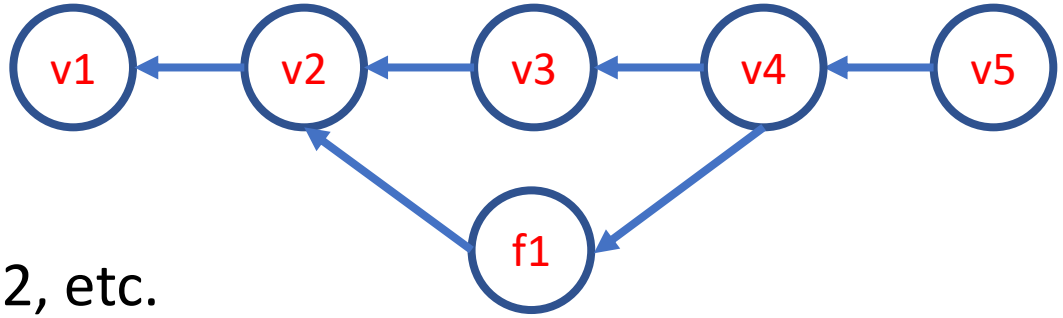
Intro to Git & GitHub

Jay / TDMDAL

Website for this workshop: https://tdmdal.github.io/git-workshop-2023-rccl

What's Git

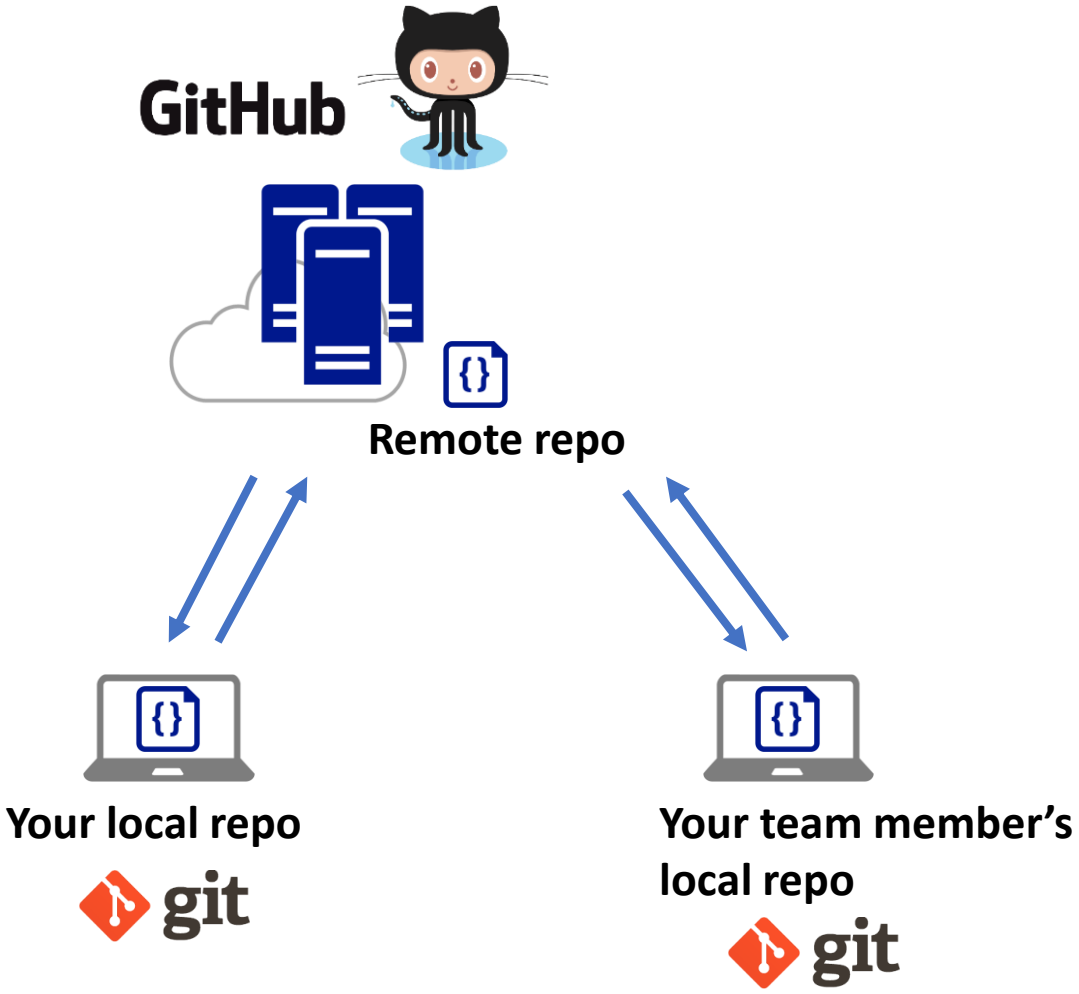
- A version control system
  - manage the evolution of a set of files (repository / repo)
  - mainly for source code (or text files)
    - **NOT** for large datasets, but see git lfs and github lfs
    - NOT really for binary files (.xlsx, .docx, .pdf, etc.): hard to track content changes, but OK to use as file backups



- Version control?
  - keep track of changes: version 1, version 2, etc.
  - like "Track Changes" in MS Word, or "save progress" in game play

What's GitHub

- A git-aware online repo host
- Enable repo sharing and collaboration
  - raise issues, pull request, etc.
- Free public and private repo (*)
- Other repo hosts exist
  - e.g., bitbucket, gitlab, etc.



*Ref: https://github.com/pricing

What’s GitHub (Other than a Git Repo Host)

- GitHub Pages: static web site host
  - The workshop website is hosted on github,
    - https://tdmdal.github.io/git-workshop-2023-rccl
  - We will learn how to create a blog site and host it on GitHub in this workshop
    - Like this example, https://eijoac.github.io/my-blog/

- Codespaces: online code editor/developer environment

- Copilot: “Don’t fly solo”, and code together with AI!

- …

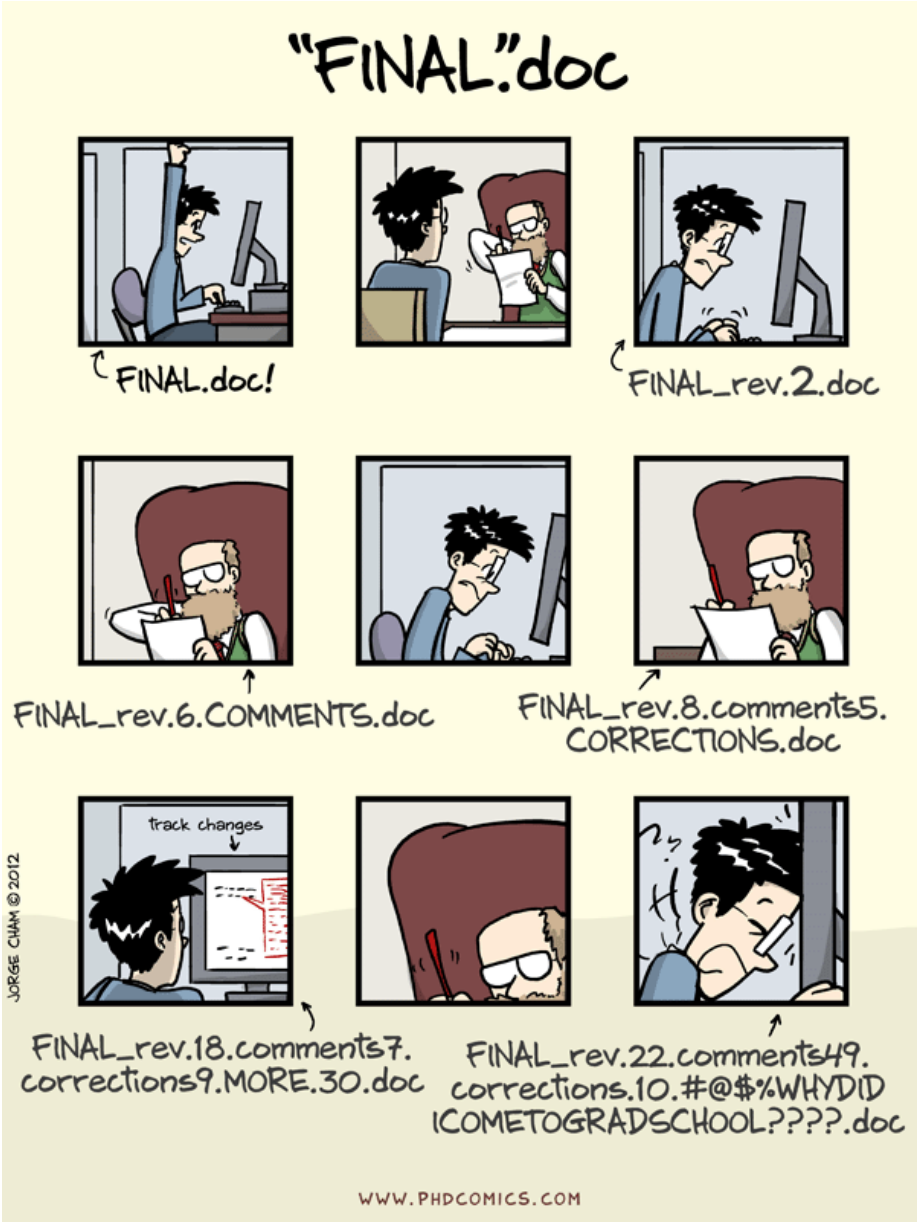
Why Git & GitHub

- **Organize** (record keeping; traceability)
  - Track, compare and undo changes
  - Manage multiple versions/ideas at the same time efficiently
  - Backup your work

- **Share**
  - project code, notes, ideas, etc.

- **Collaborate**
  - Team members (no more emailing code around)
  - open-source community

- Others…
  - e.g., host personal/project website, and blogs on GitHub, i.e., online presence, "I web, therefore I am ~~a spiderman~~."



Using Git: GUI Clients vs Command Line

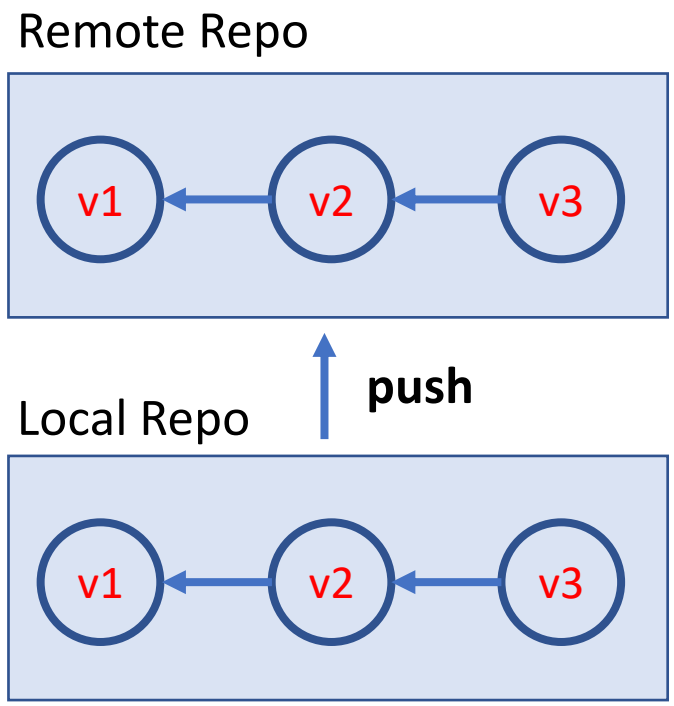
- GUI is easy to get started
  - In this workshop, we will focus on a GUI client, GitHub Desktop
    - Briefly discuss some underlying concepts & git commands associated with each GUI operation
  - Note that many code editors comes with Git integration too (semi-GUI)
    - e.g., RStudio, VSCode, etc.

- Command line is universal
  - i.e., same commands for Windows, Mac, and Linux

- It's easy to go from command line to a GUI client
  - Not quite vice versa

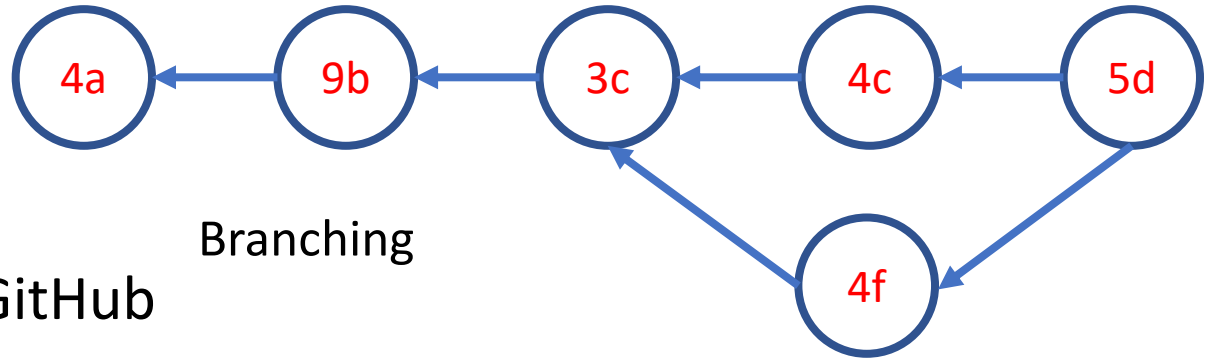
Plan for This Workshop - Today

- Focus on a simple linear workflow
  - manage version history in local repo
  - push local repo to GitHub



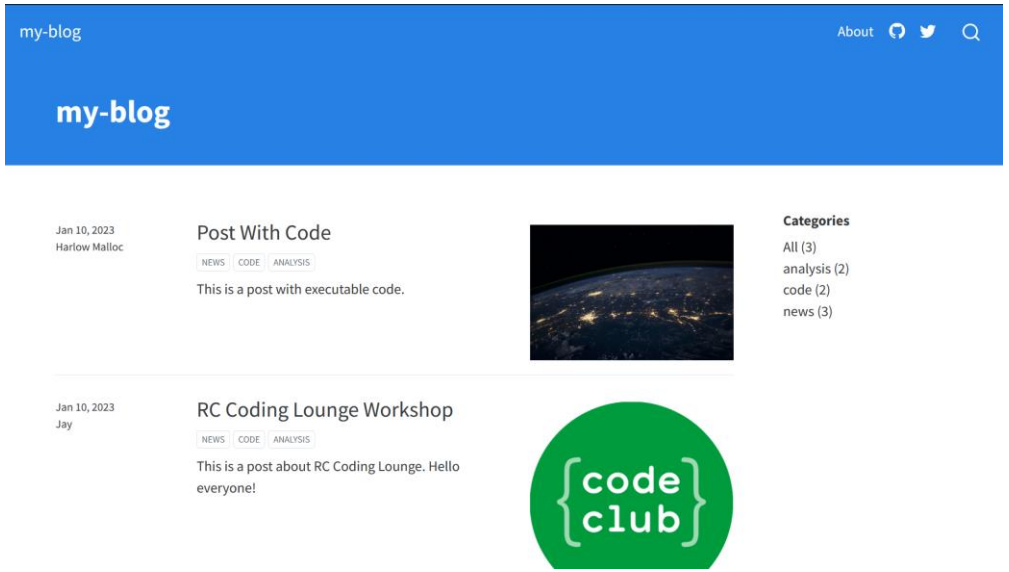
Plan for This Workshop – Next Time

- Intro to
  - a simple branching workflow
  - a simple collaboration workflow via GitHub



Branching

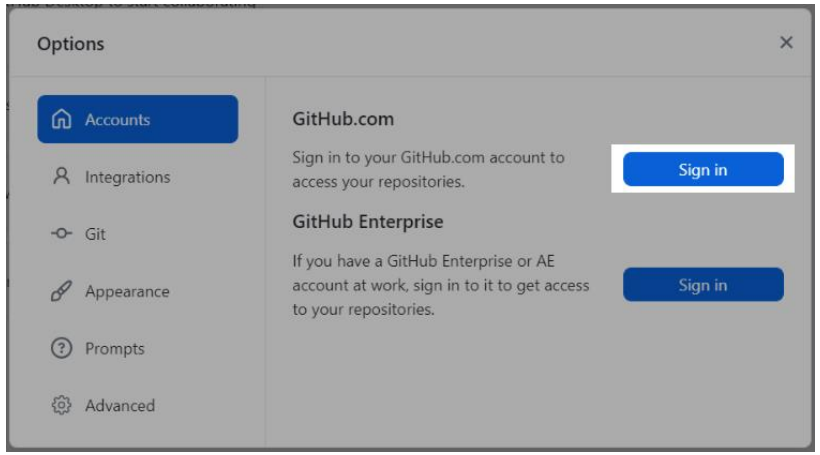
- Host a blog site on GitHub
  - Create a blog site using Quarto
  - Host it on Github via GitHub Page



Setup GitHub Desktop

- Step 1: Create a GitHub account, https://github.com/

- Step 2: Install GitHub Desktop, https://desktop.github.com/
  - Launch GitHub Desktop
  - Sign in GitHub: `File → Options… → Accounts`
  - Set some global options: `File → Options… → Git`
    - Configure git for first-time use (>_: `git config`



- Optional: Install Git (command line): https://git-scm.com/downloads

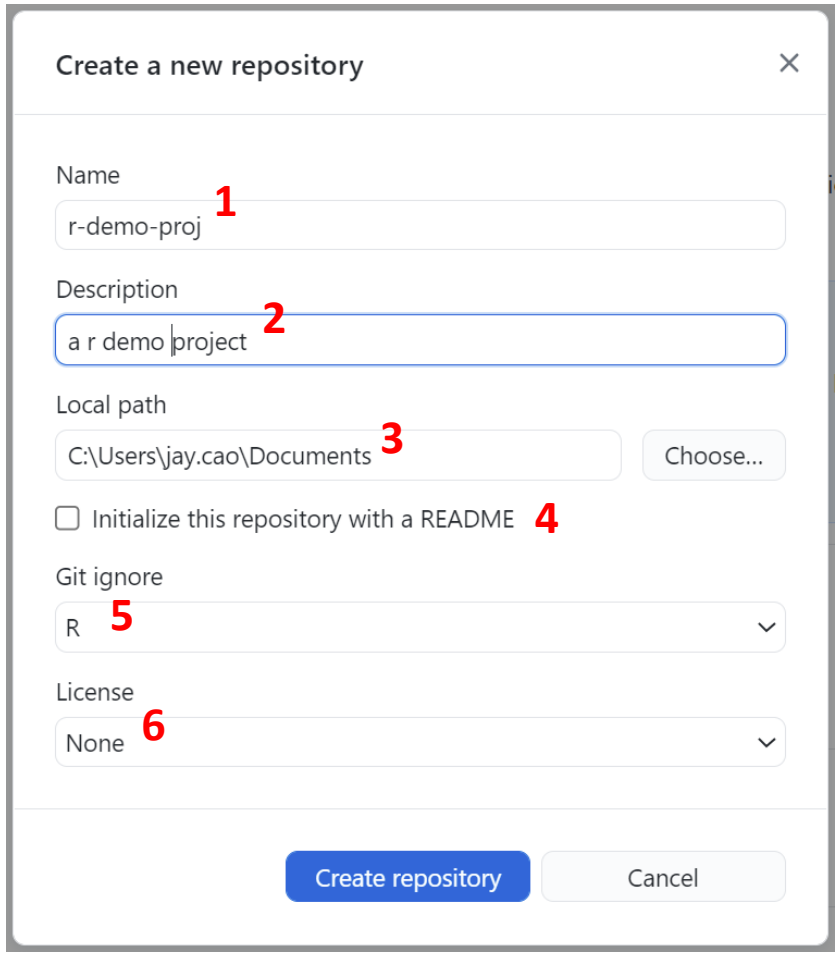
The simplest git workflow (demo)

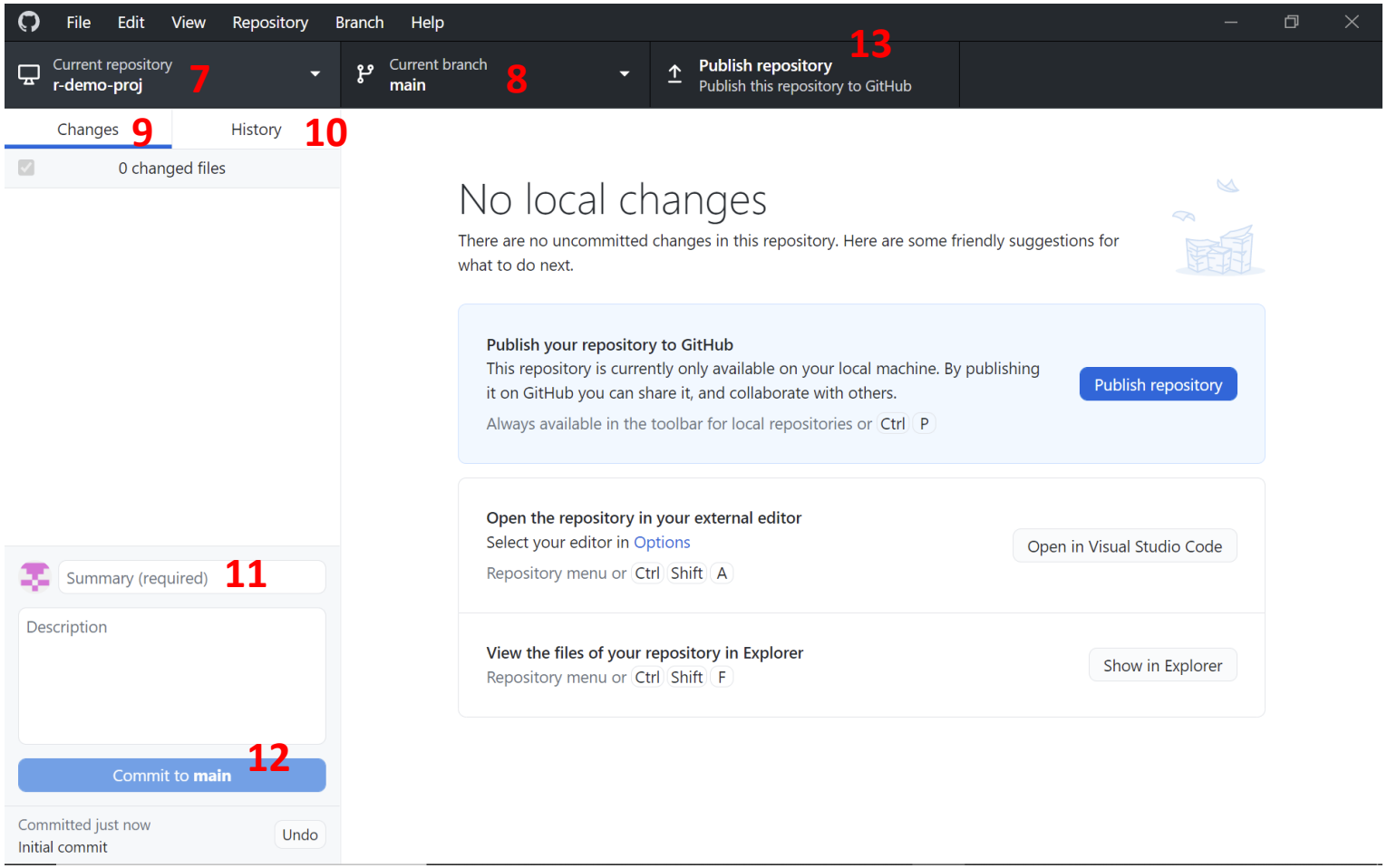
1. Create a new local git repo
2. Create or make changes to your files/code
3. Snapshot files to prepare versioning (stage the changes)
4. Record version history (commit the changes)
5. repeat (back to 2)…

Check commit history

Compare difference between changes

Create a New Local Git Repo



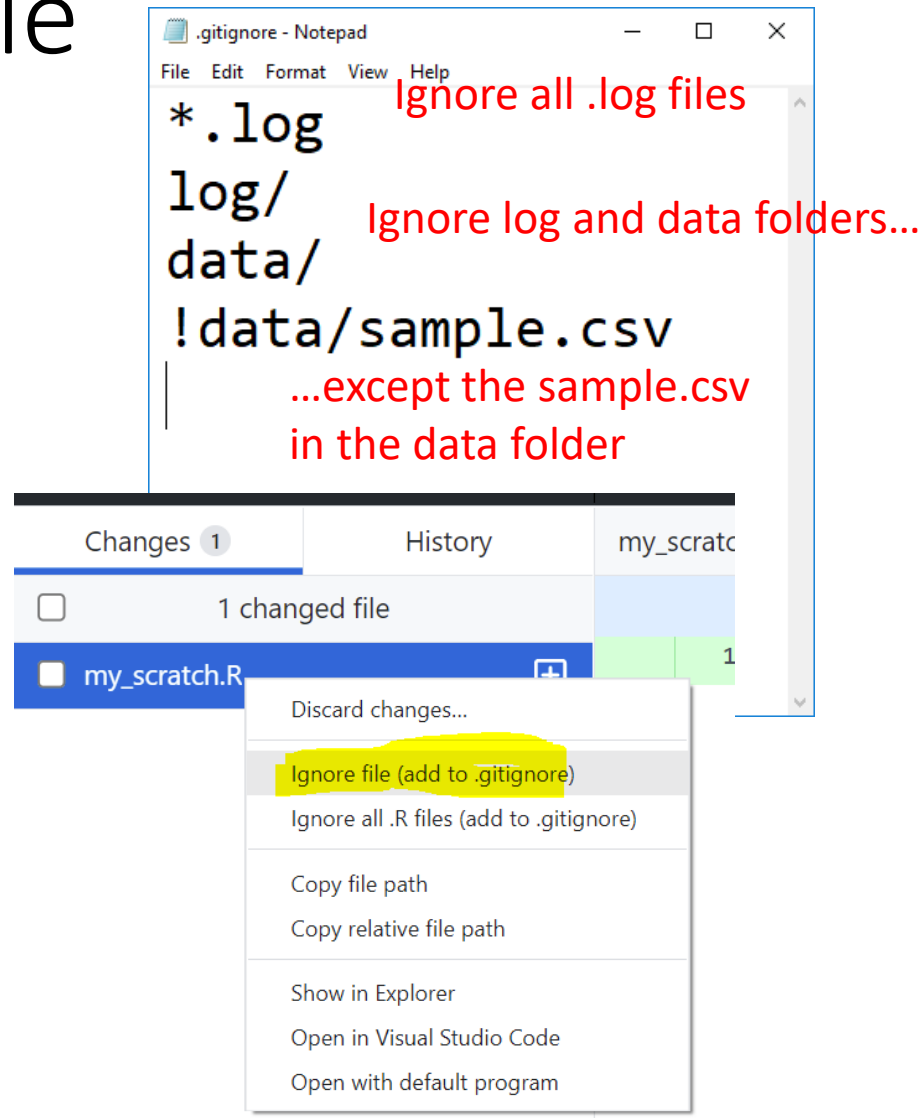


Suppress Tracking: .gitignore file

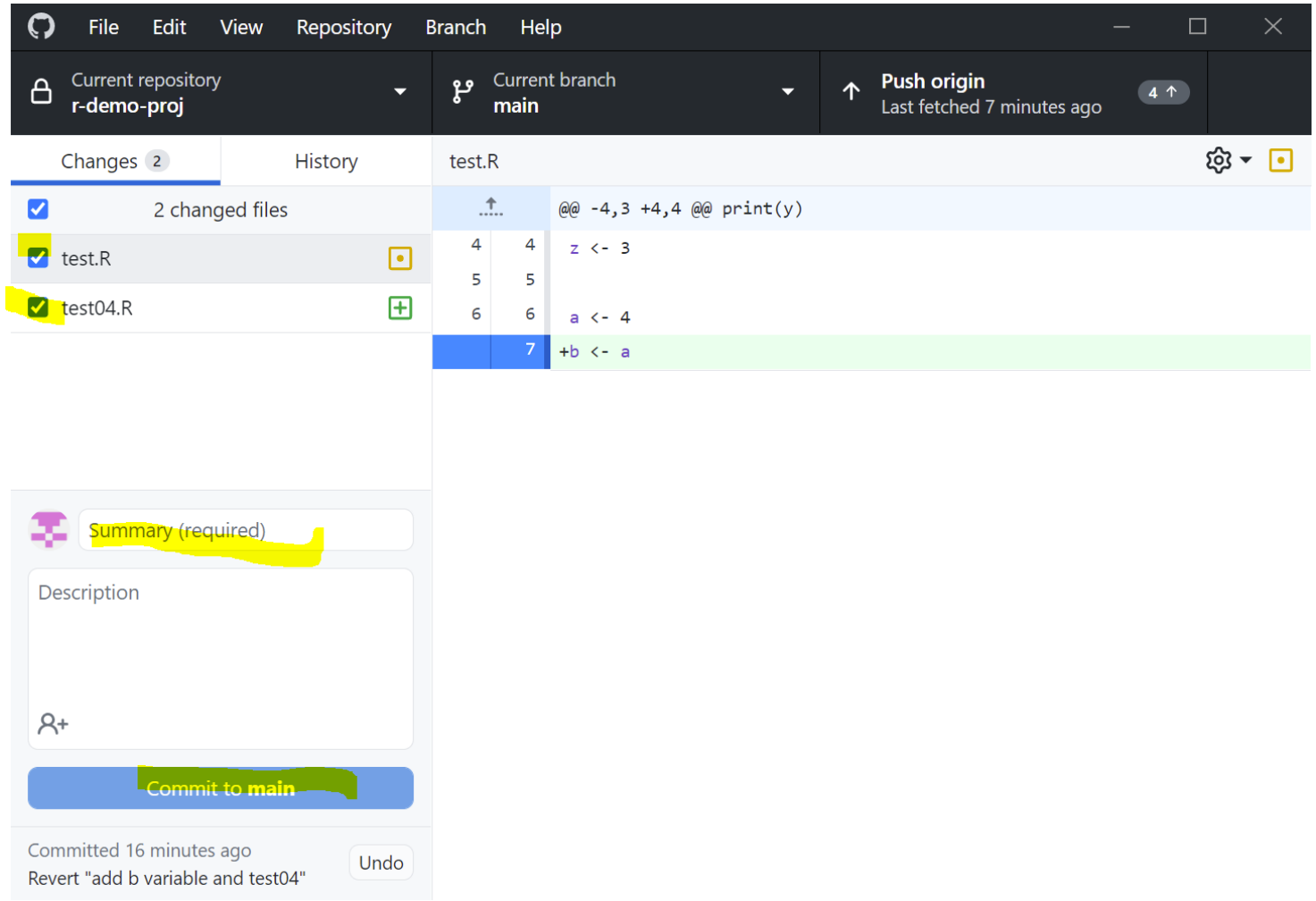
- You may not want to check in and push to GitHub
  - Large or confidential datasets
  - Intermediate or temporary files
    - generated by IDE or a compiler
  - Password/API key files

- a file named `.gitignore` in your git repo folder
  - e.g., `my_proj/.gitignore`

- A collection `.gitignore` templates
  - https://github.com/github/gitignore



Stage and Commit



The simplest git workflow (FYR)

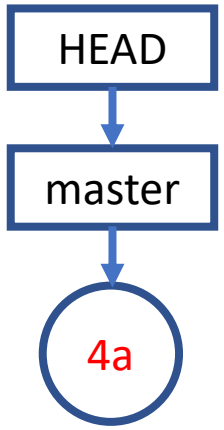
1. Create a new local git repo: `git init`
2. Create or make changes to your files/code
3. Snapshot files to prepare versioning (stage the changes): `git add`
4. Record version history (commit the changes): `git commit`
5. repeat (back to 2)…

Check commit history: `git log; git show`

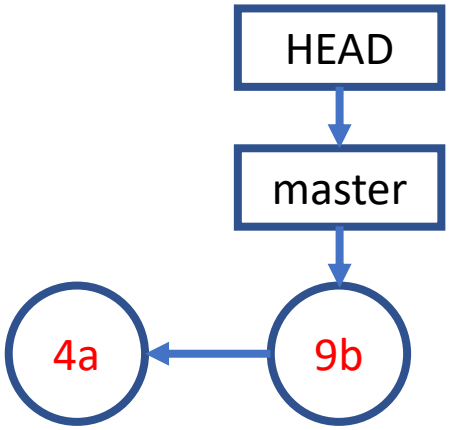
Compare difference between changes: `git diff`

Basic workflow command line details: https://tdmdal.github.io/git-workshop/basic-git-workflow.html

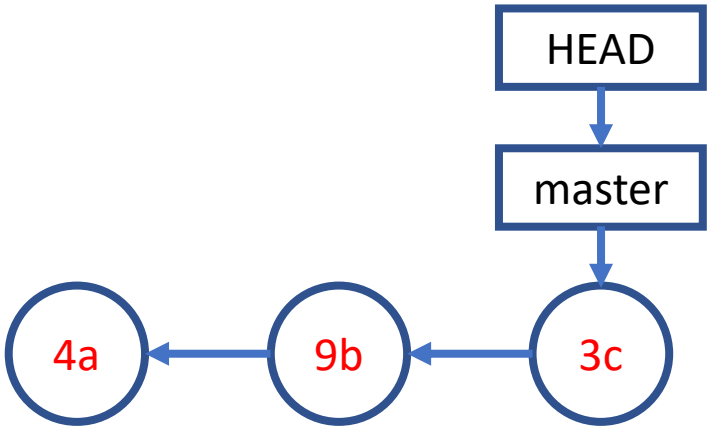
Git Concepts – First commit



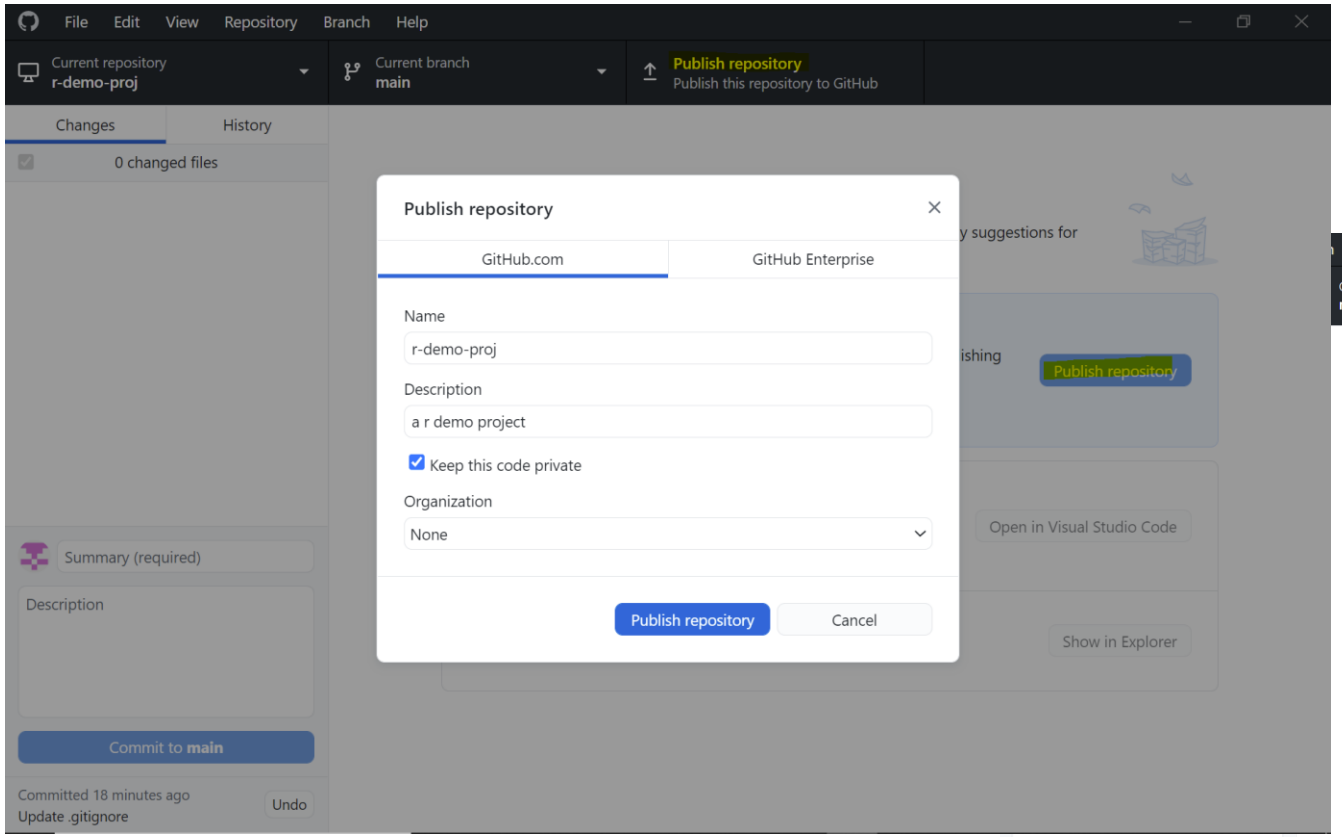
Git Concepts – Second commit

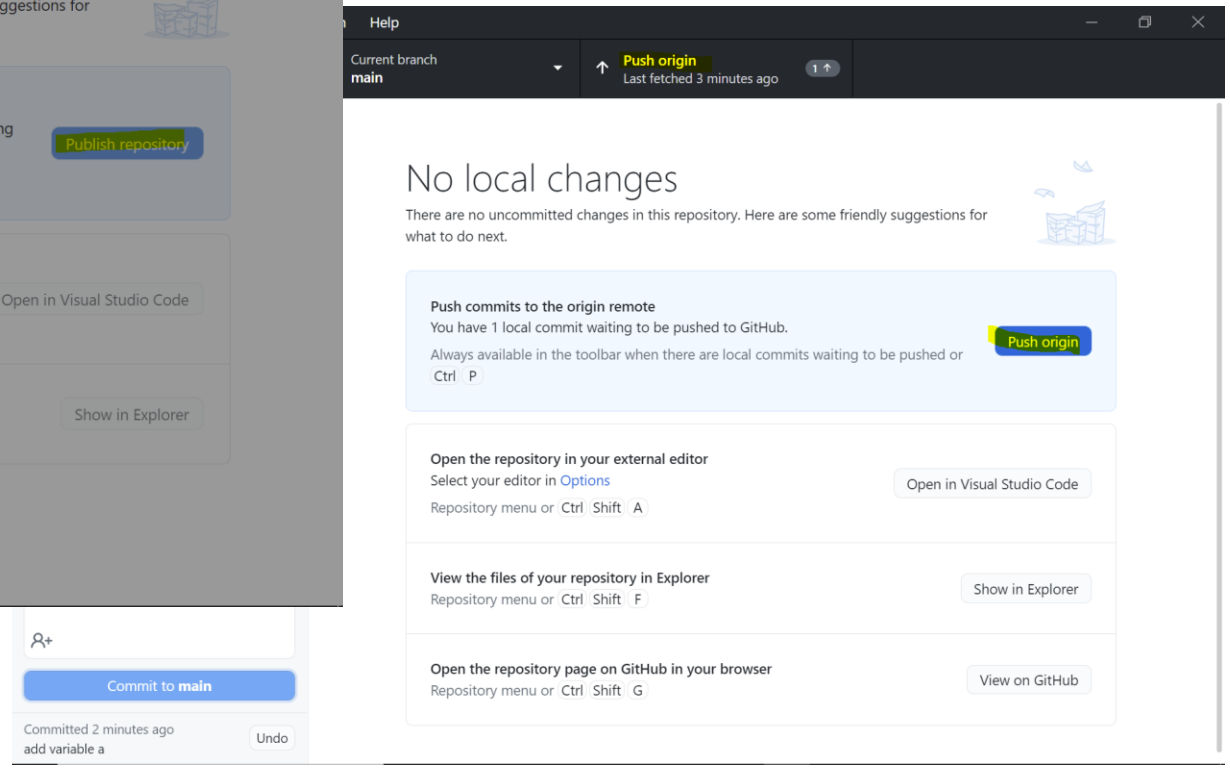


Git Concepts – Third commit and so on…



Publish/Push Local Repo to GitHub (demo)





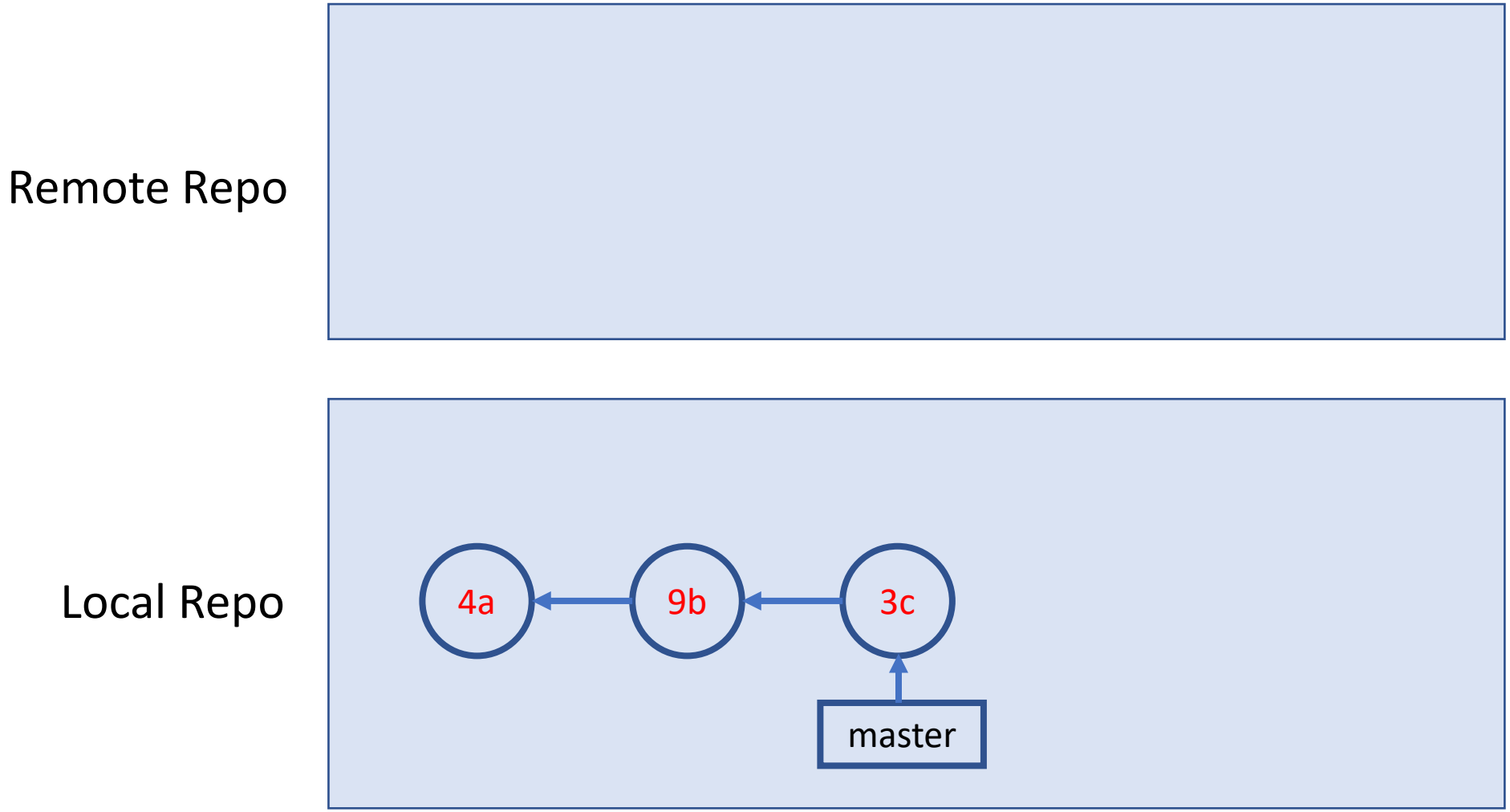
Publish/Push Local Repo to GitHub (FYR)

- Create a GitHub project repo

- Push your code there
  - backup
  - collaborate with your co-authors
  - collaborate with open-source community

```
git remote add
git push
```

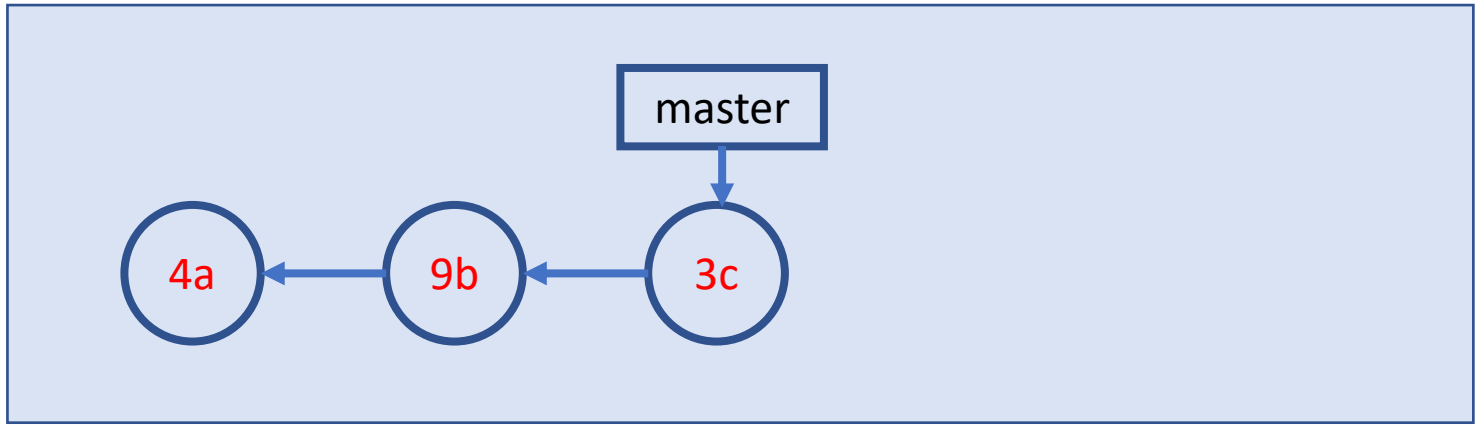
A Simple Remote Repo Workflow



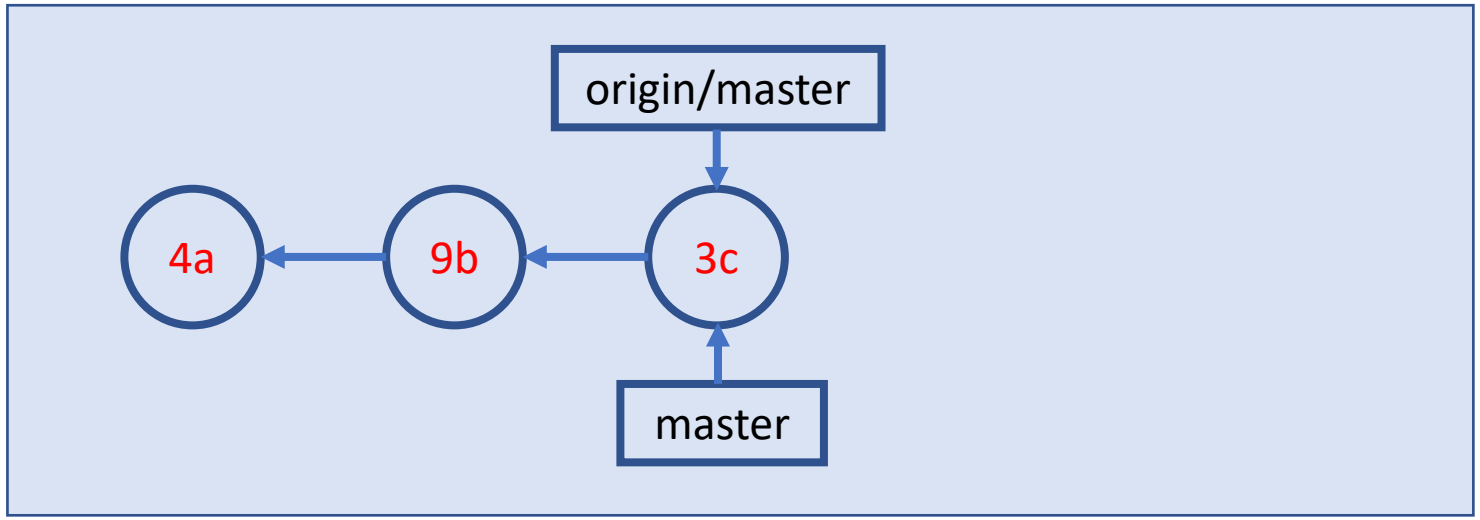
Source: [Git Essential Training](#) by Kevin Skoglund on LinkedIn Learning

A Simple Remote Repo Workflow `git push`

Remote Repo



Local Repo



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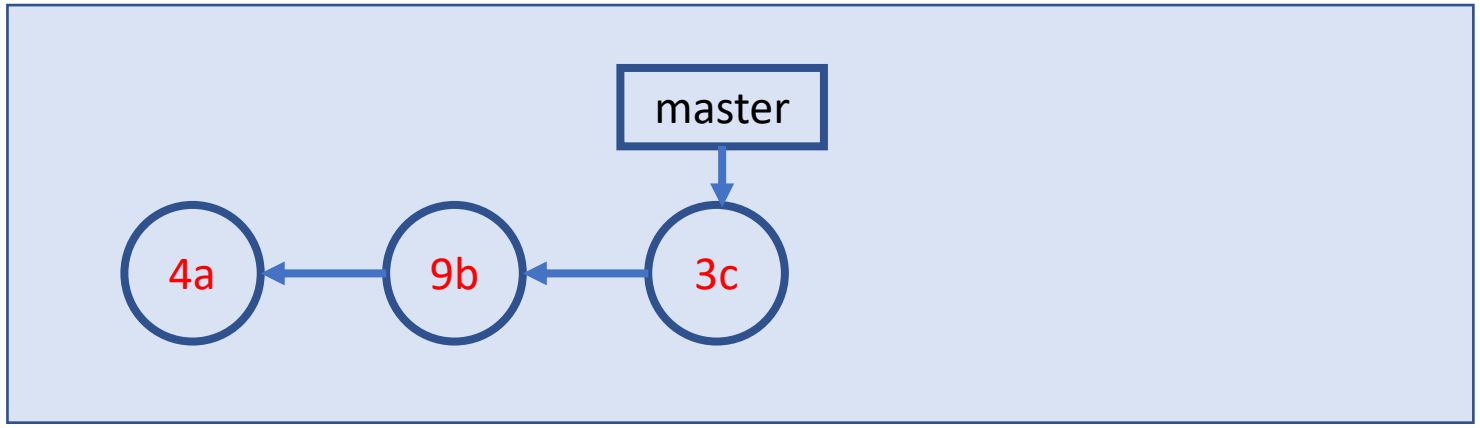
A Simple Remote Repo Workflow

Remote Repo



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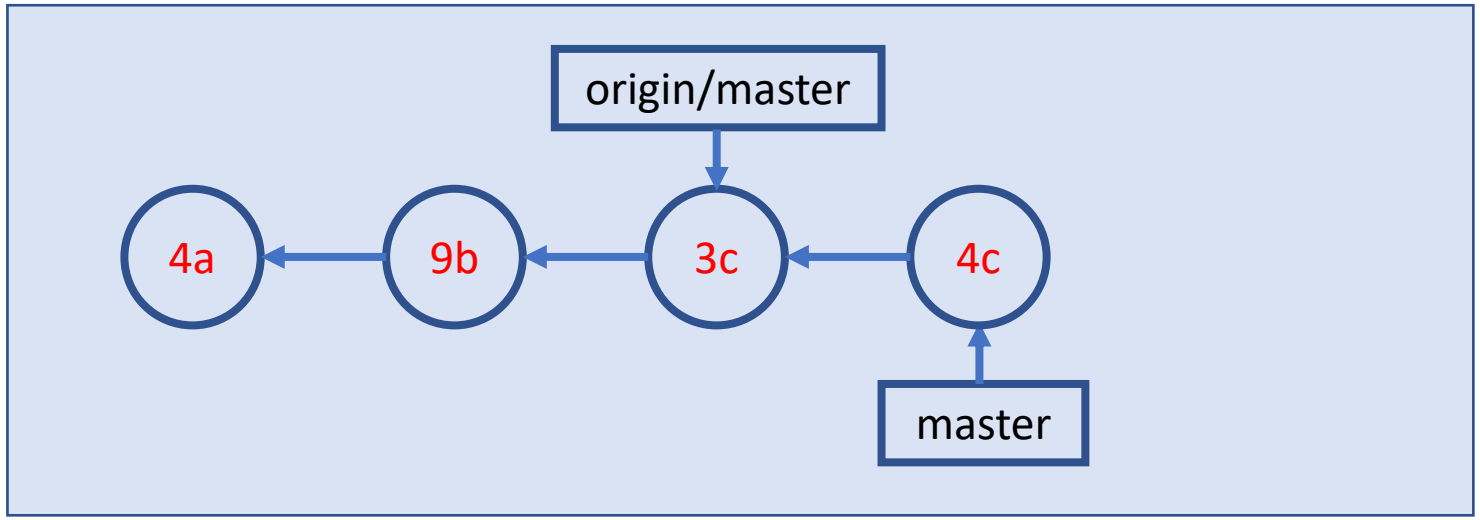

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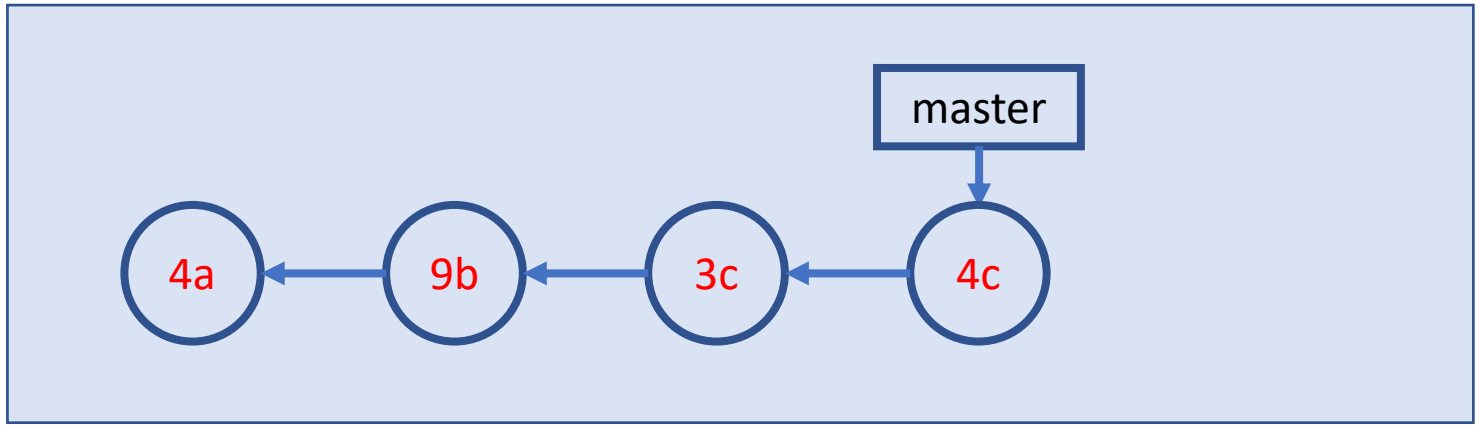
A Simple Remote Repo Workflow `git push`

Remote Repo



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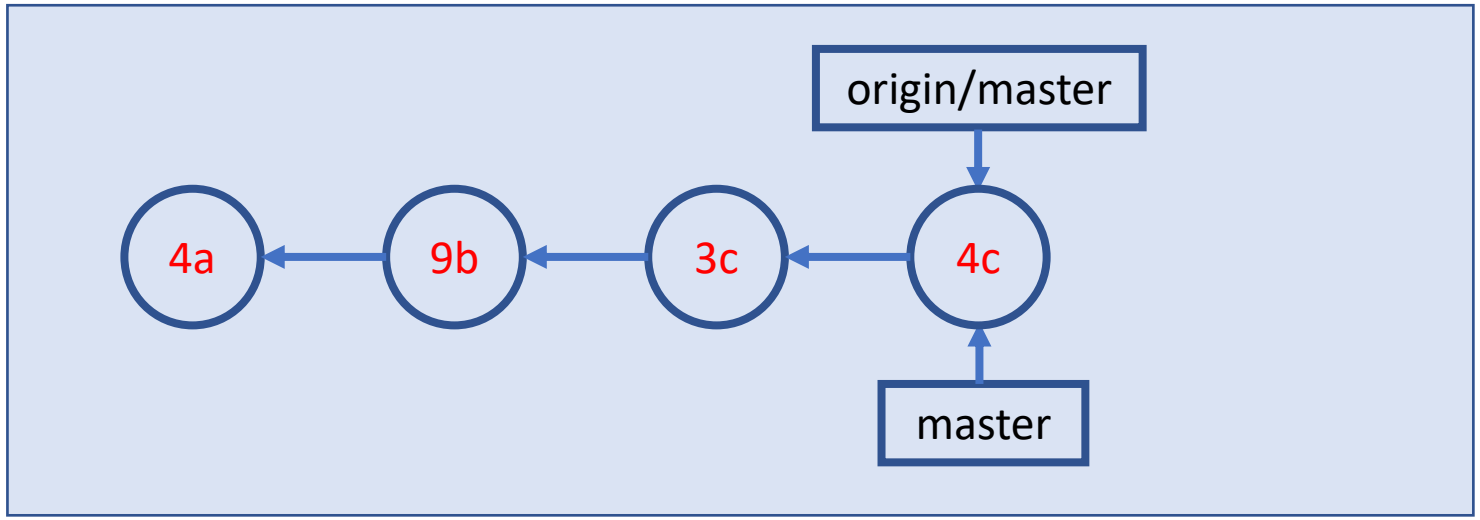
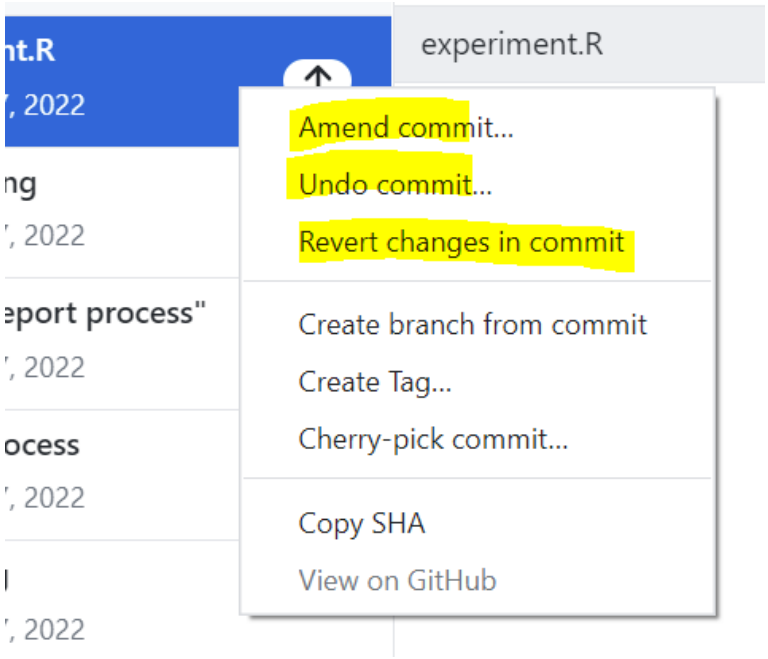


Source: [Git Essential Training](#) by Kevin Skoglund on LinkedIn Learning

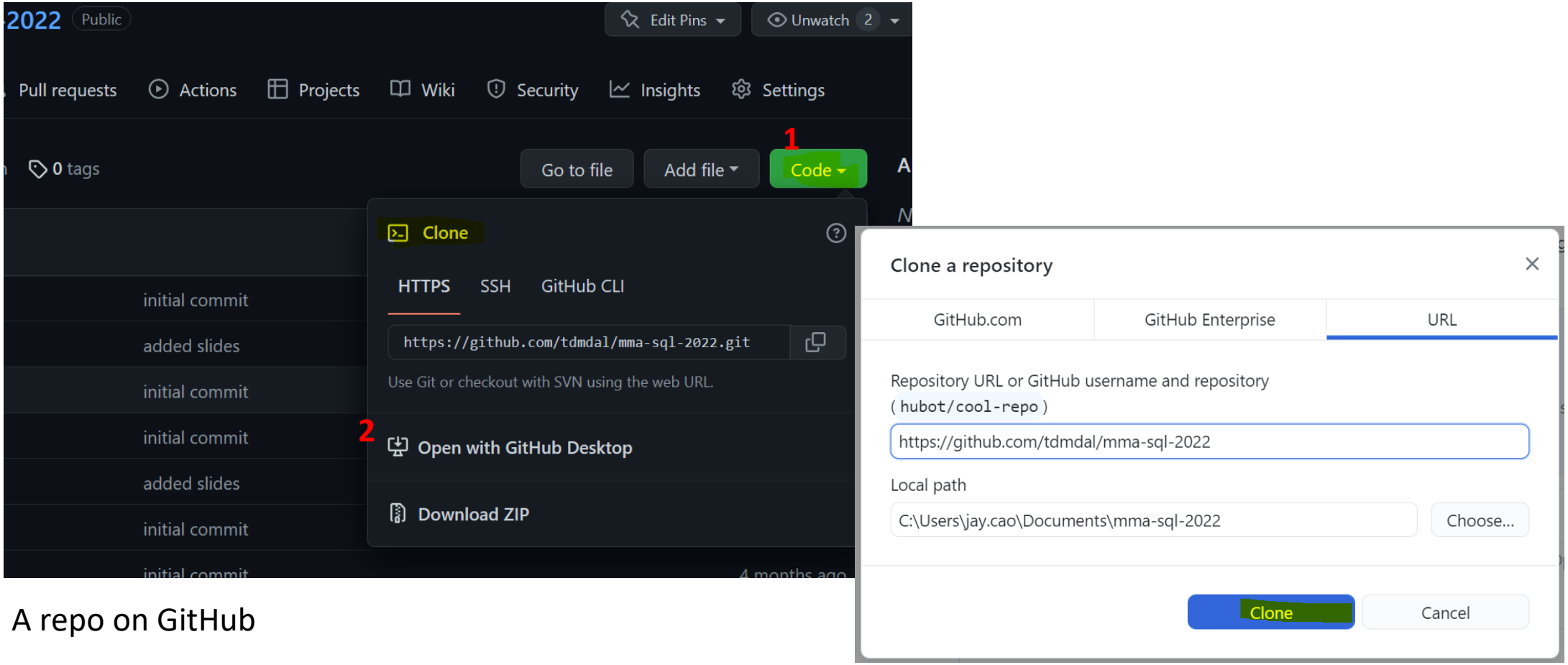
Amend, Undo, Revert, Remove & Rename

- Amend the last commit: change commit message or add new files to commit
  - In principle, don't do it if the commit is already pushed
- Undo the last commit: "uncommit" the last commit
  - Disabled by GitHub Desktop if the commit is already pushed
  - In general, don't change history
- Revert a previous commit: revert a previous code change, and commit it
  - May need to resolve conflict
- Remove or Rename a file



Note: Many other "undo" type of operations can be done in command line.

Clone a GitHub Repo



A repo on GitHub

Clone a GitHub Repo (FYR)

- Clone a GitHub Repo `git clone`
  - Clone your co-author's code (which you have granted access to)
  - Use a public repo as your project starting point

- What is Fork?

Many more to explore… (when needed)

- Git concept / command
  - branch & remote branch
  - merge conflict
  - git reset
  - git stash, rebase, bisect
  - …
- Git best practice
  - workflows
  - commit size / message
  - …

Source: https://xkcd.com/1296/

Resources

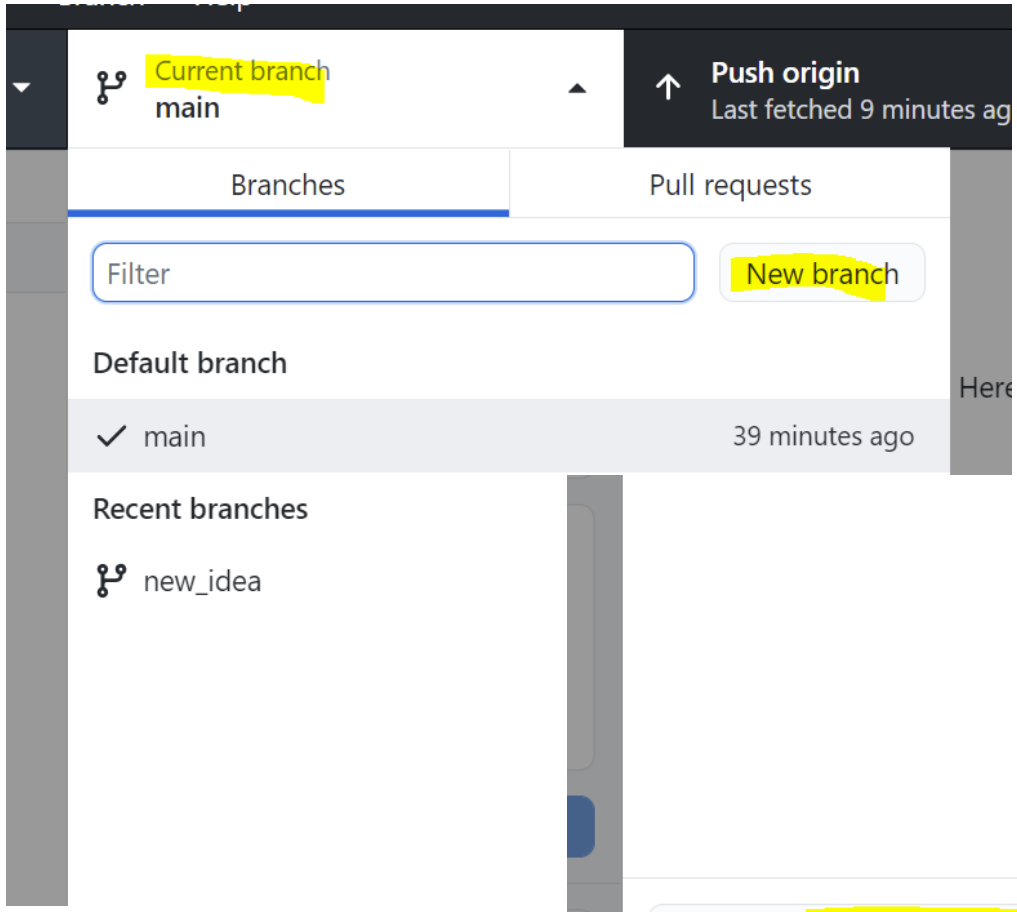
- Git/GitHub with GitHub Desktop
  - Youtube Video by Coder Coder (22mins; great review for today's workshop)

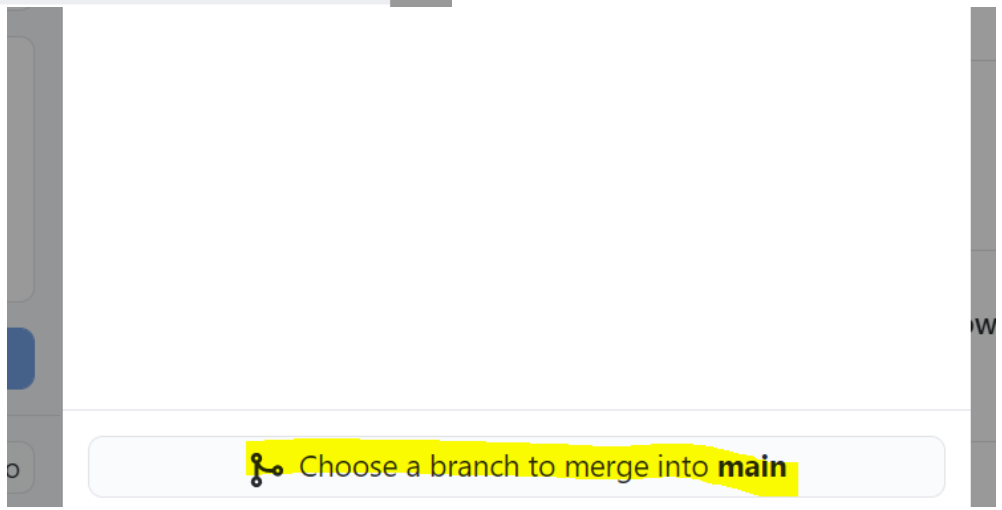
- Git Command Line Tutorials
  - Version Control with Git by Software Carpentry
  - Git Essential Training by Kevin Skoglund at LinkedIn Learning
    - Faculty and staff login from here for UofT free access
    - Toronto Public Library free access here for everyone with a library card
  - Get Started Tutorials from Bitbucket Atlassian
  - Getting Started with Git from GitHub

- Git Ref Book: https://git-scm.com/book/en/v2

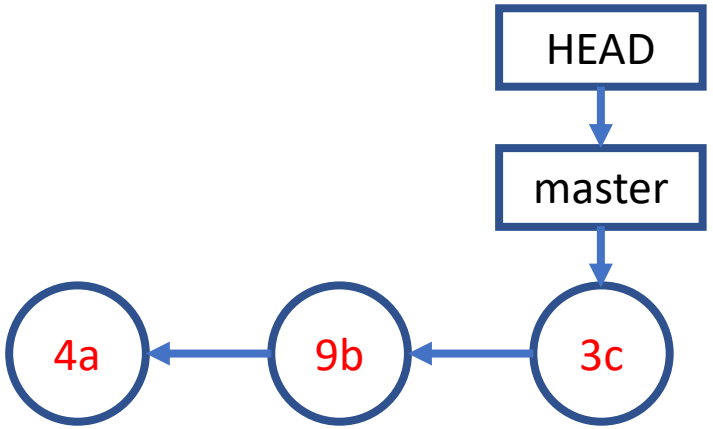
Two More Git Workflows

Branch and Merge (demo)





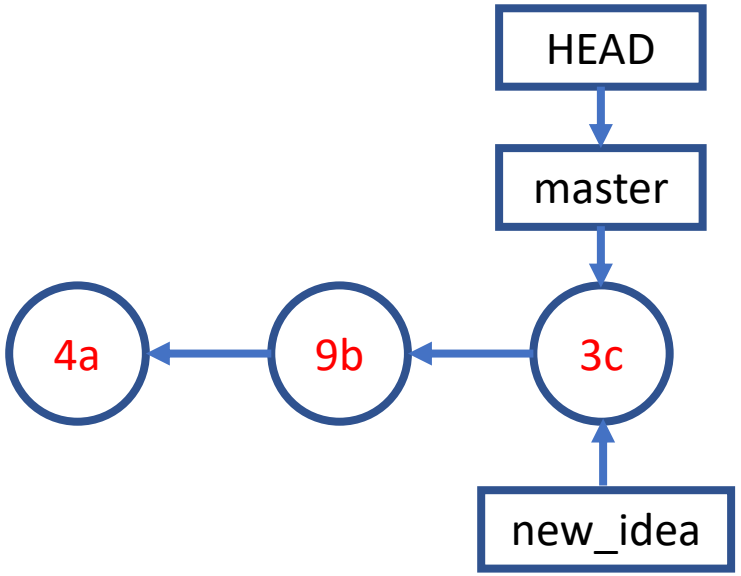
A Simple Branching Workflow



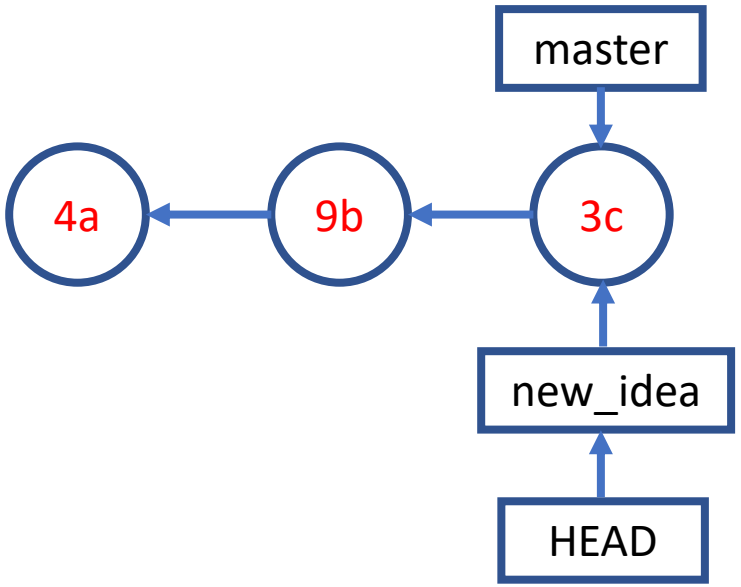
Source: [Git Essential Training](#) by Kevin Skoglund on LinkedIn Learning

A Simple Branching Workflow

```
git branch new_idea
```

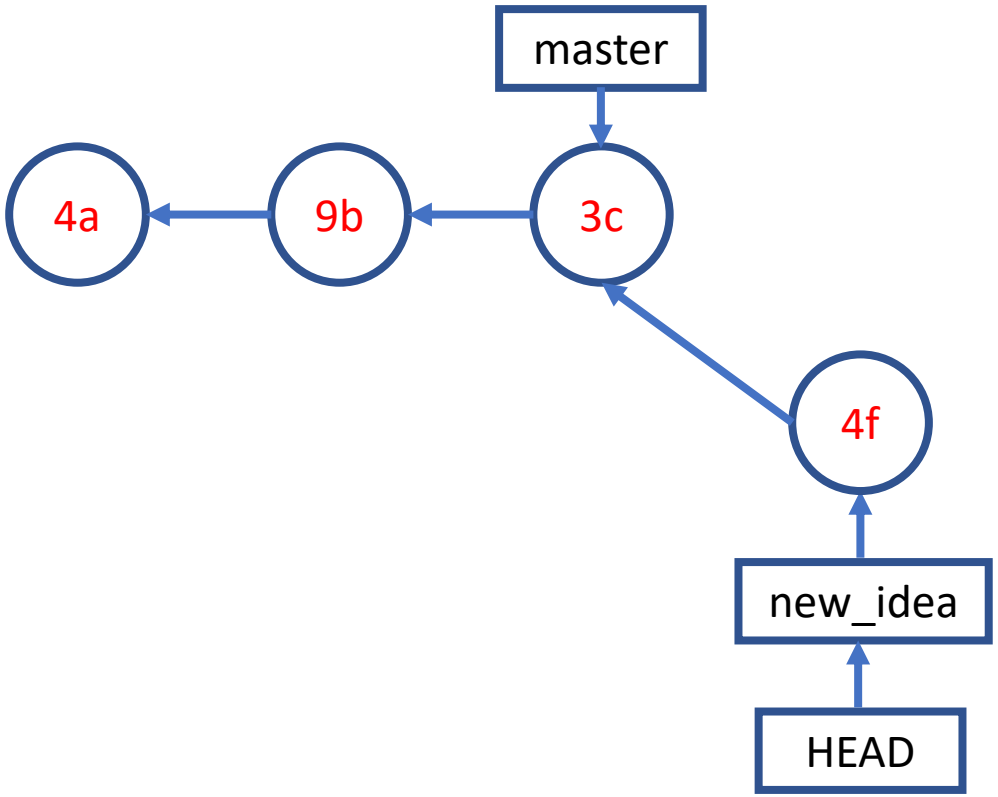


A Simple Branching Workflow `git checkout new_idea`

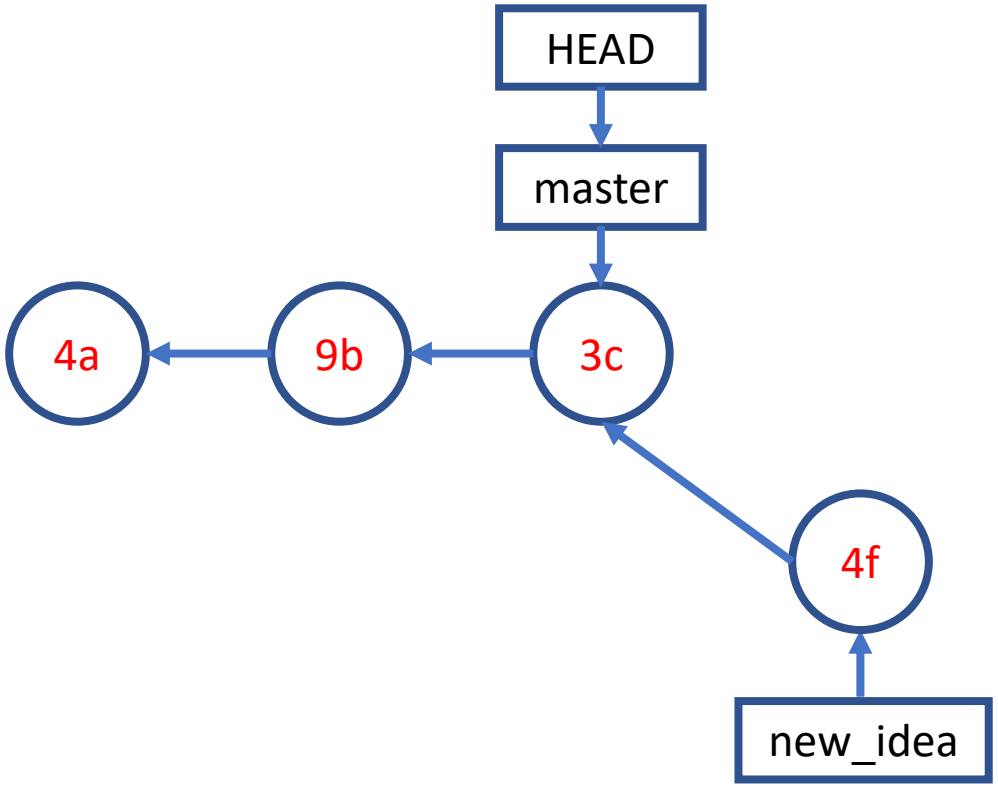


A Simple Branching Workflow

```
git add; git commit;
```

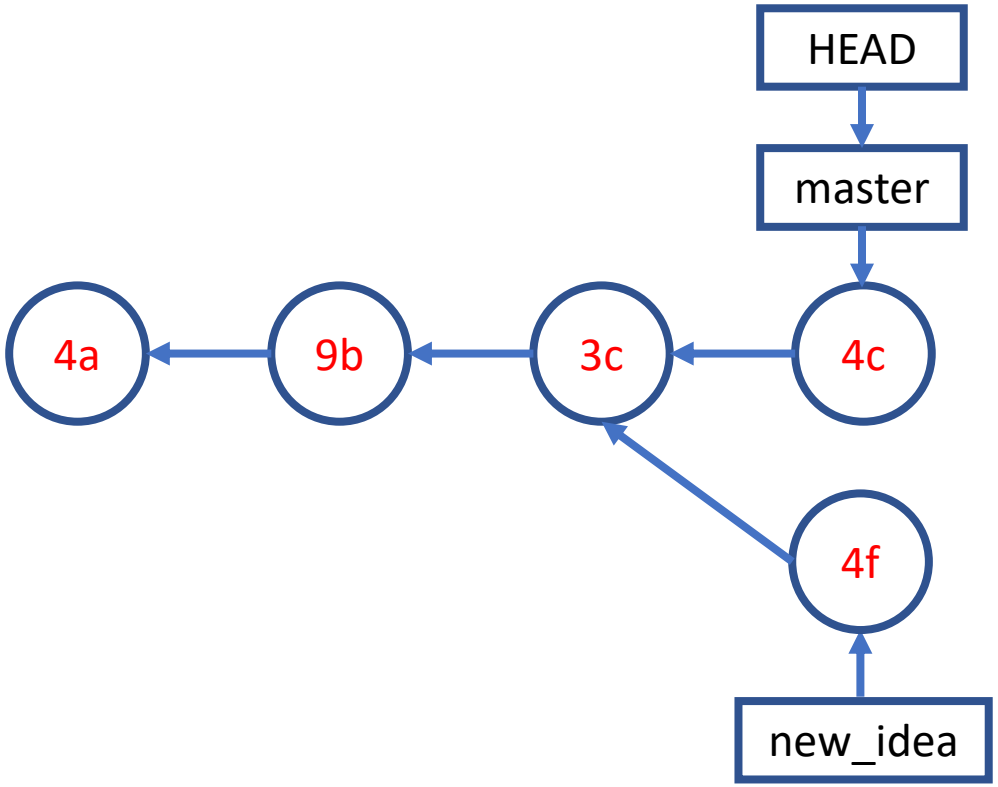


A Simple Branching Workflow `git checkout master`

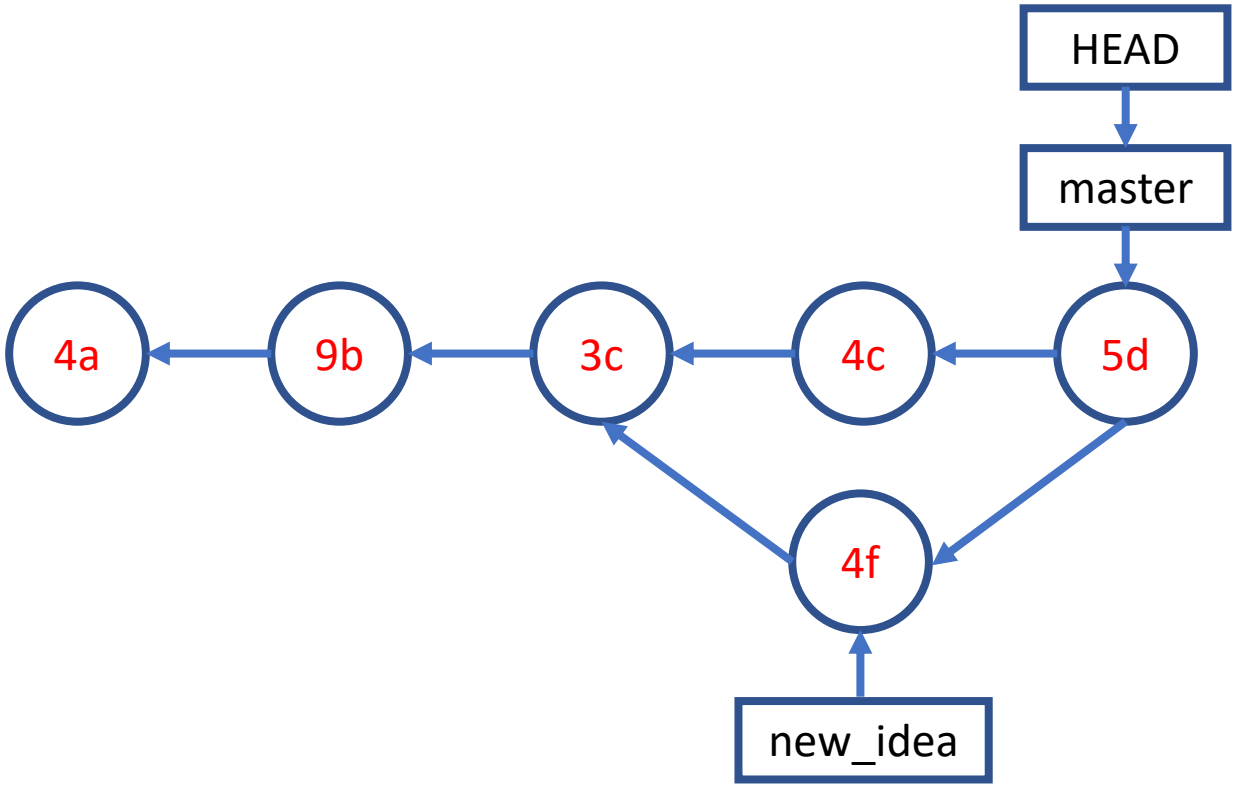


A Simple Branching Workflow

```
git add; git commit;
```

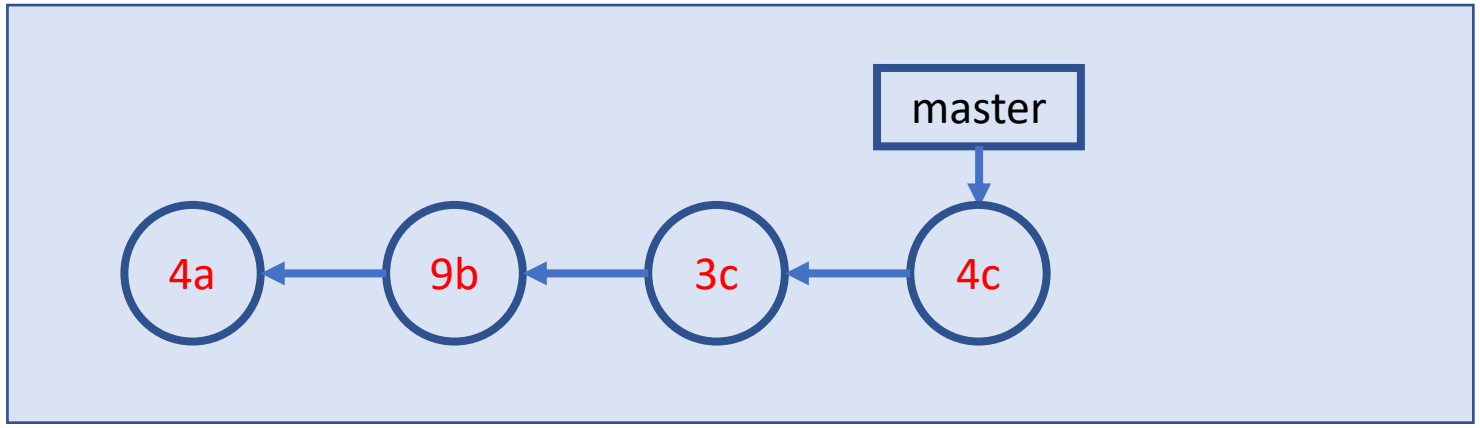


A Simple Branching Workflow `git merge new_idea`

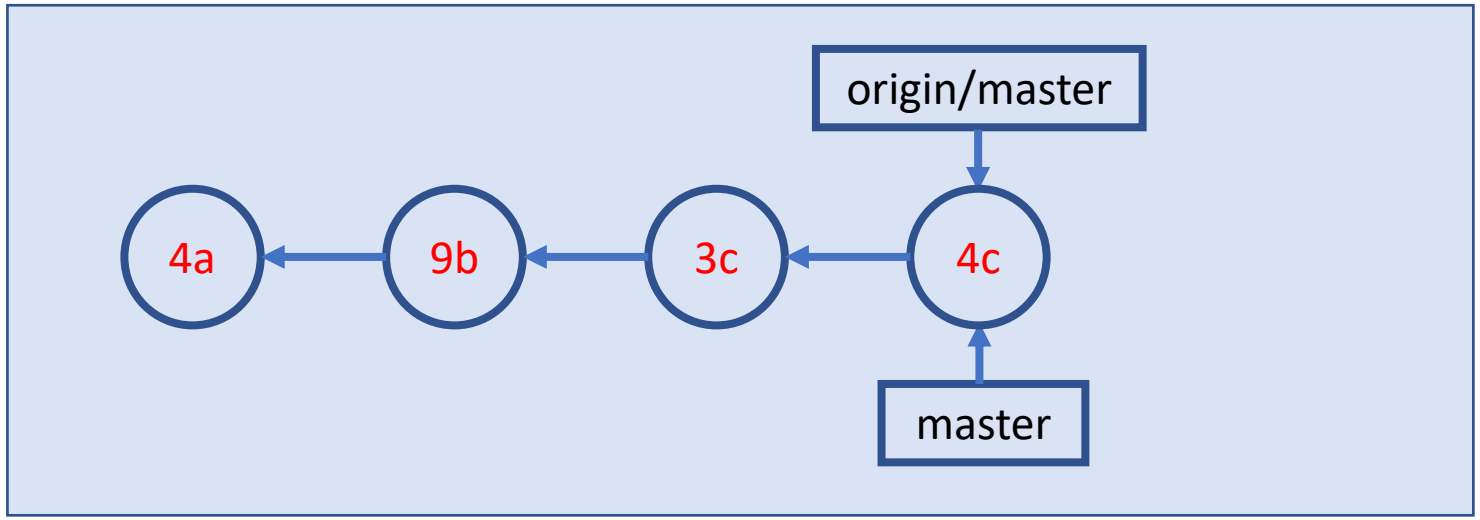


A Simple Collaboration Workflow

Remote Repo



Local Repo



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A Simple Collaboration Workflow

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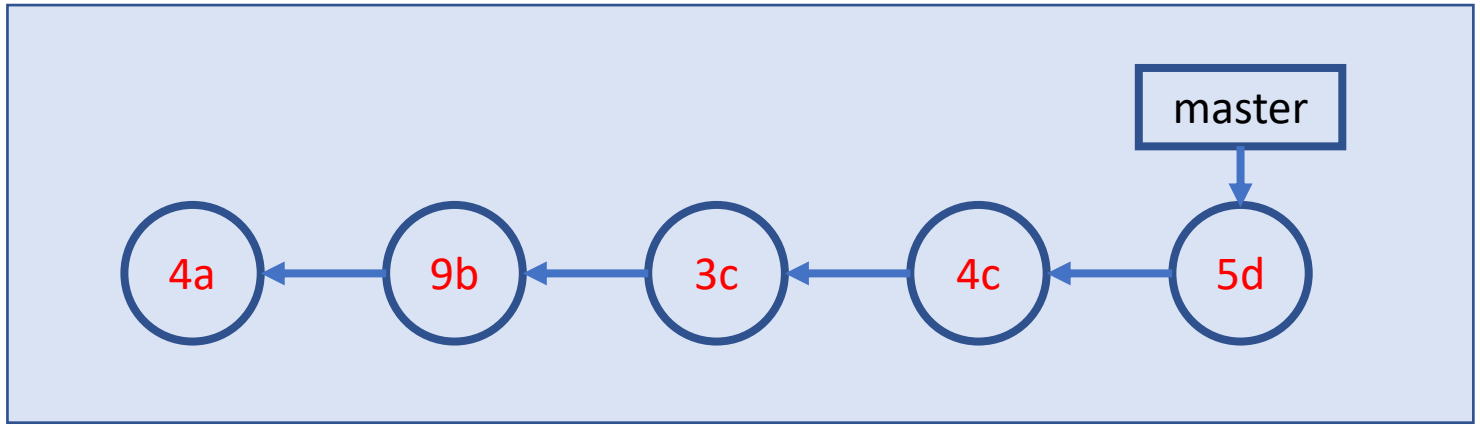

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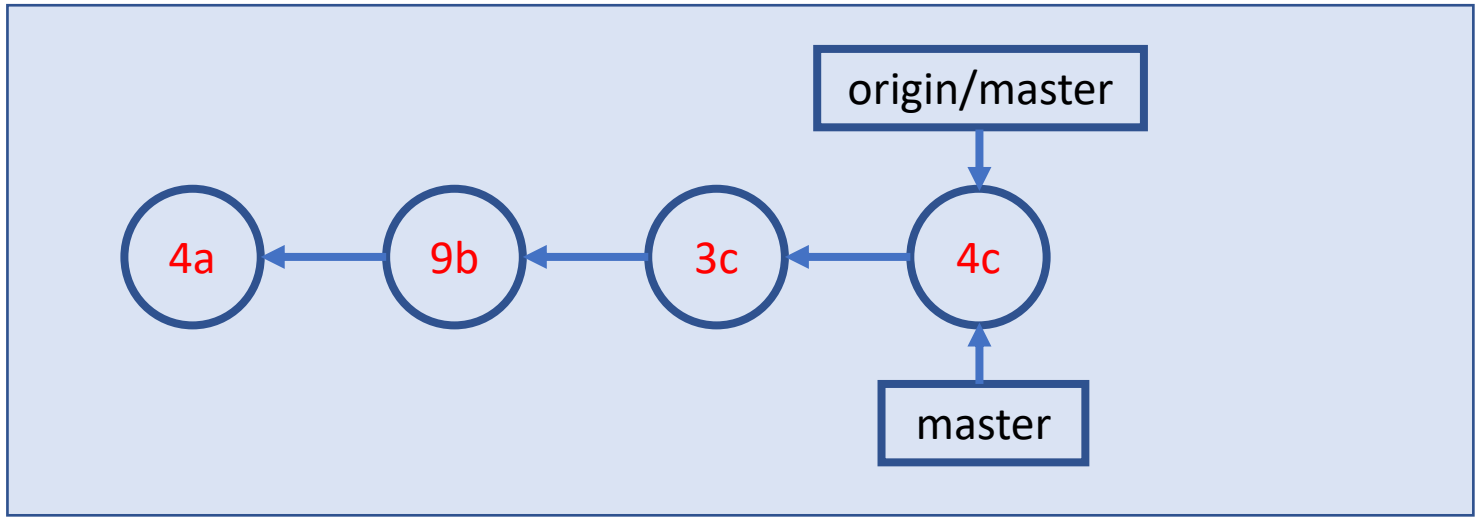
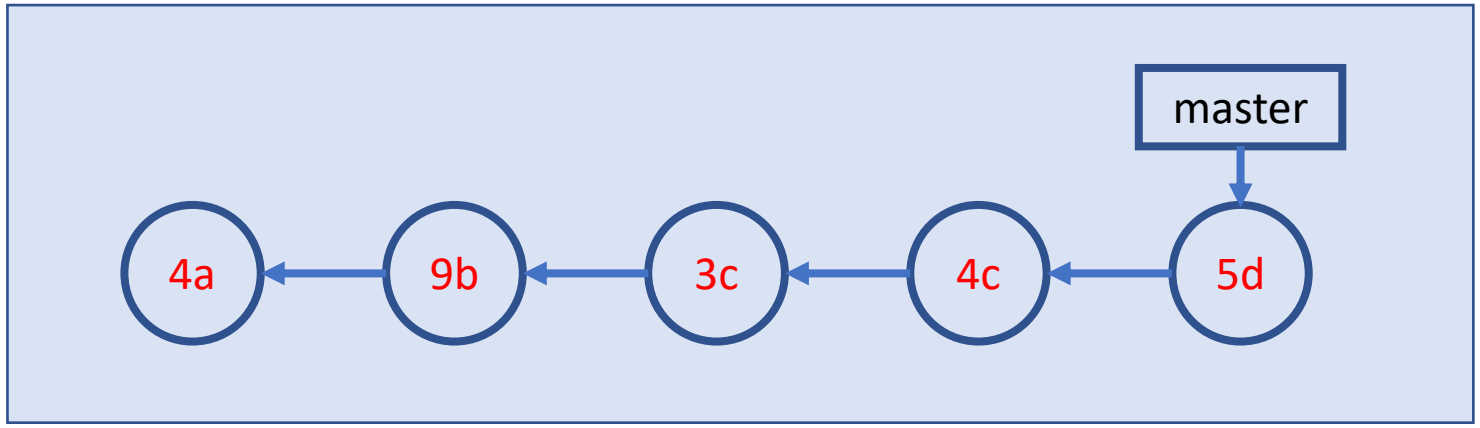


Source: [Git Essential Training](#) by Kevin Skoglund on LinkedIn Learning

A Simple Collaboration Workflow

`git fetch`

Remote Repo



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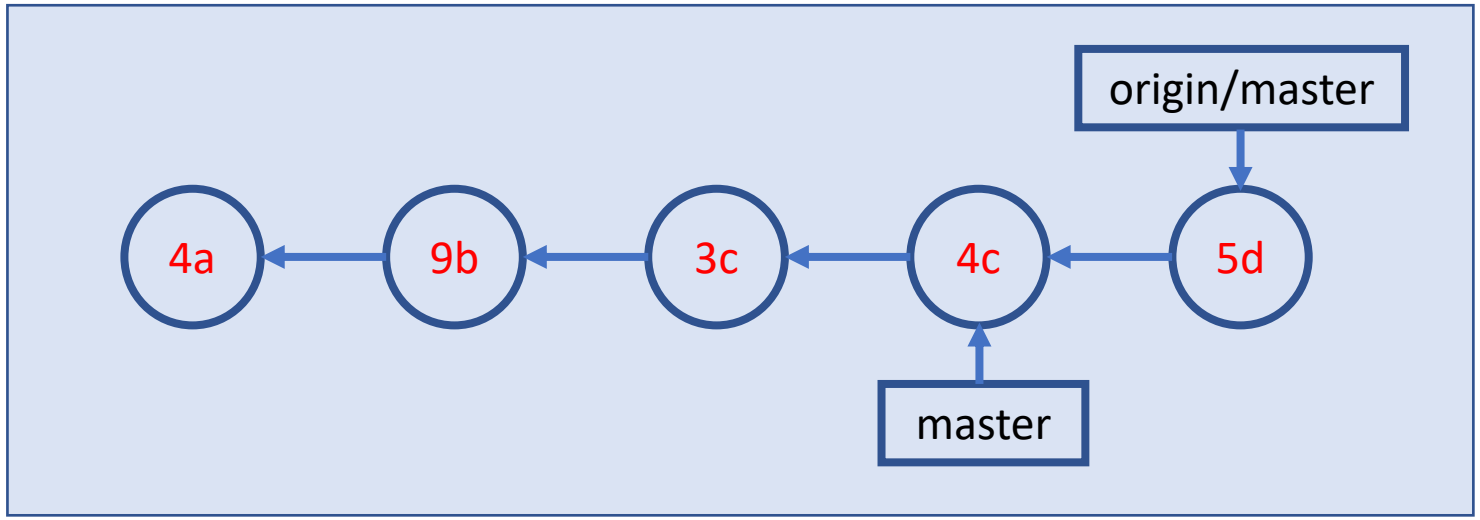
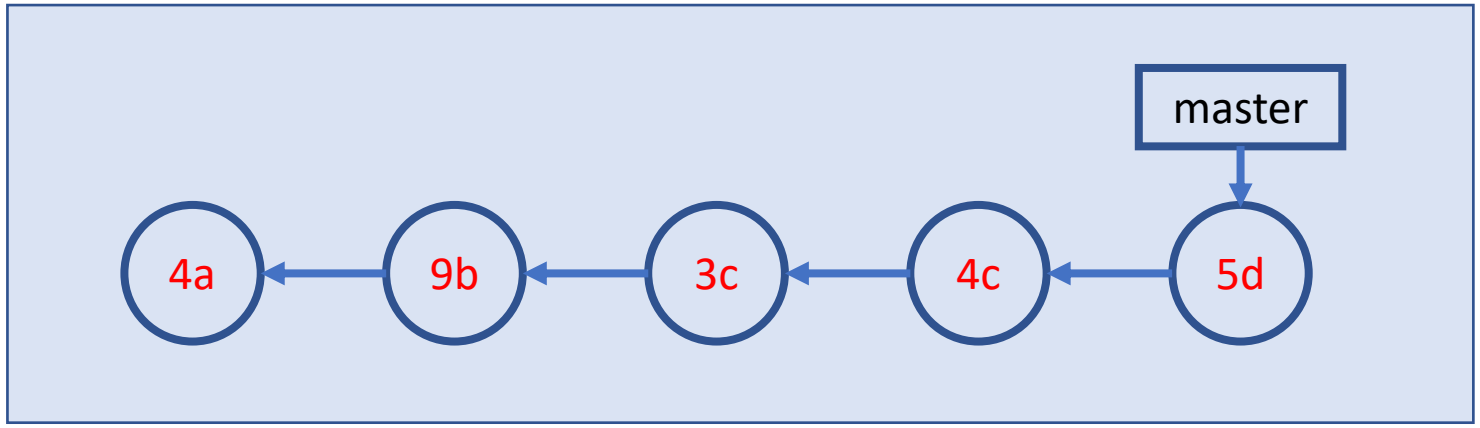


Source: [Git Essential Training](#) by Kevin Skoglund on LinkedIn Learning

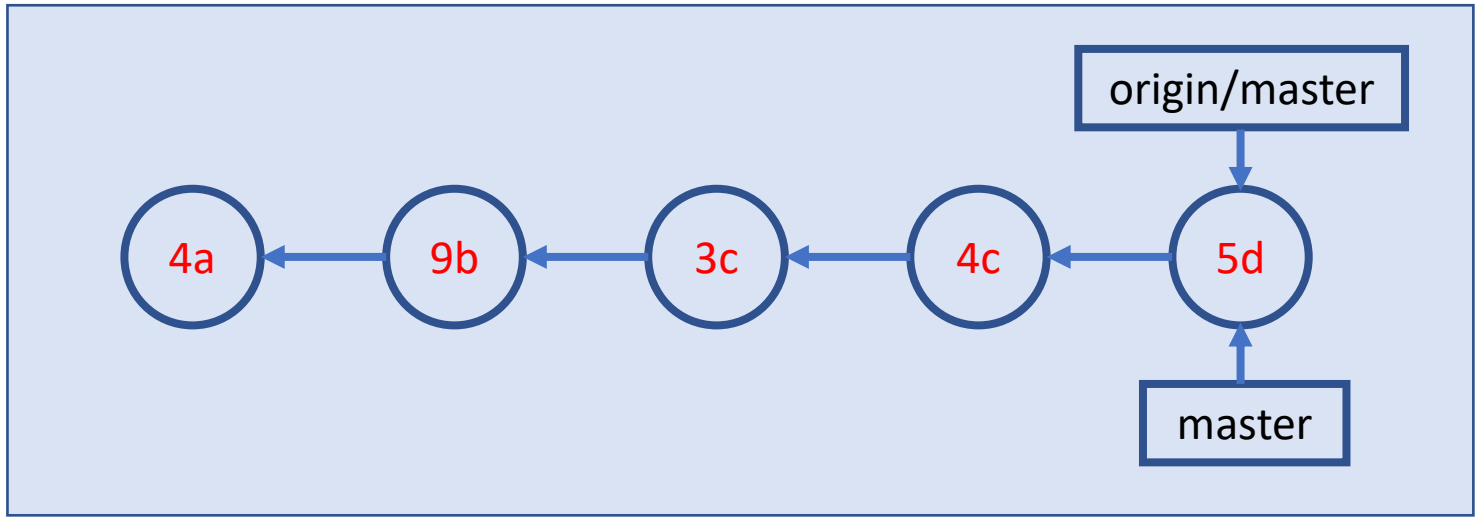
A Simple Collaboration Workflow

`git merge`

Remote Repo



Local Repo



Source: [Git Essential Training](#) by Kevin Skoglund on LinkedIn Learning; Note: git pull = git fetch + git merge

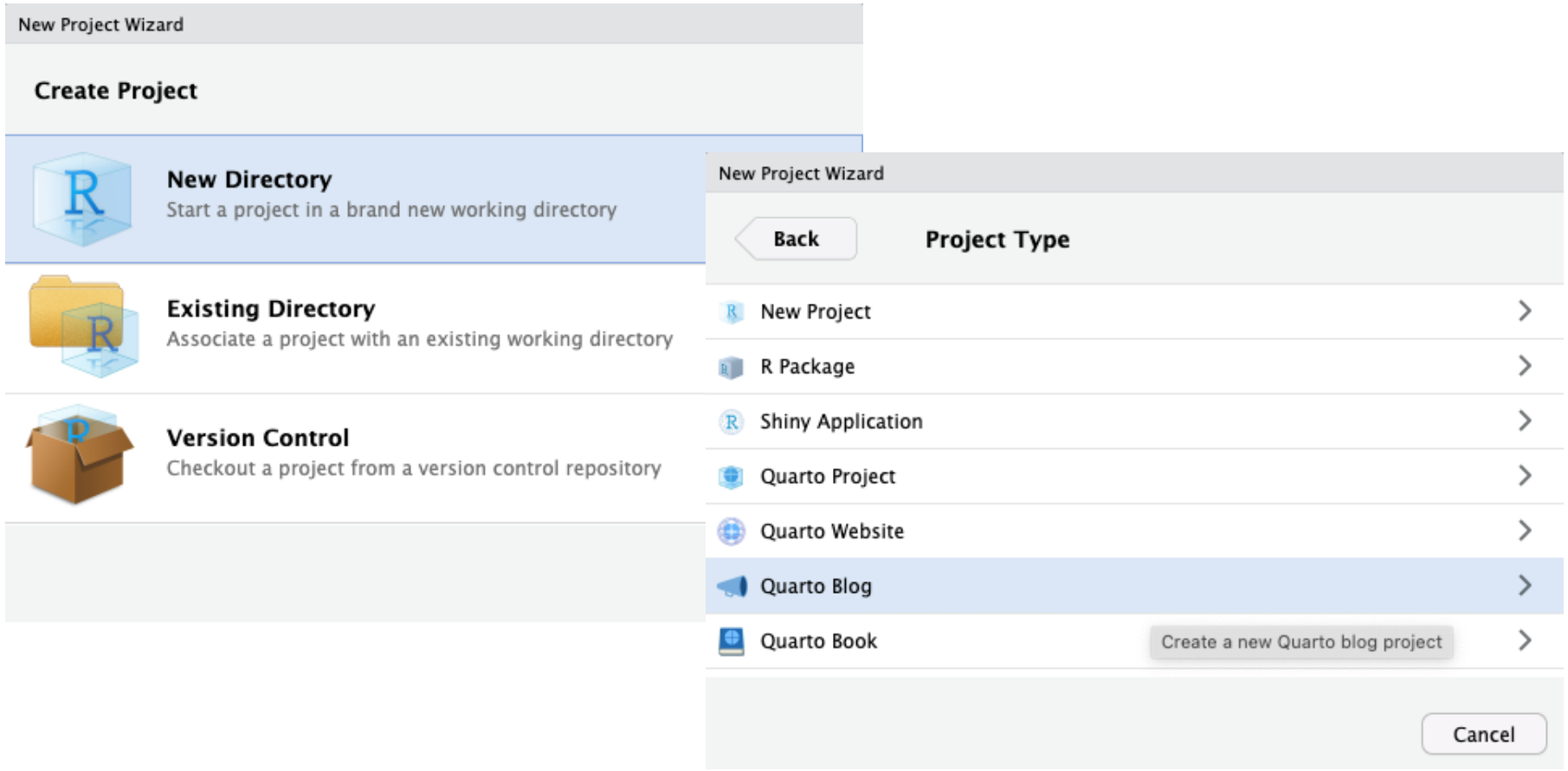
Build/Author a Blog Site
&
Host it on GitHub

Quarto

- An authoring and publishing system built on Pandoc
  - The workshop website is built using Quarto
- Authoring uses markdown
- Output can be html (website), PDF, or Word Doc.

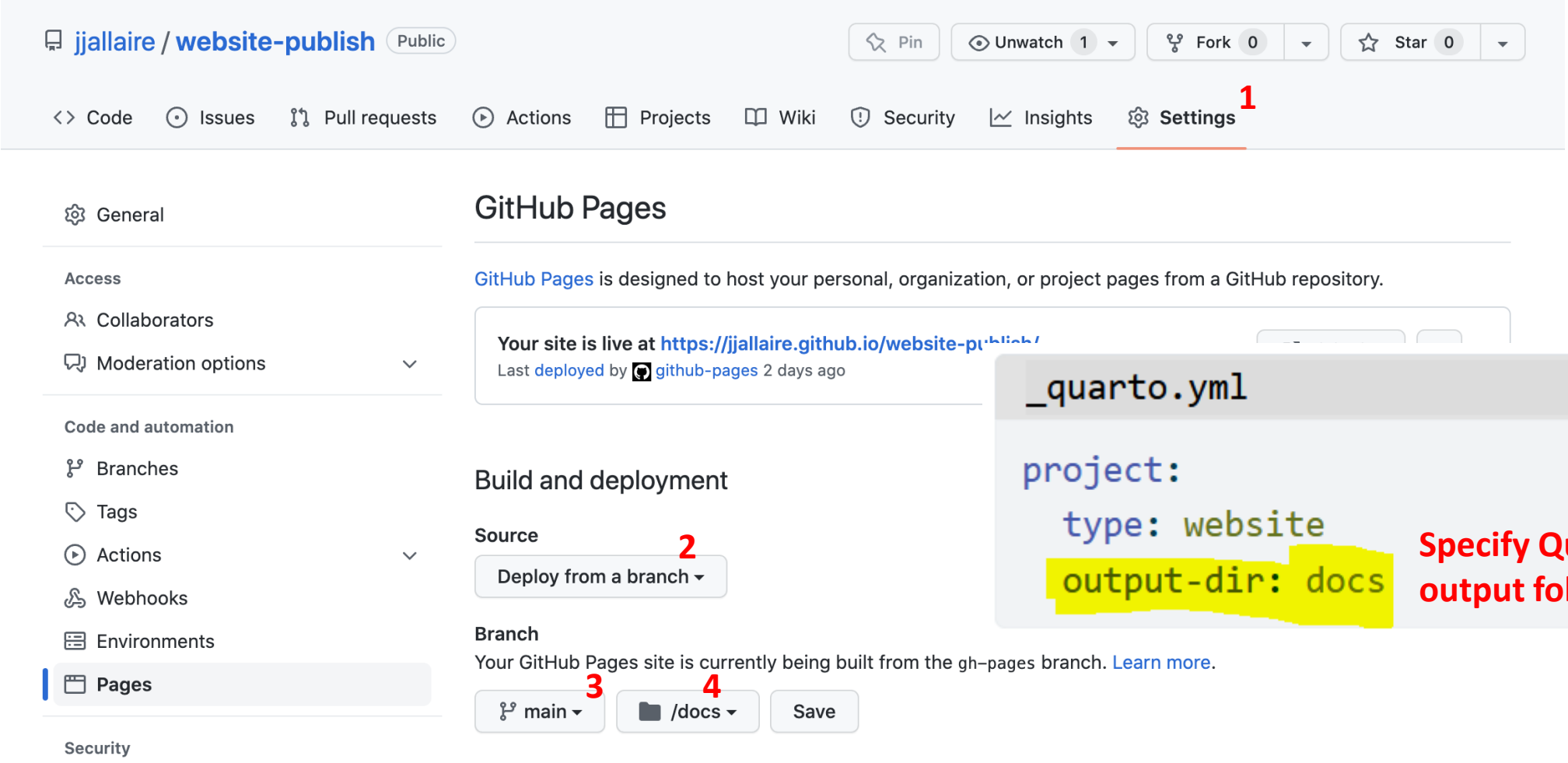
Ref: https://quarto.org/docs/get-started/hello/rstudio.html

Build a Blog Site



Note: You don't have to use R and RStudio to use Quarto
Ref: https://quarto.org/docs/websites/website-blog.html

Publish via GitHub Pages



_quarto.yml

```
project:
  type: website
  output-dir: docs
```

Specify Quarto output folder

Ref: https://quarto.org/docs/publishing/github-pages.html