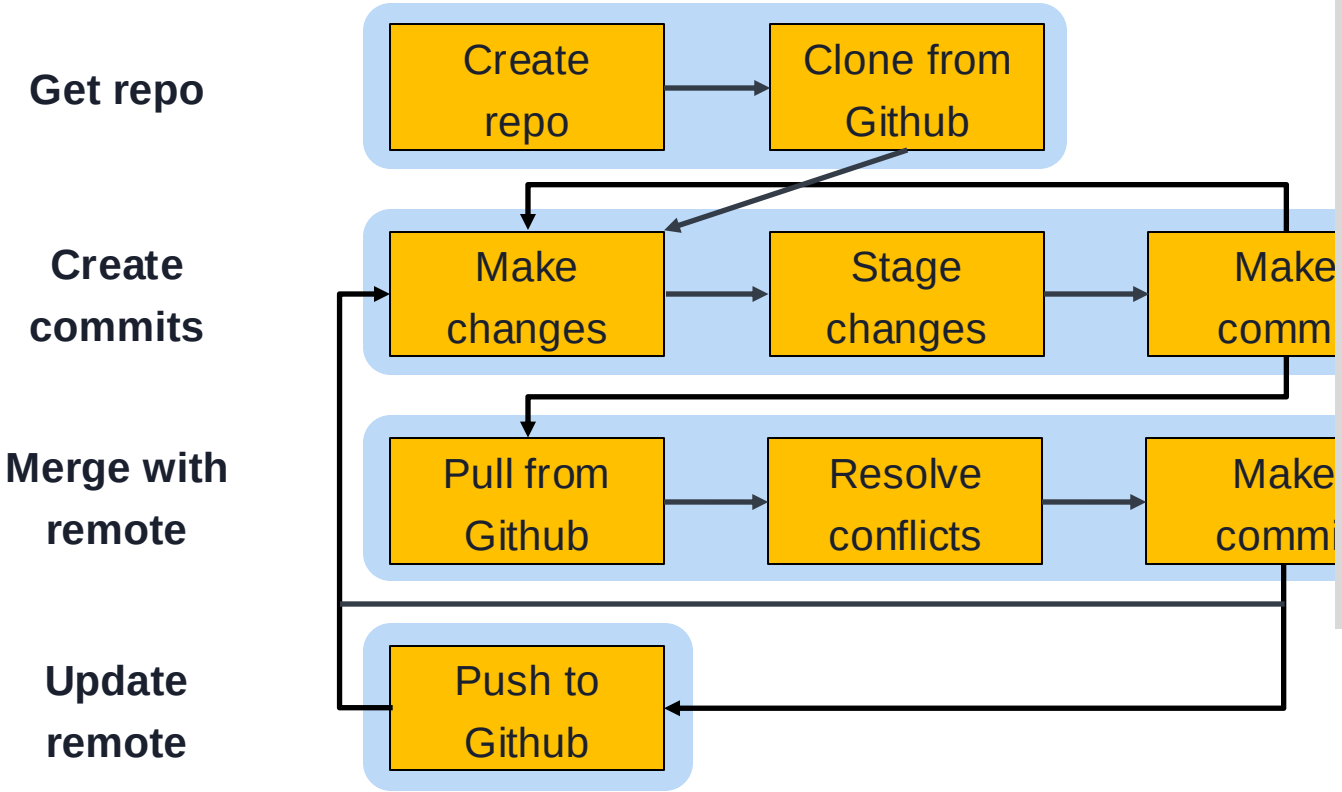
When do you make a commit?

- Think “atomic”
- Single bug fix, feature, re-factor

When do you push to Github?

- Completed and tested feature, ready for use or review

Basic Workflow (Option 1)



When should I branch?

- May need to run `main`
- When you and a collaborator are working on different things

Why might I push my branch to Github?

- If you want to collaborate on the branch
- As a code back-up!

Social Coding Workflow (Option 2)

Thus far, we've focused on using Github with a small group of people who have shared access to a repository.

How can you contribute to projects in the broader Github community?

- Not everyone has repo access, so we can't just push our changes
- Repository owner has a reviewing mechanism

Social Coding Workflow (Option 2)

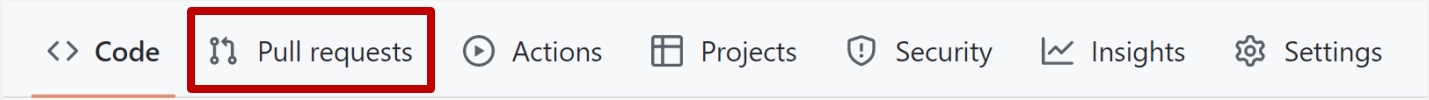
Create a new local branch called `new_branch`, add some text to `newfile.txt` on `new_branch` and commit. Pull any new changes from Github from `main` into `new_branch`. Push `new_branch` to Github and make a pull request.

Step-by-step:

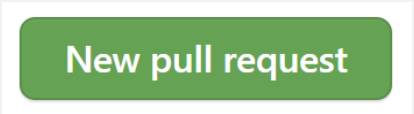
```
git checkout -b new_branch
nano mynewfile.txt
git add mynewfile.txt
git commit –m “Adding a text file”
git push origin new_branch
<make ”pull request” on Github>
```

How to submit a pull request on Github

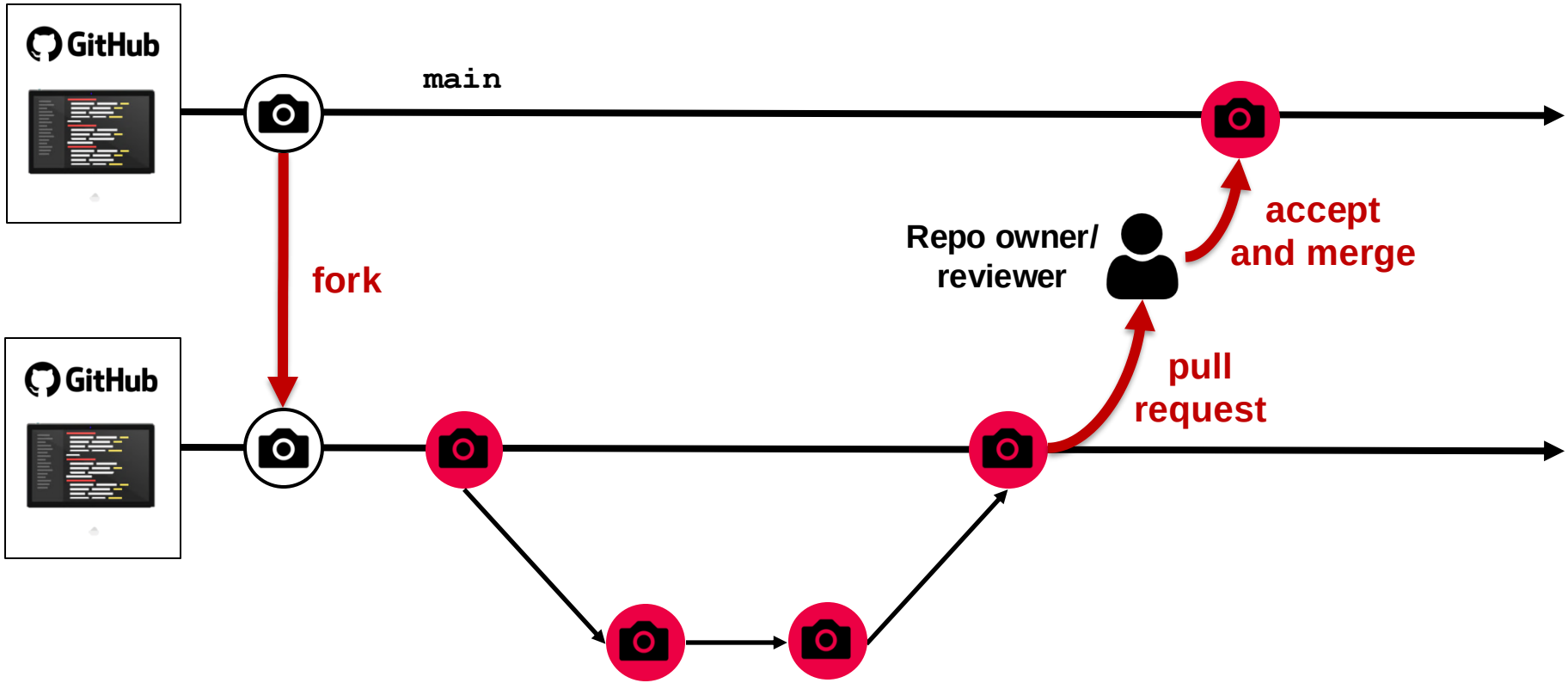
1. Navigate to your repository on Github and switch to this tab:



2. Click “New pull request” and follow prompts



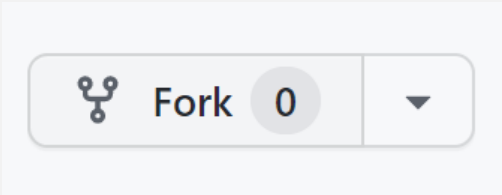
Another Workflow – Forking / Pull Requests



How to fork a repo on Github

Fork a repository from Github and clone your forked copy onto your local machine.

1. Go to github.com, login, and find the repo you want to clone
2. Click “Fork” in the right of the repo page



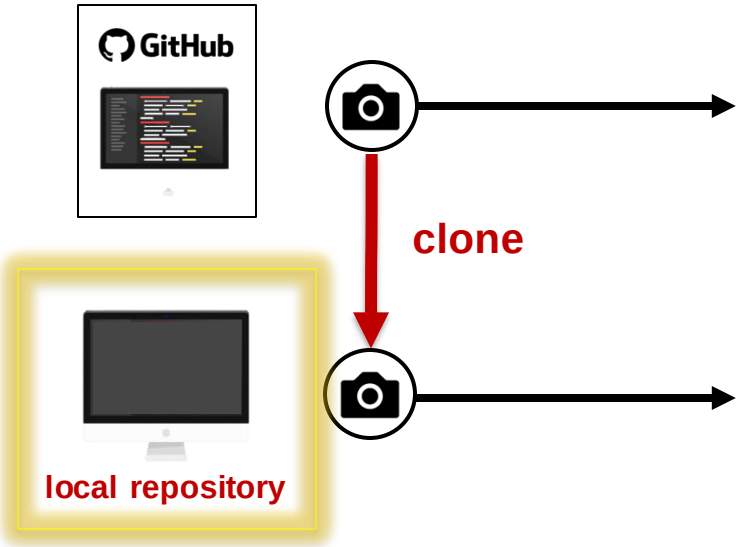
3. Clone the forked Github repository to your machine

```
git clone https://github.com/<yourusername>/<reponame>.git
```

Cloning vs. Forking

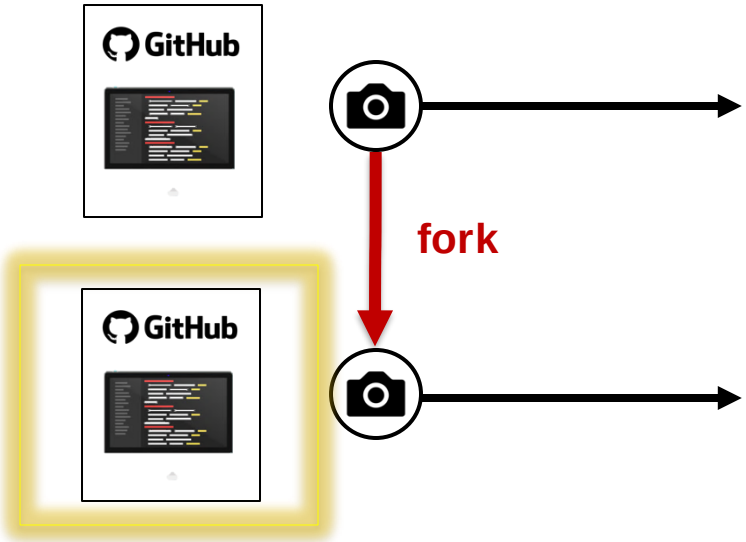
Clone

- Creates a local copy of the repo
- Execute in terminal with git



Fork

- Creates a copy of the repo on Github
- Execute in Github



Question

Your collaborator gave you access to a repository that contains shared code. You want to be able to make your own changes and push them to the Github repo.

Should you clone or fork the repository?

A.) `Clone`

B.) `Fork`

Question

You found a Github repo and think it would be a great starting point for a project you're working on.

Should you clone or fork the repository?

A.) `Clone`

B.) `Fork (then clone)`

Question

You find a repo on Github that has some room for improvement, but to which you don’t have access.

What would happen if you tried to clone the repository?

A.) `An error. You can’t clone without access.`

B.) `Git would create a local copy of the repo, but you couldn’t push changes.`

C.) `Git would create a local copy of the repo and you could push changes to the Github repo.`

LATEX

Adapted from slides and documents by Arthur Delarue

Learning Objectives

At the end of the session, students will be able to…

- Organize and format a simple document in LaTeX, including tables, figures, and bibliography
- Add papers to their Zotero library, organize and categorize their papers, link their account to Overleaf, and directly cite their papers in LaTeX

Motivation

TeX

Donald Knuth created TeX to specify all kinds of formatting for documents.

Includes algorithms to make documents “beautiful” (kerning, spacing, word breaks).

LaTeX

Leslie Lamport released LaTeX (Lamport’s TeX) which includes macros he built on top of TeX. This makes the writing process more content-focused instead of formatting-focused.

To create a new “Intro” section:

TeX: Specify larger font, bold, space before and after, section numbering convention, etc.

LaTeX: `\section{Introduction}`

Benefits of LaTeX

- Separate content from formatting: type everything in plain text, then easily adjust formatting afterwards
- Easily format a wide range of documents with style templates
- Prettiest and easiest way to type up mathematical notation and formulas
- Helps keep citations and references in a consistent format

Using LaTeX

TeX distributions

- Installed locally on your machine
- Greater control of customization and formatting
- Fewer privacy concerns for sensitive documents

Overleaf

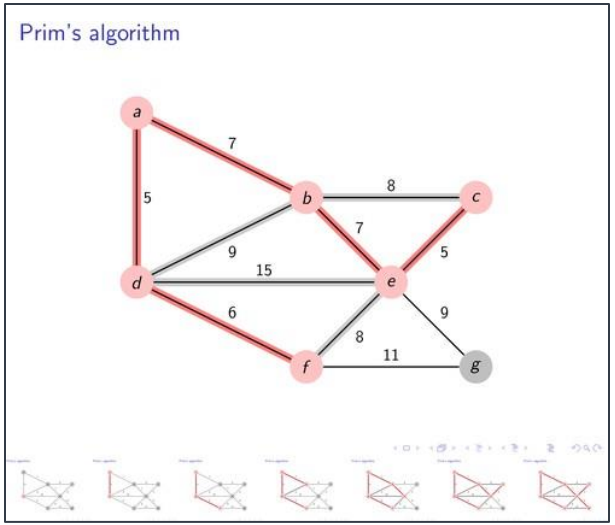
- Available online with no install needed
- Optimized for ease-of-use and a good place to learn
- Allows for easy collaboration, kind of like “Google Docs” for LaTeX

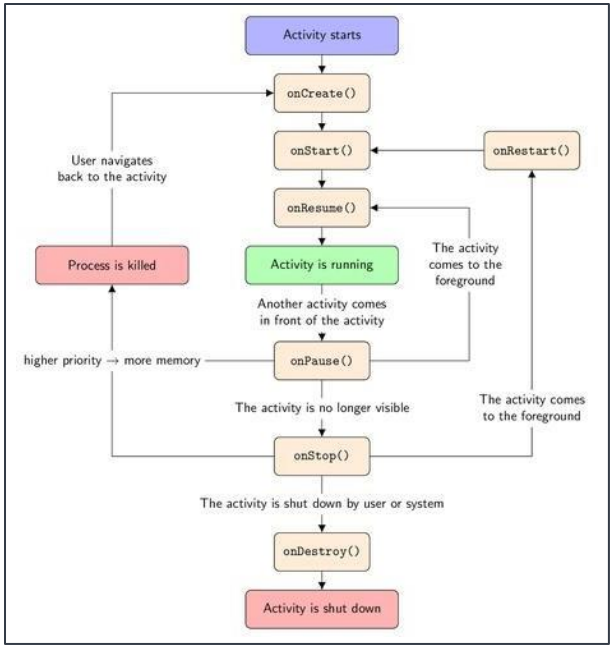
Overleaf Demo

View demo here: https://www.overleaf.com/read/hhdngkdkkcsm

Figures in TikZ

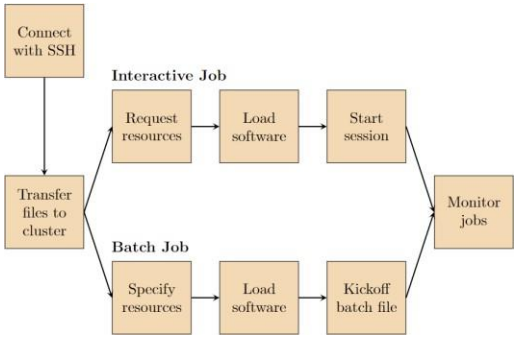
Make paper-ready figures using the TikZ package. Same “modular” formatting principle the rest of LaTeX.

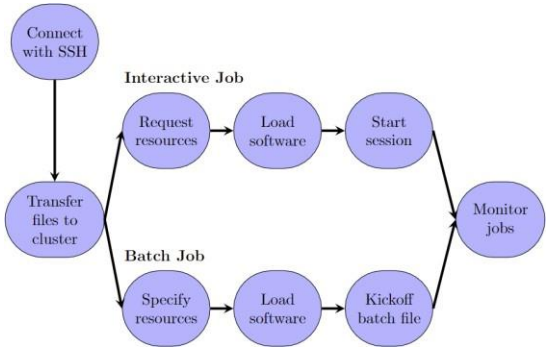




Figures in TikZ

- Specify style elements (red rounded boxes, thick black arrows, font size 12, etc.)
- Build your figure using the alias of each element (box, arrow, etc.)
- Easily change the formatting for all elements with one command, and TikZ will apply the new style to everything





Key Takeaways

- LaTeX allows you to focus on content first, then easily adjust formatting
- Use Google to find commands, packages, and templates
- LaTeX is widely used: if you’re doing a tedious task, there may be a simple tool to help if you search! (e.g. generate a large LaTeX table from an Excel table, translate markdown to LaTeX)

ZOTERO

Adapted from slides and documents by Alexandria Schmid

Motivation

- It can be difficult to keep papers organized, both for specific literature reviews and for your general library
- Tools like Zotero, Mendeley, EndNote, and PaperPile are easy to use and can save lots of time and frustration

Add papers to library

Automatically capture citation information

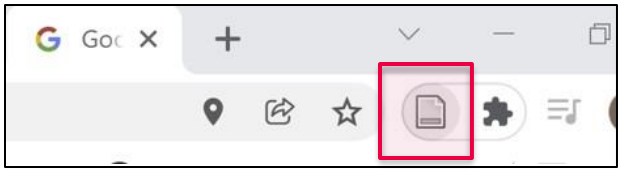
Organize by project, topic, and tags

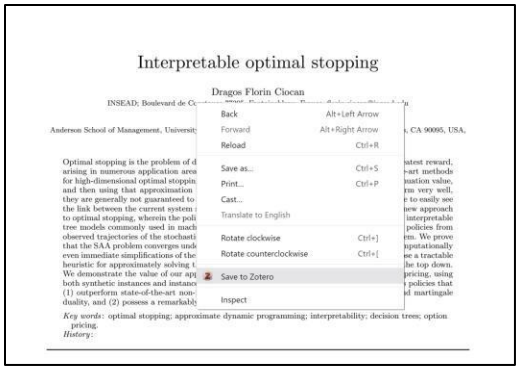
Connect to Overleaf to generate bibliographies

Adding Papers

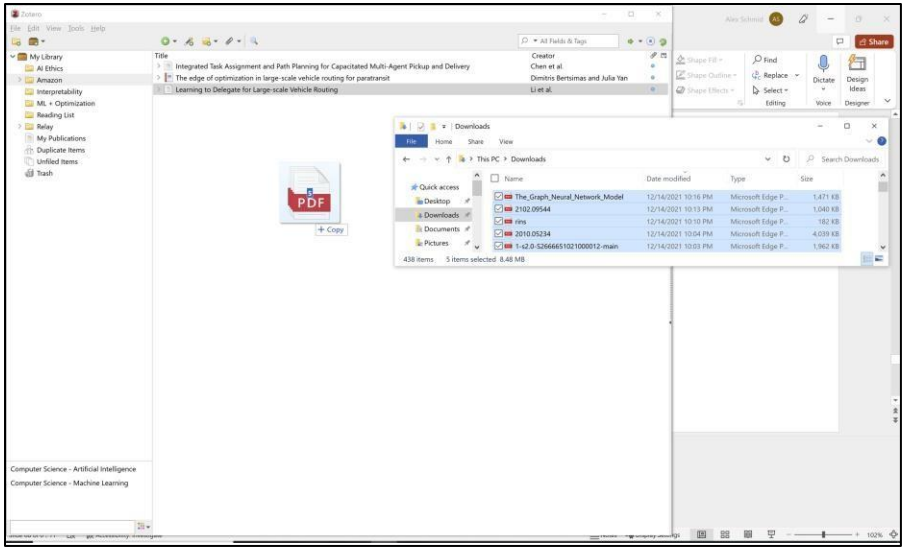
Download: https://www.zotero.org/download/

Add browser connector to add papers with button in search bar or with right click



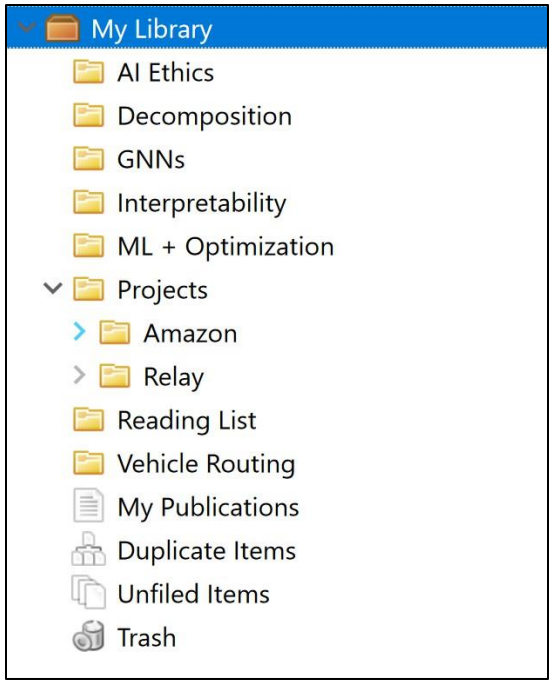


Drag downloaded papers into your Zotero library



Organizing Your Library

Organize papers into folders by topic, project, etc.

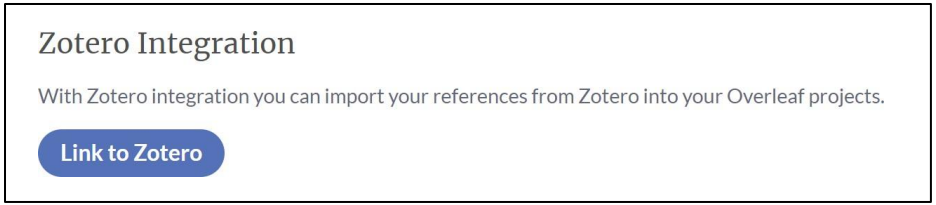


Organization Tips

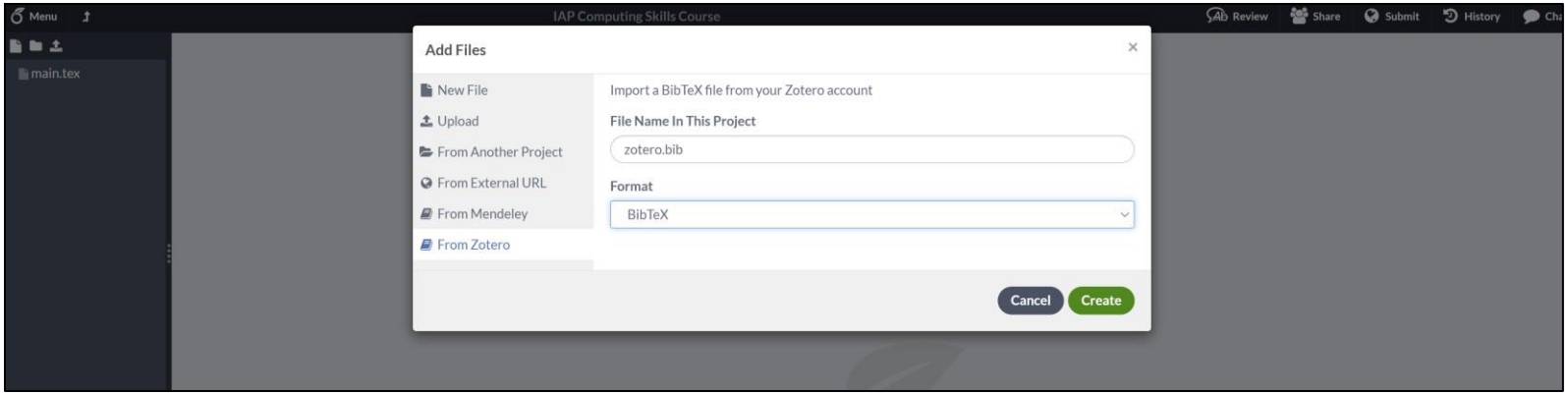
- Keep a “reading list” to separate papers that you have not read yet and prune the list often. If you add lots of random, unread papers, you may end up with a cluttered and difficult to use library.
- Add tags and ensure citations are correct when you first add a paper, otherwise risk doing lots of organizational work later
- Link related papers to help jump start future literature reviews

Connecting to Overleaf

Overleaf > Account > Account Settings > Zotero Integration (or Mendeley)



From your project, Upload > Import a .bib file containing your Zotero library



More tips

- To change the reference label used in the Zotero BibTeX file for a paper, add “Citation key: <desired label>” to the “Extra” field of the paper’s Zotero info section.
- Mendeley also offers Overleaf integration, with the additional feature of allowing you to import BibTeX files for specific folders, rather than your entire library.

Reference, reference, reference!

Now that you're **TeX-savvy™**, use your new skills to reference your Zotero papers in LaTeX documents with ease!

Homework

- Due 11:59 pm, Tuesday, Jan 14
- Create a LaTeX document
- Cite something using Zotero
- Start your personal website and practice forking and committing using Git/Github