Version Control with Git and GitHub
Winter Institute in Data Science

Ryan T. Moore

2023-01-05

Introducing Git + GitHub

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- *Distributed*: full codebase (current and history) lives on every developer's machine
- Originally written by Linus Torvalds (Linux)

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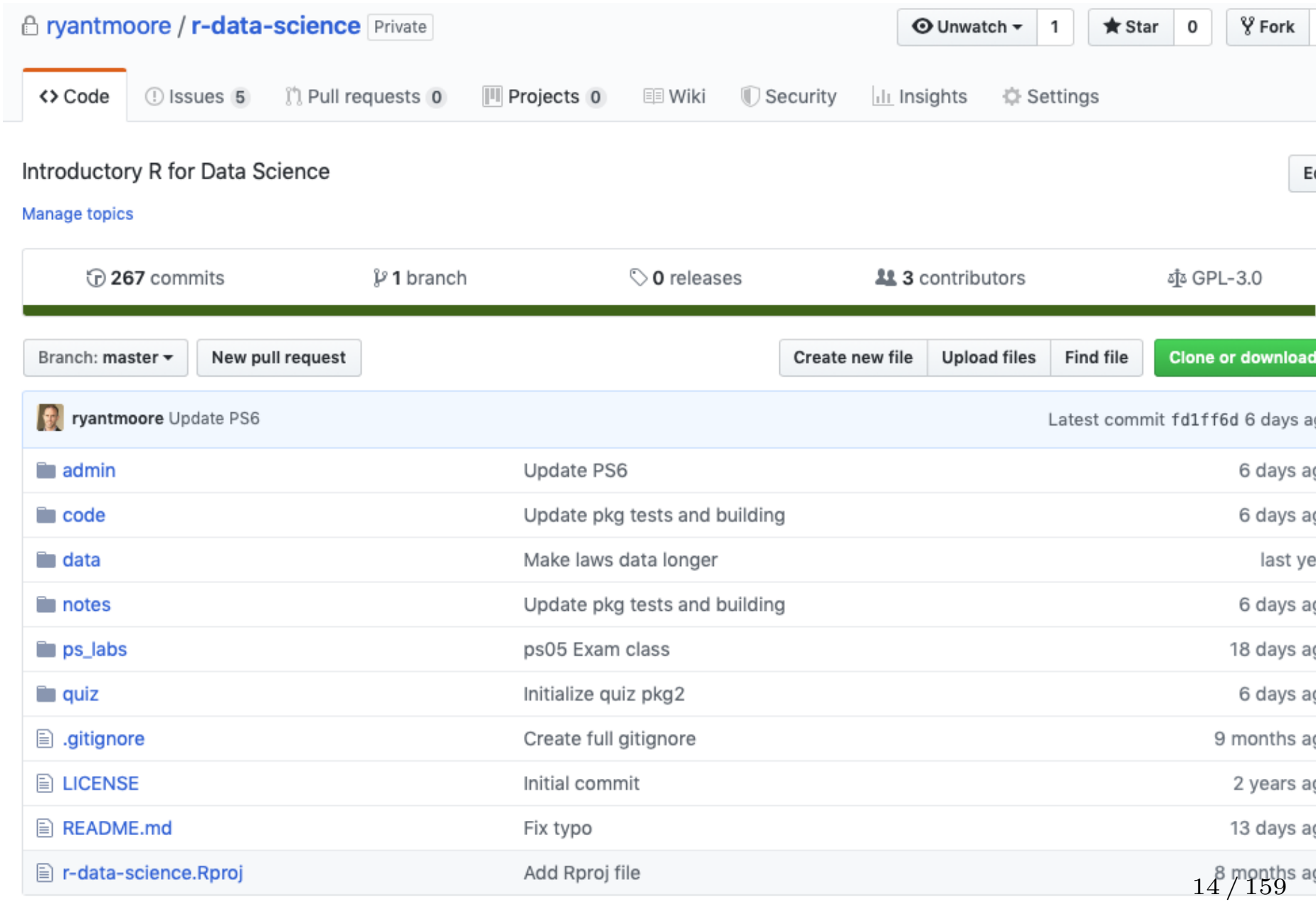
- Think Dropbox/GDrive, but better, more deliberate.
- Next step: Containers, Docker, Code Ocean

Examples


ryantmoore / r-data-science
Private
Unwatch 1
Star 0
Fork
Code
Issues 5
Pull requests 0
Projects 0
Wiki
Security
Insights
Settings
Introductory R for Data Science
Manage topics
267 commits
1 branch
0 releases
3 contributors
GPL-3.0
Branch: master
New pull request
Create new file
Upload files
Find file
Clone or download
ryantmoore Update PS6
Latest commit fd1ff6d 6 days ag
admin Update PS6 6 days ag
code Update pkg tests and building 6 days ag
data Make laws data longer last ye
notes Update pkg tests and building 6 days ag
ps_labs ps05 Exam class 18 days ag
quiz Initialize quiz pkg2 6 days ag
.gitignore Create full gitignore 9 months ag
LICENSE Initial commit 2 years ag
README.md Fix typo 13 days ag
r-data-science.Rproj Add Rproj file 8 months ag

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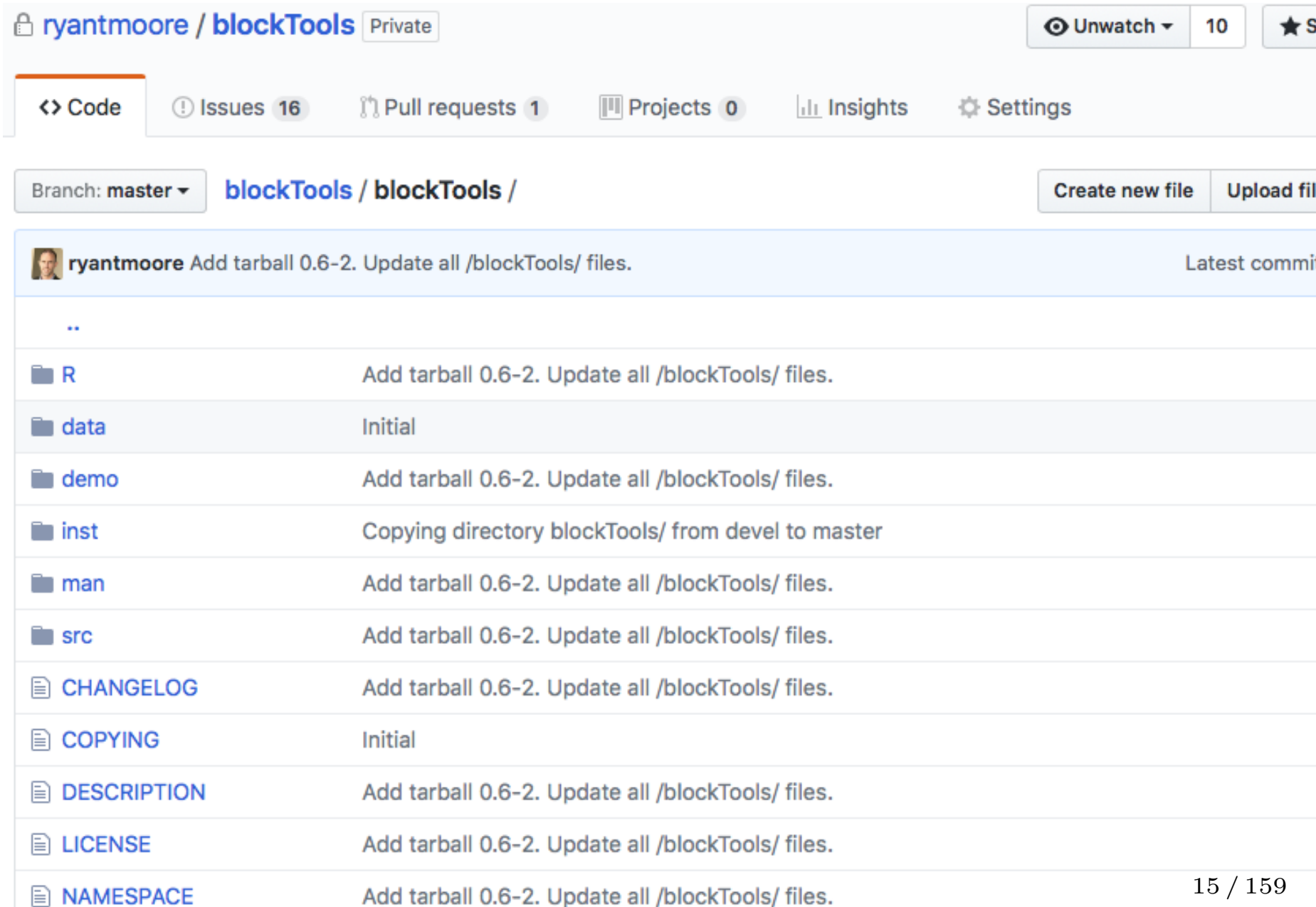
ryantmoore / blockTools Private
Unwatch 10
Code
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Pull requests 1
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Insights
Settings
Branch: master
blockTools / blockTools /
Create new file
Upload fil
ryantmoore Add tarball 0.6-2. Update all /blockTools/ files.
Latest commi
..
R Add tarball 0.6-2. Update all /blockTools/ files.
data Initial
demo Add tarball 0.6-2. Update all /blockTools/ files.
inst Copying directory blockTools/ from devel to master
man Add tarball 0.6-2. Update all /blockTools/ files.
src Add tarball 0.6-2. Update all /blockTools/ files.
CHANGELOG Add tarball 0.6-2. Update all /blockTools/ files.
COPYING Initial
DESCRIPTION Add tarball 0.6-2. Update all /blockTools/ files.
LICENSE Add tarball 0.6-2. Update all /blockTools/ files.
NAMESPACE Add tarball 0.6-2. Update all /blockTools/ files.

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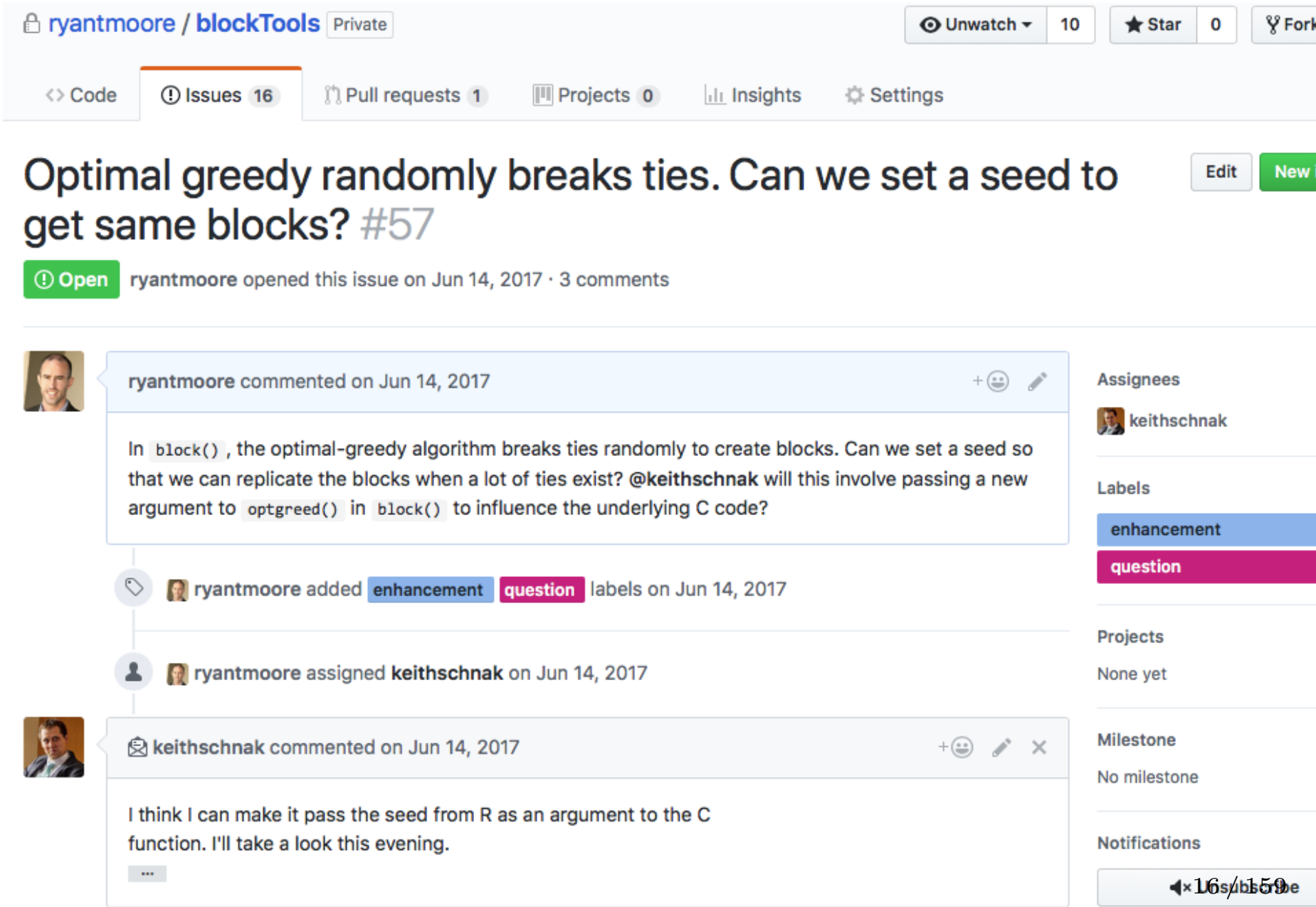
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Settings
Optimal greedy randomly breaks ties. Can we set a seed to get same blocks? #57
Edit
New
Open
ryantmoore opened this issue on Jun 14, 2017 · 3 comments
ryantmoore commented on Jun 14, 2017
In block(), the optimal-greedy algorithm breaks ties randomly to create blocks. Can we set a seed so that we can replicate the blocks when a lot of ties exist? @keithschnak will this involve passing a new argument to optgreed() in block() to influence the underlying C code?
ryantmoore added enhancement question labels on Jun 14, 2017
ryantmoore assigned keithschnak on Jun 14, 2017
keithschnak commented on Jun 14, 2017
I think I can make it pass the seed from R as an argument to the C function. I'll take a look this evening.
...
Assignees
keithschnak
Labels
enhancement
question
Projects
None yet
Milestone
No milestone
Notifications
Unsubscribe

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- Data science jobs: provide GitHub ID

Alternatives

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- Bitbucket
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Workflow and Git Commands

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- Send commits to GitHub (*push*)

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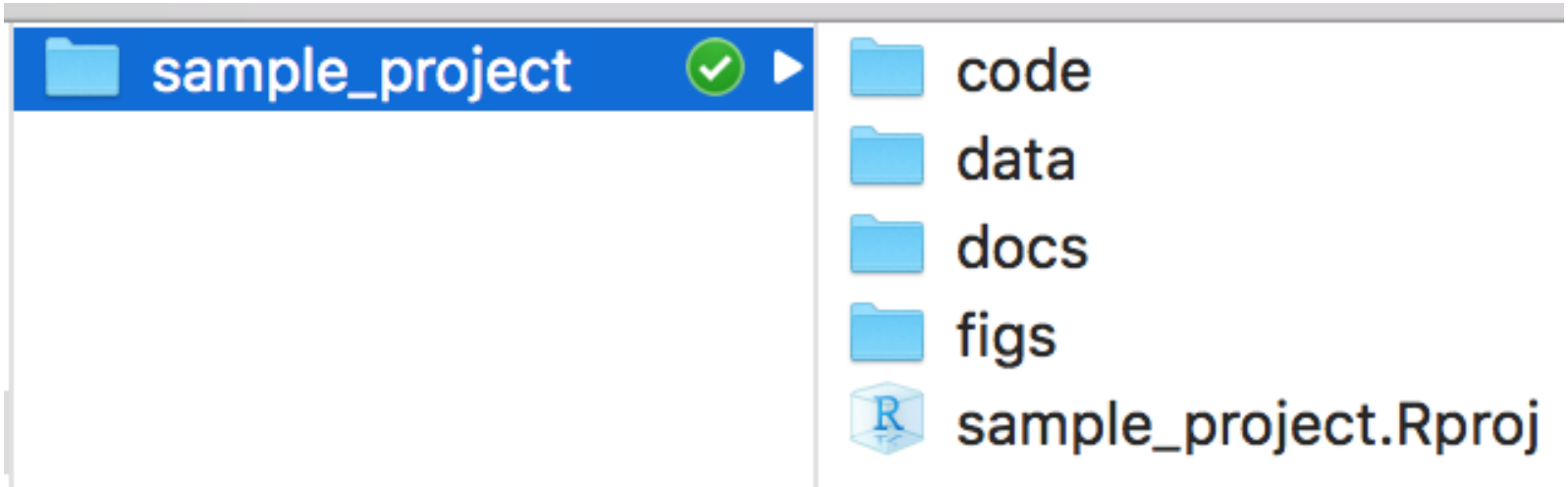
- Exclude sensitive files
  - Seriously. This is hard to undo.

Work Product: Directory Structure



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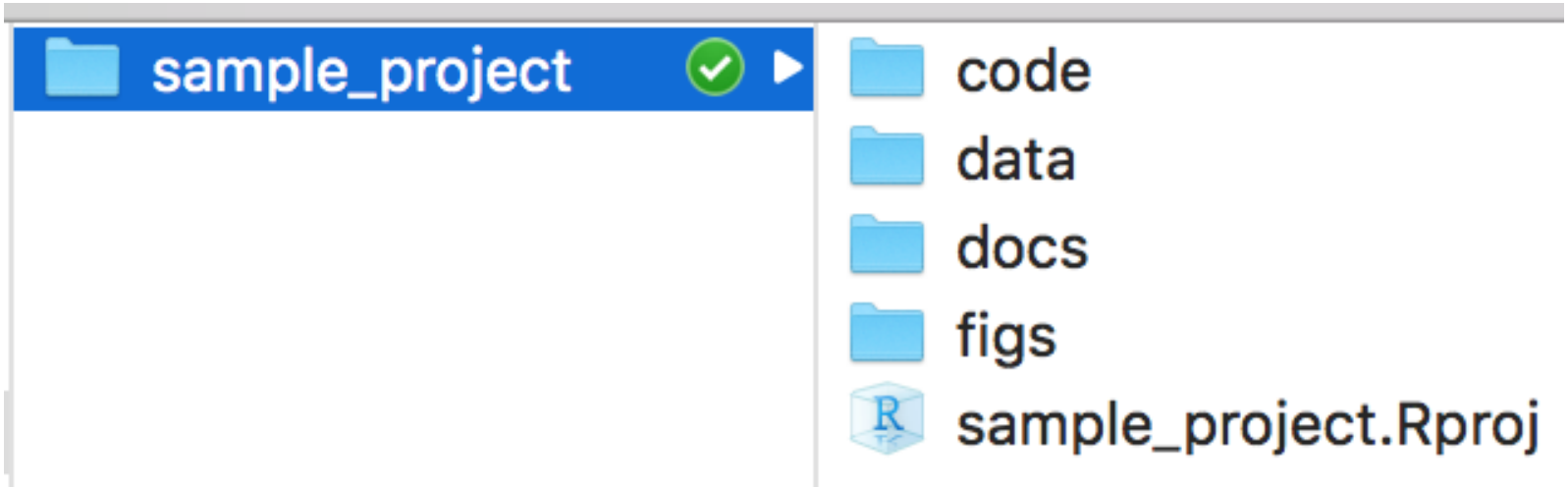

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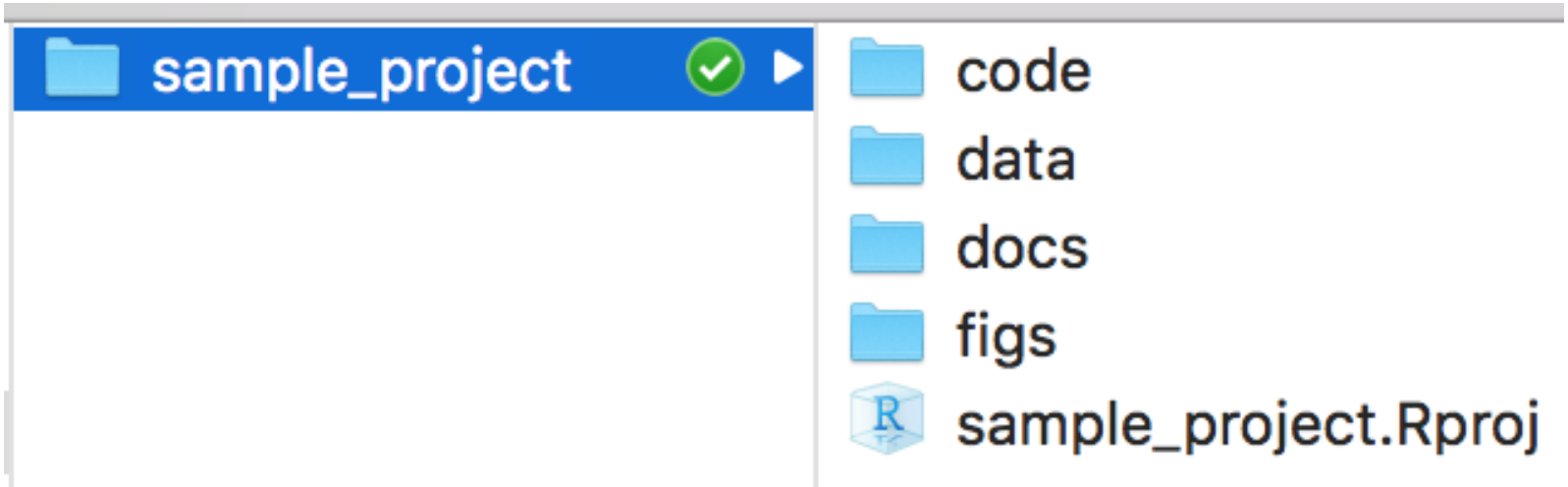

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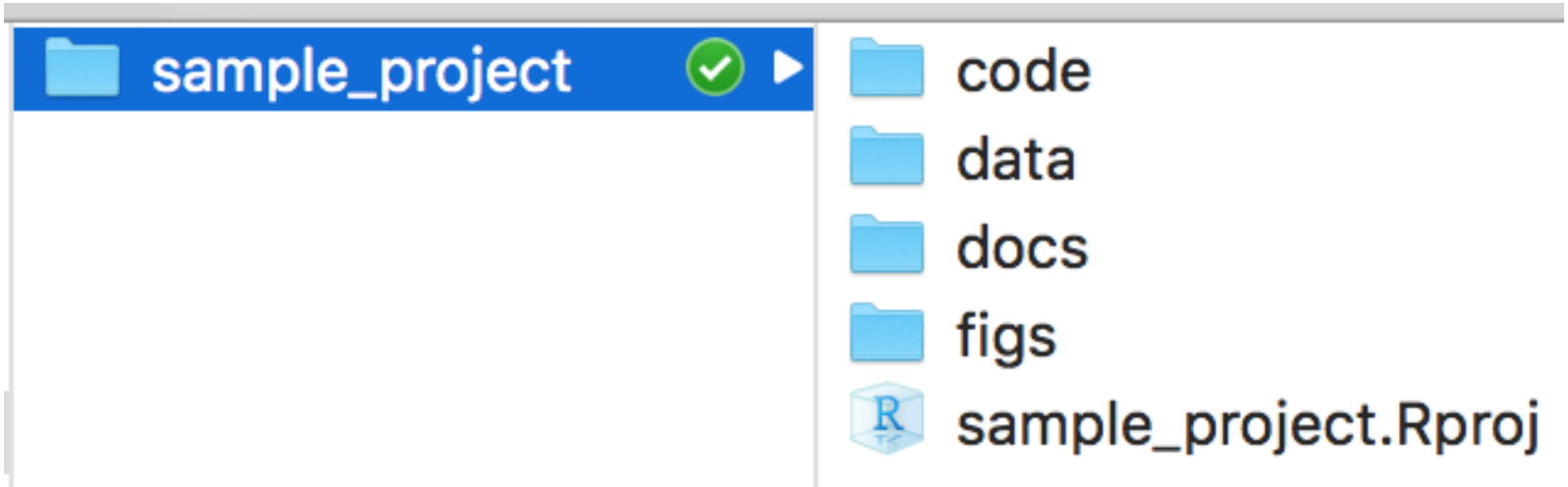

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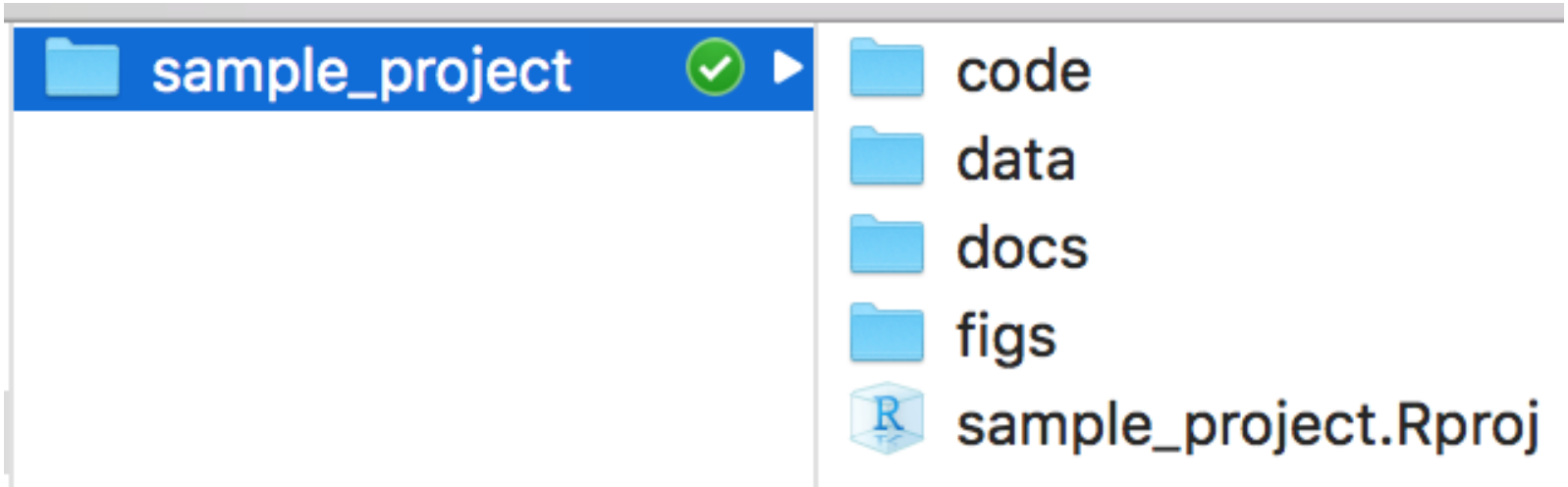

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  - (How I make `ps` directories)

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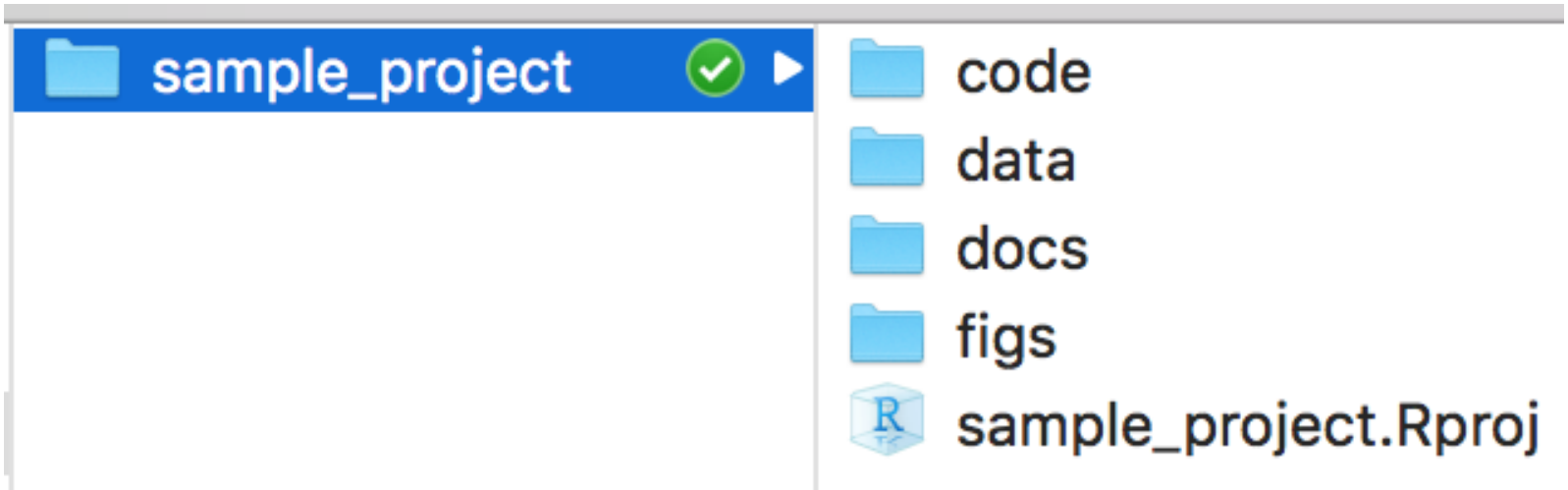

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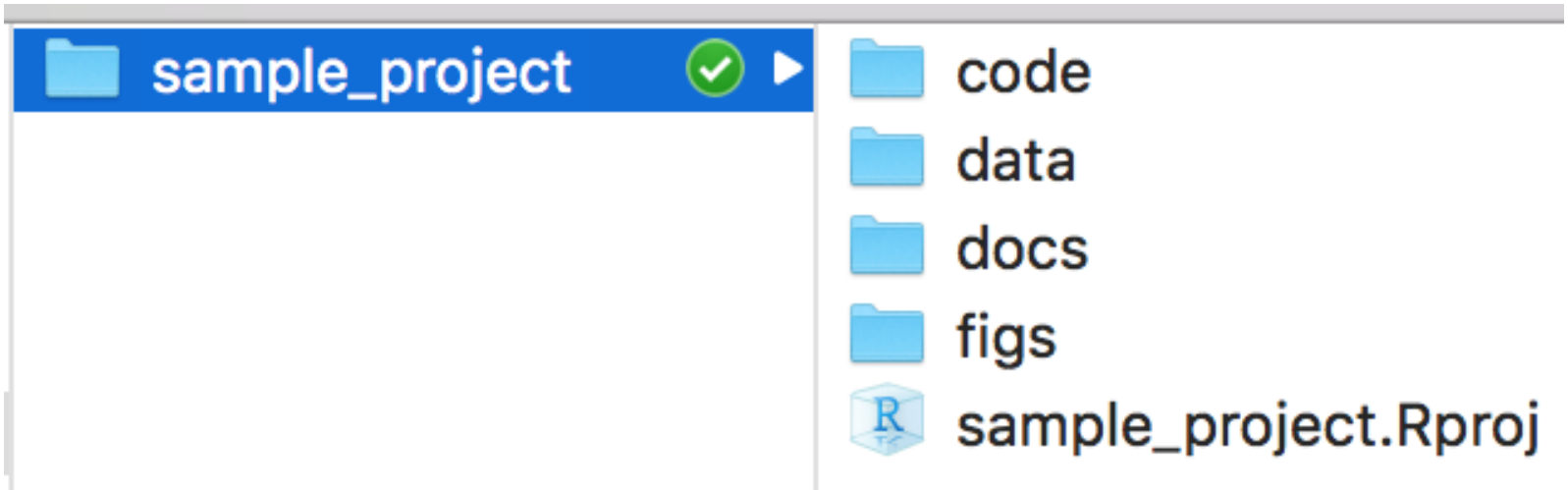

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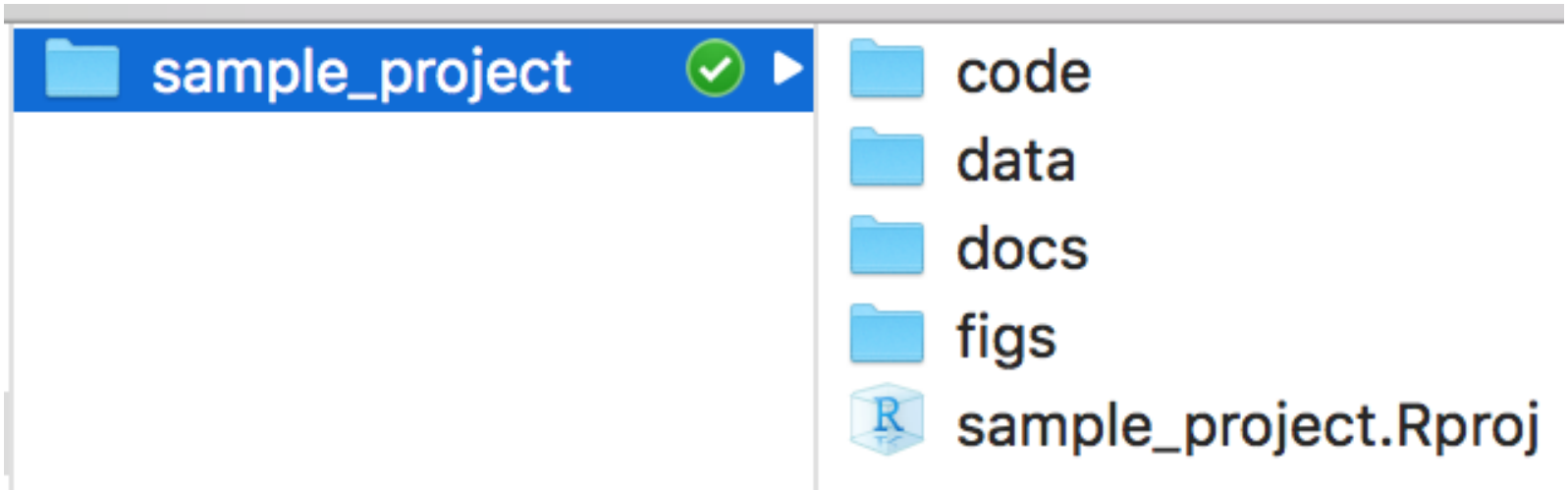

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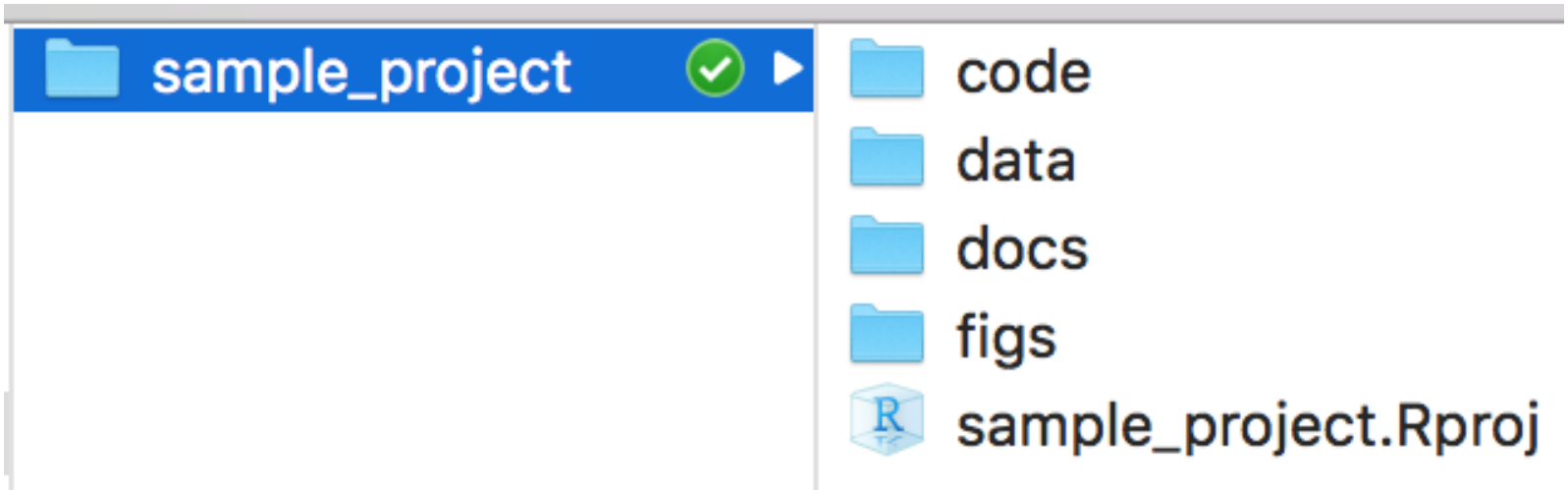

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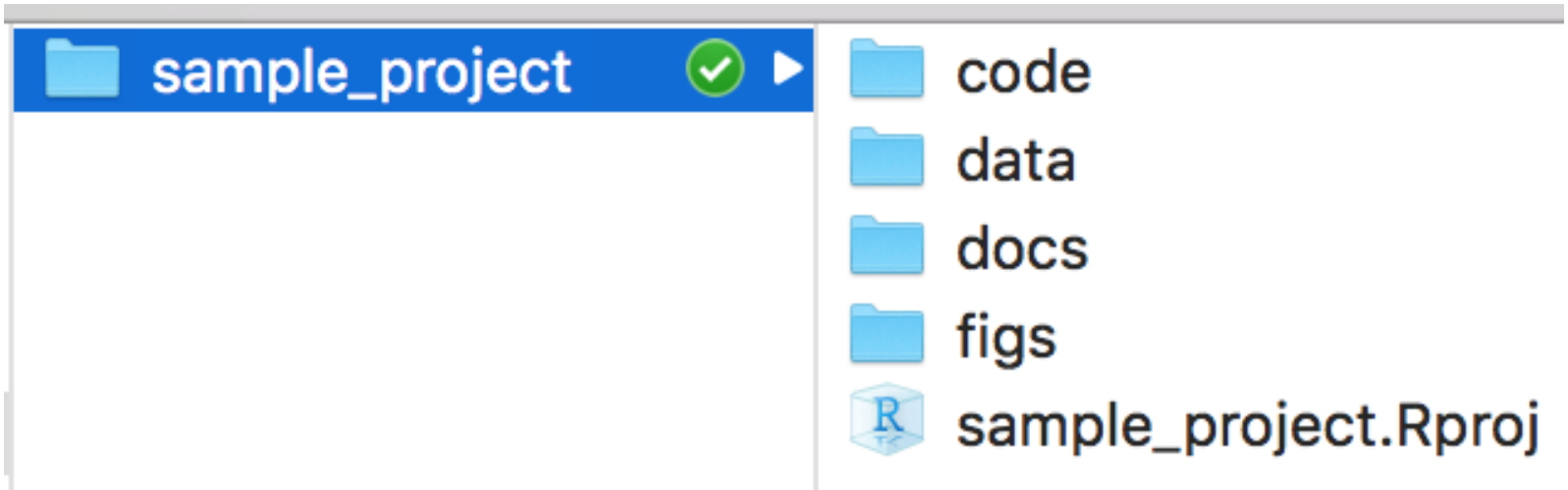

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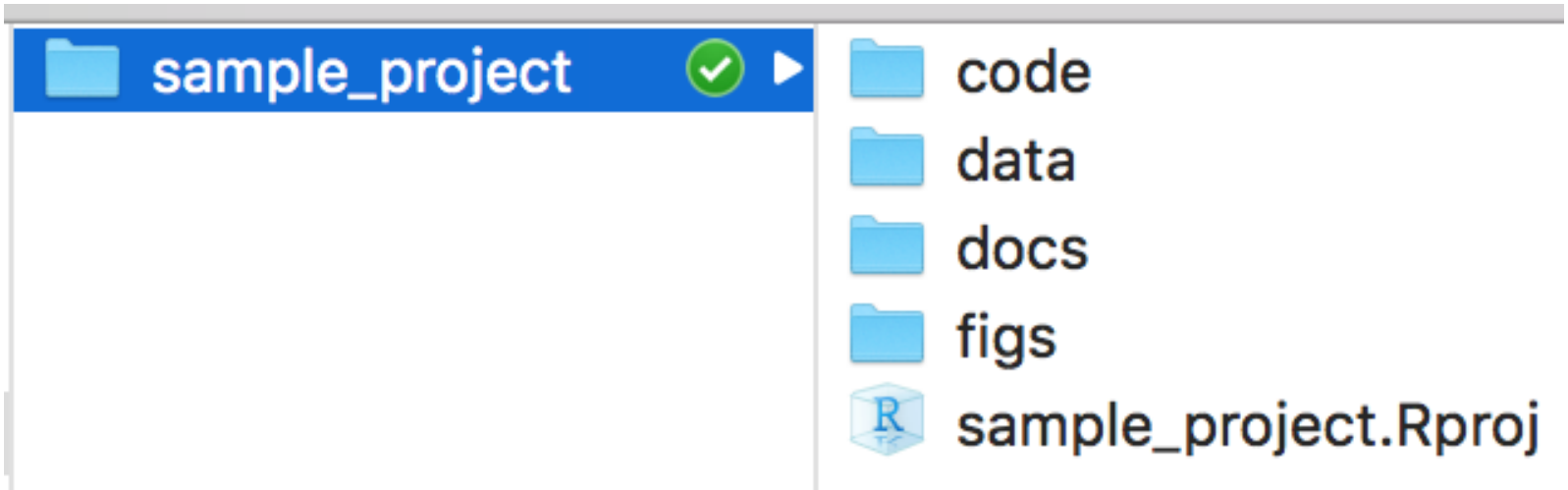

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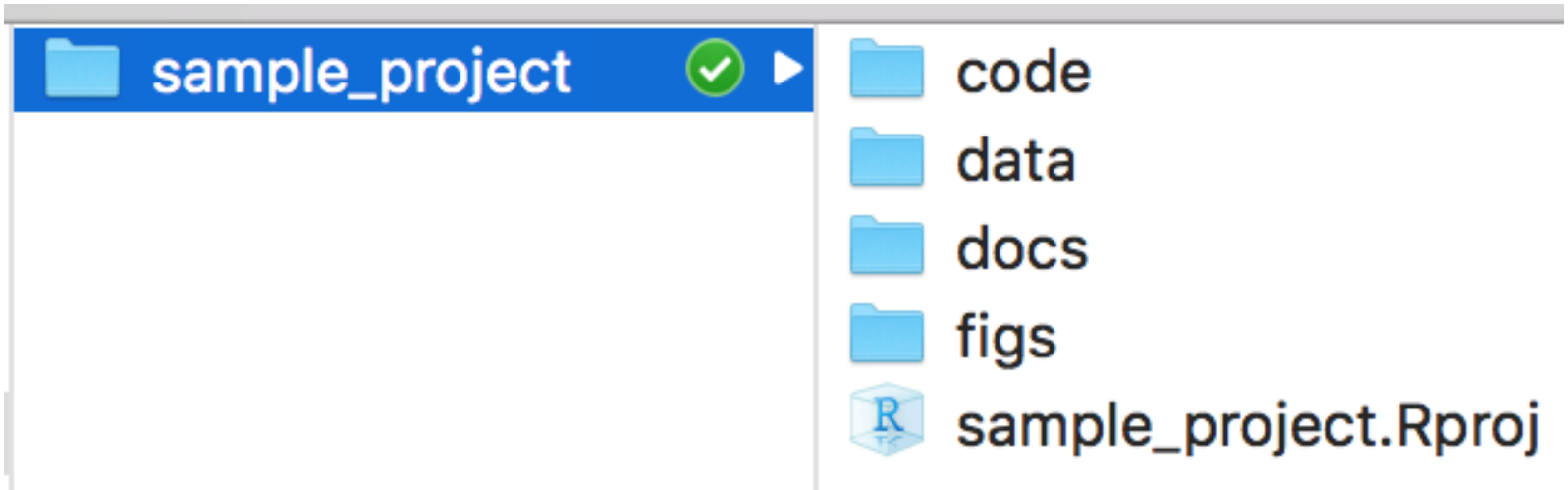

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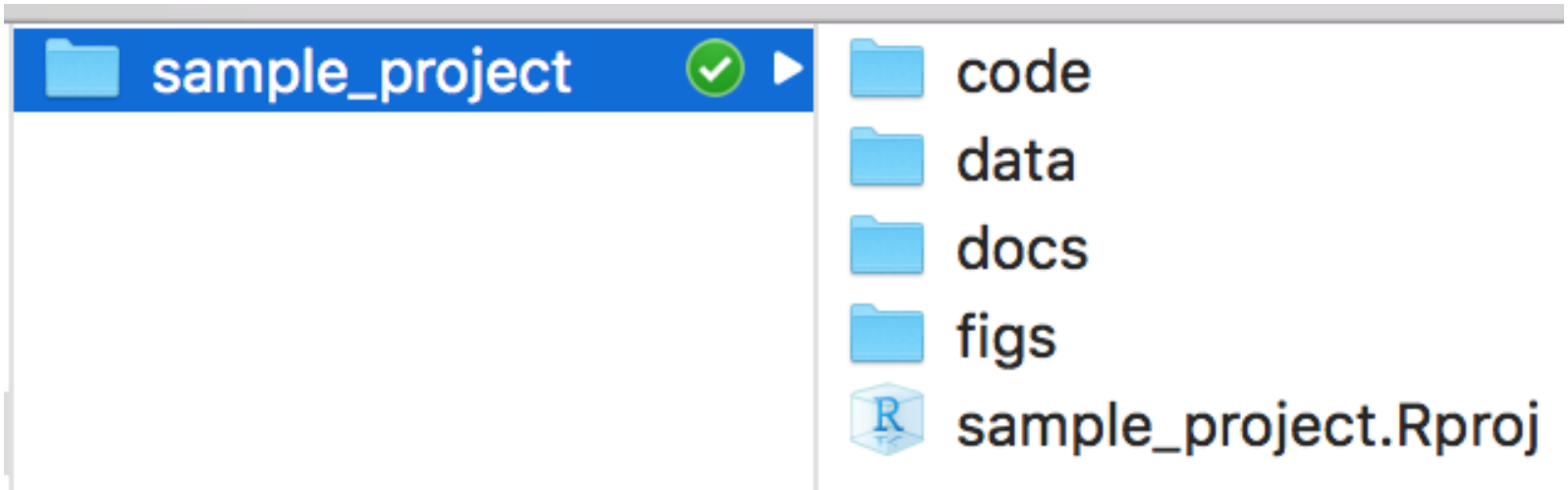

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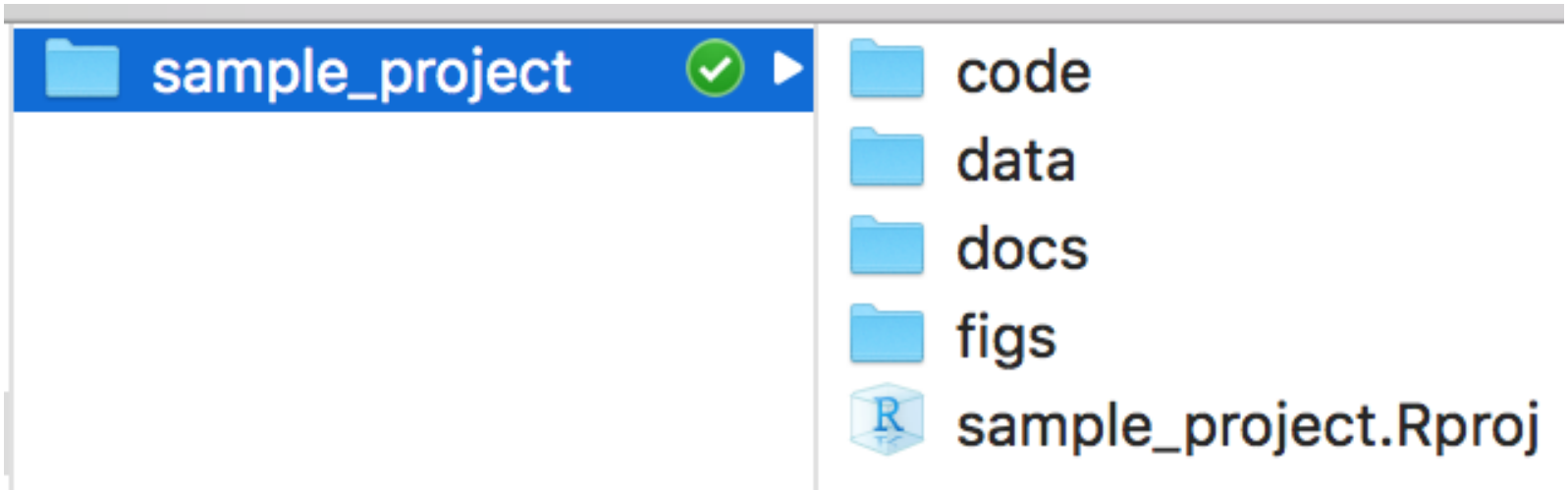

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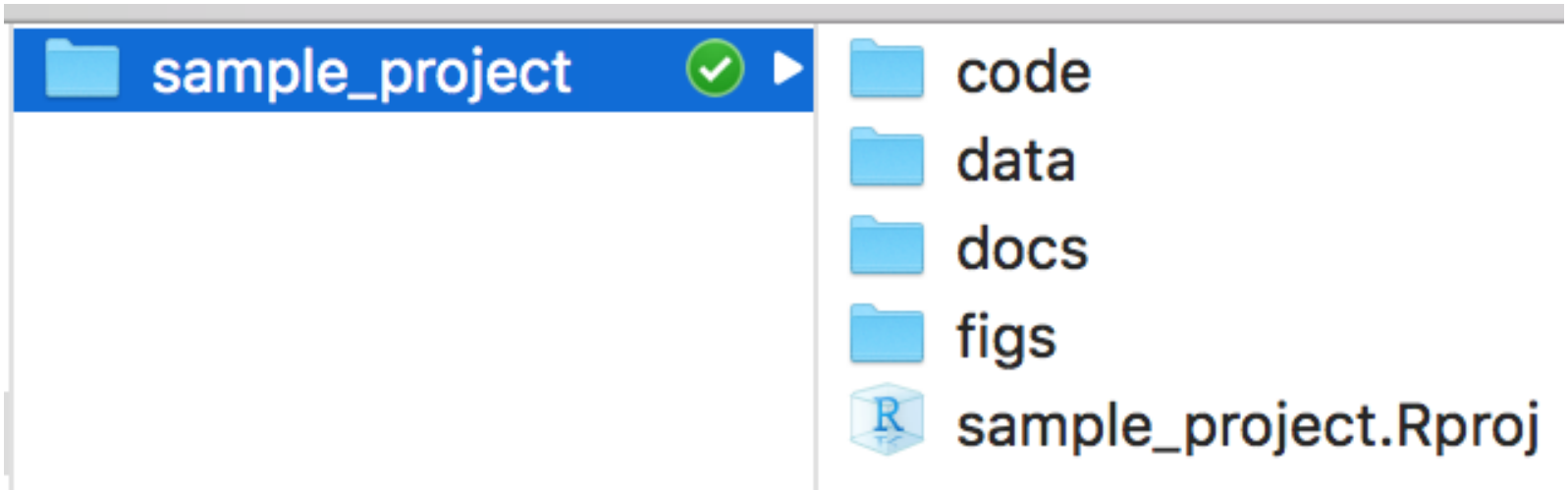

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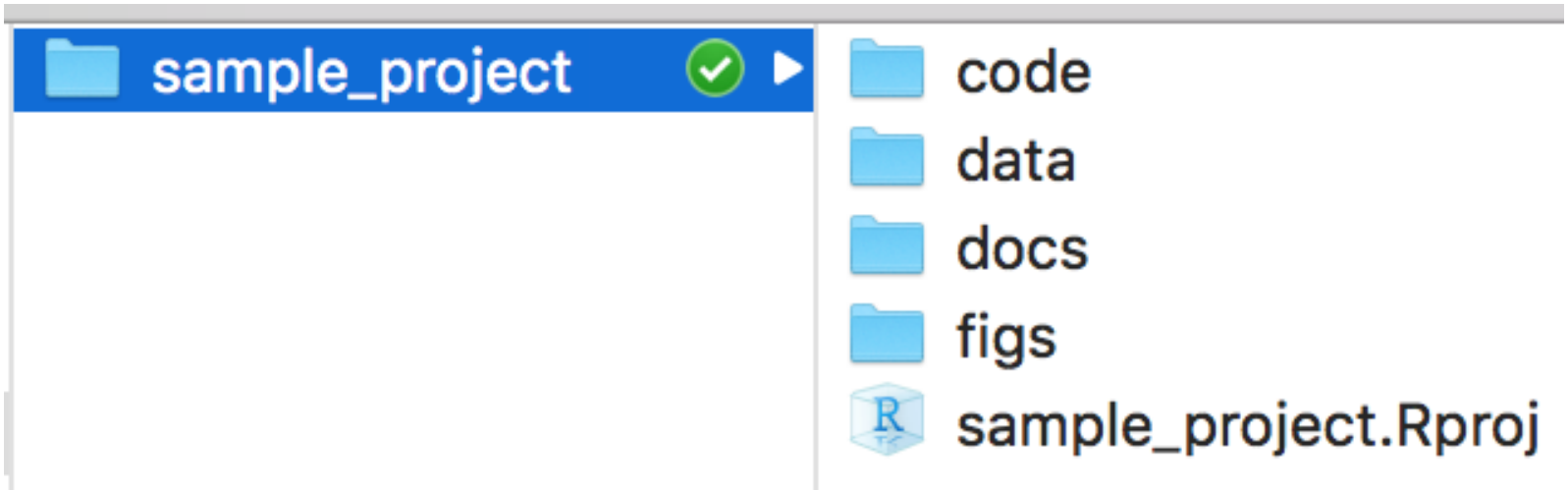

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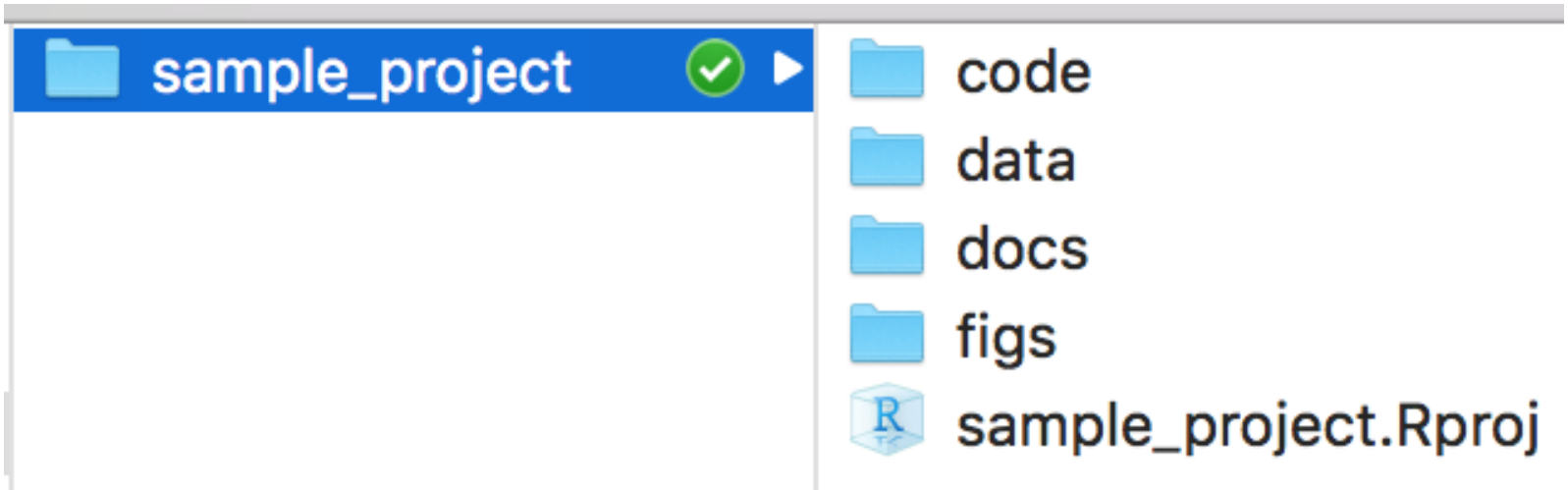

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  - Repeat for every branch

Work Product and `.gitignore`

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- Initialize repo w/ `.gitignore`, choose R
- Immediately update via https://www.gitignore.io

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- R
- LaTeX
- TeX
- Python
- Data files, directories
- ...

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- GitHub's GUI
- GitKraken
- Tower
- RStudio
- ...

Where to find the command line?

- Stand-alone programs:
  - MacOS **iTerm2**, Terminal ...
  - Windows **Cmder**, Git BASH, PowerShell
- RStudio Terminal
  - (next to Console)
  - (why not? Workflow.)
  - (Multiple windows, Cmd-tab, file mngmnt w/o RStudio)

Some Command Line basics

- `ls`: list files/dirs
- `pwd`: print working dir
- `mkdir subdir`: make new subdir
- `cd subdir`: change working dir (to `subdir`)
- `cd ..`: change working dir (to one above)
- `cp file.R file_copy.R`: copy file
- `mv file.R subdir/file.R`: move file
- `rm file.R`: delete file
- `touch file.R`: create new file
- `open file.R`: open extant file
  (Win: `file.R` + Enter)
- `cat file.R`: print contents of file
- `man ls`: help file for `ls` (e.g.)

Let's Practice

Using only the command line,

1. Navigate to your Desktop
2. Make a directory called `cl_dir`
3. Navigate to `cl_dir`
4. Create an empty file here called `empty.txt`
5. Open `empty.txt`
6. Add a line of text; save the file
7. Change the filename to `notempty.txt`
8. Navigate up to the Desktop
9. Print contents of `notempty.txt`
10. List the files in `Desktop/cl_dir`
11. Delete `notempty.txt`

This is how I navigate files/directories.

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Git uses similar commands, prefaced with `git`.

Some Command Line intermediates

- `ps -u <username>`: view running processes
- `top`: view CPU hogs
- `kill <pid>`: kill process (given ID)
- `mail`
- `cal`

Some help

GitHub's Git Cheat Sheet:
http://j.mp/2Y5HklD

Creating a new repository

- On GitHub.com:
  Profile > Repositories > New
- Name (`mytest`)
- Description (brief descr)
- `README` (yes, initialize it)
- `.gitignore`
  (yes, choose R, then www.gitignore.io)
- license (yes, select one)

Contributing to a repository

On web directly:

- Click on `README`, pencil icon. Edit the `.md` file.

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`README.md` is "GitHub-flavored markdown"

Like `.Rmd`, but not identical.

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- Edit file, Preview changes

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Contributing to a repository

On web directly:

- Upload files
- Commit

Contributing to a repository

Note: each commit is *complete* and *minimal*.

- Solve a problem, make an addition
- Addresses a **single** issue

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Different problem? Different commit.

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Using local version:

- Clone repo

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git status
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```

Workflow: `commit`, `commit`, `commit`, ..., `push`

In Case of Emergency

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Cloning extant repository

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

Workflow Commands

```
git status
```

Workflow Commands

```
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```

Neurotically.

Workflow Commands

`git status`

Neurotically.

`git status` will suggest what to do next.

Workflow Commands

When I start,

```
git fetch
```

to bring pushed changes to my local version.

Workflow Commands

When I start,

```
git fetch
```

to bring pushed changes to my local version.

If needed,

```
git pull
```

to merge version on GitHub into mine.

Make changes.

Workflow Commands

Make changes. Then `git`:

```
git add <file>
git commit -m "Commit msg"
git push
```

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At terminal prompt, `pwd` and `cd` to a dir (Desktop, e.g.).

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Then,

```
git clone git@github.com:<yourusername>/mytest.git
```

and `/mytest/` will appear in the dir.

Clone an extant repository

At terminal prompt, `pwd` and `cd` to a dir (Desktop, e.g.).

Then,

```
git clone git@github.com:<yourusername>/mytest.git
```

and `/mytest/` will appear in the dir.

Now, edit `README` a bit.

Clone an extant repository

At terminal prompt, `pwd` and `cd` to a dir (Desktop, e.g.).

Then,

```
git clone git@github.com:<yourusername>/mytest.git
```

and `/mytest/` will appear in the dir.

Now, edit `README` a bit.

Then, at terminal

```
git status
git commit -m "Commit Msg"
git push
```

Delete the local version

- Delete the local folders
- (Note: no `git` here, so truth unaffected.)
- Reclone

Remove a file from future commits

- `git rm ps06/rtm.R`

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(Repeat: *future* commits)

Branches

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Then, recombine work on the branch back into `main` branch.

Goal: `main` always works.

Branching Workflow

- Create branch

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- Create branch
- Move to that branch

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Branching Workflow

- Create branch
- Move to that branch
- Make edits to code
- Commit and push
- Issue pull request at GitHub.com
- Someone reviews pull request, merges your branch in, deletes it

Branching Workflow

- `git branch bugFix`

Branching Workflow

- `git branch bugFix`
- `git checkout bugFix`

Branching Workflow

- `git branch bugFix`
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Branching Workflow

- `git branch bugFix`
- `git checkout bugFix`
- Make edits to code
- `git add`, `git commit`, `git push`
- (`git status` keeps me on track)
- `git checkout main` to return
- Eventually, `git merge bugFix`

Terminology for Branches, Forks, Commits

Recall: *distributed* version control.

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Terminology for Branches, Forks, Commits

Recall: *distributed* version control.

- a *remote*: non-local version of repo
- `origin`: standard name of your GitHub remote
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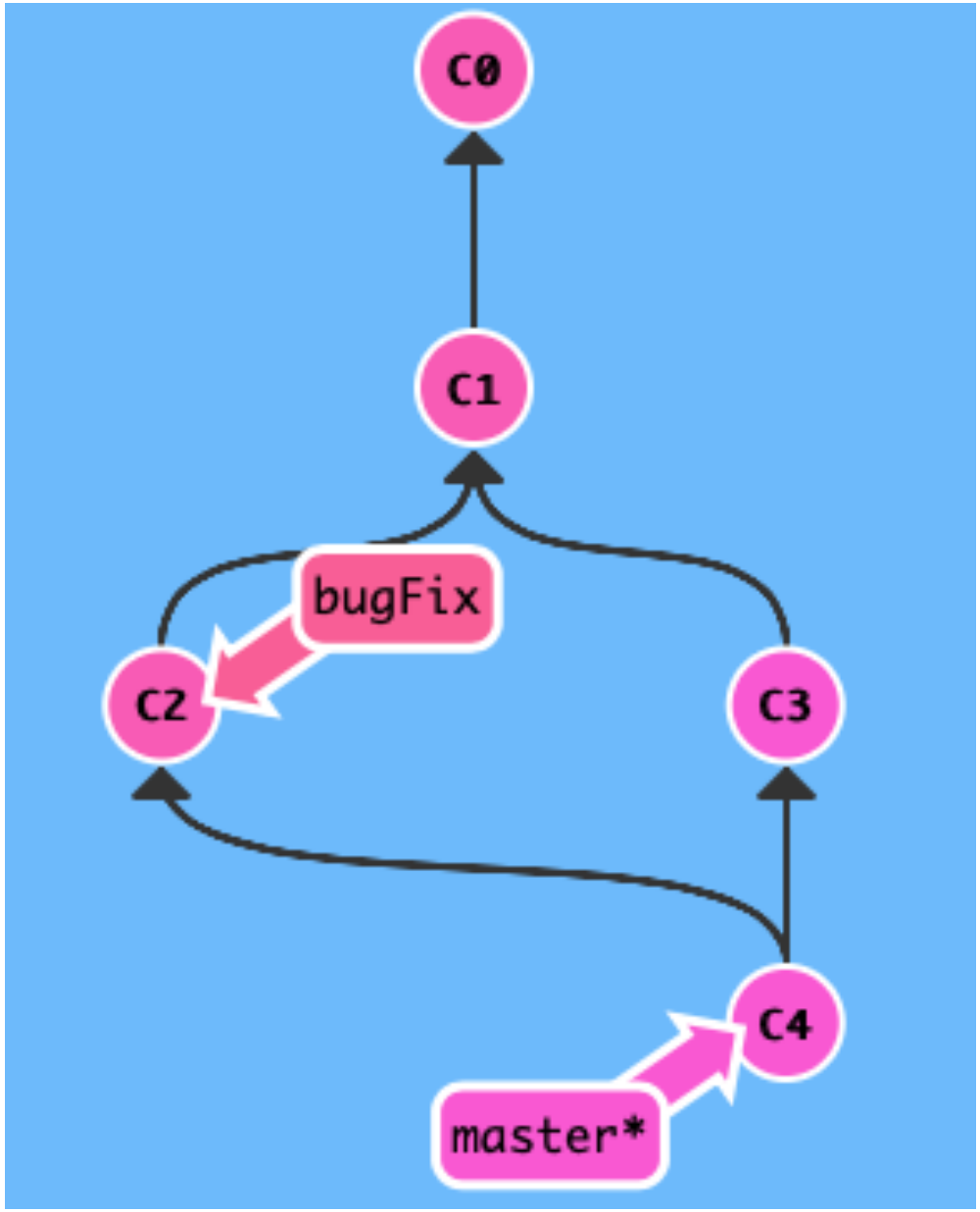
Terminology for Branches, Forks, Commits

Recall: *distributed* version control.

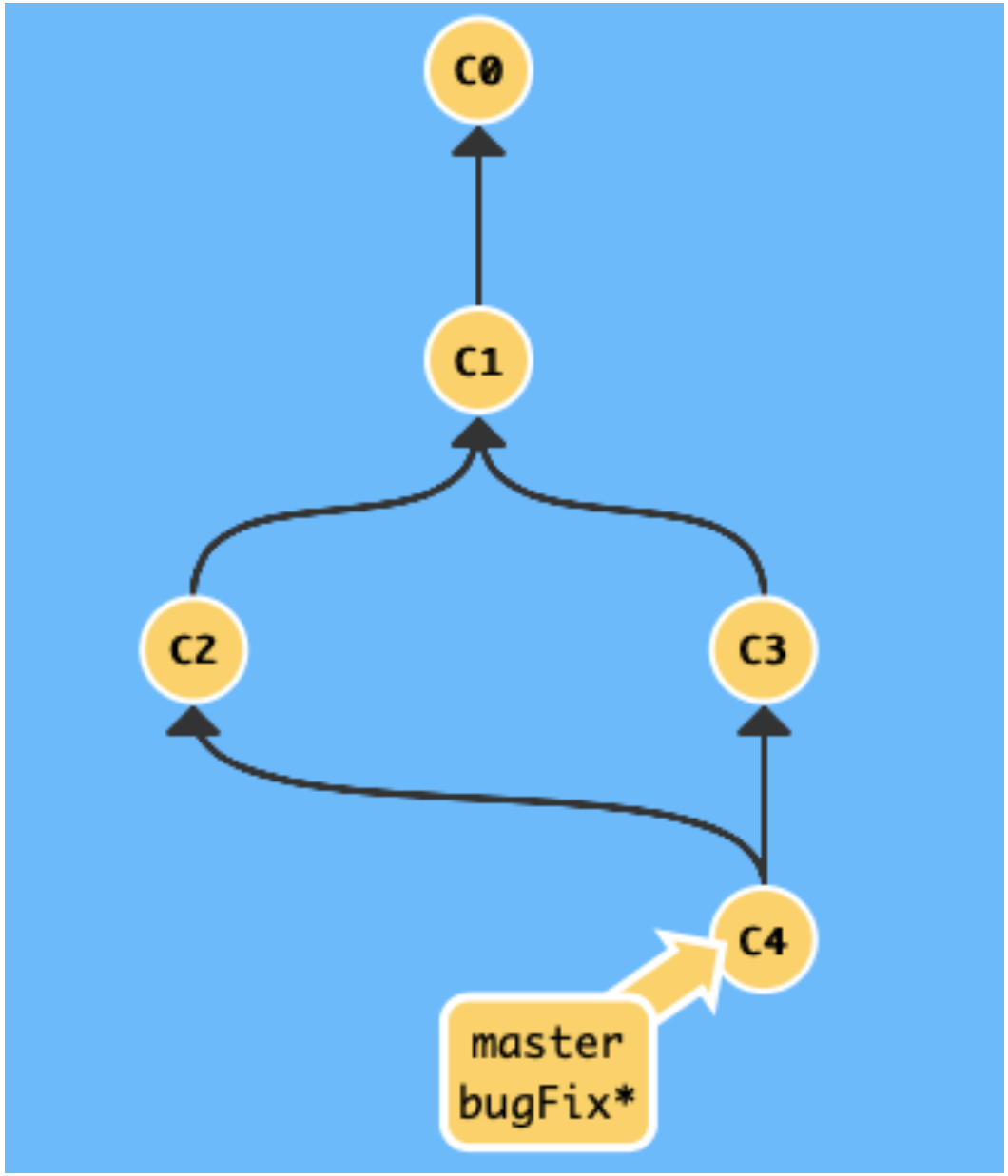
- a *remote*: non-local version of repo
- `origin`: standard name of your GitHub remote
- `upstream`: source of your clone (usually `origin`)
- `main`: standard name of main branch
- `HEAD`: most recent commit on `main` branch

Merging and Rebasing

Merging



Merging



Rebasing

Rebasing: another way to combine `main` and `subbranch`.

Rebase creates a linear (unbranched) history of commits.

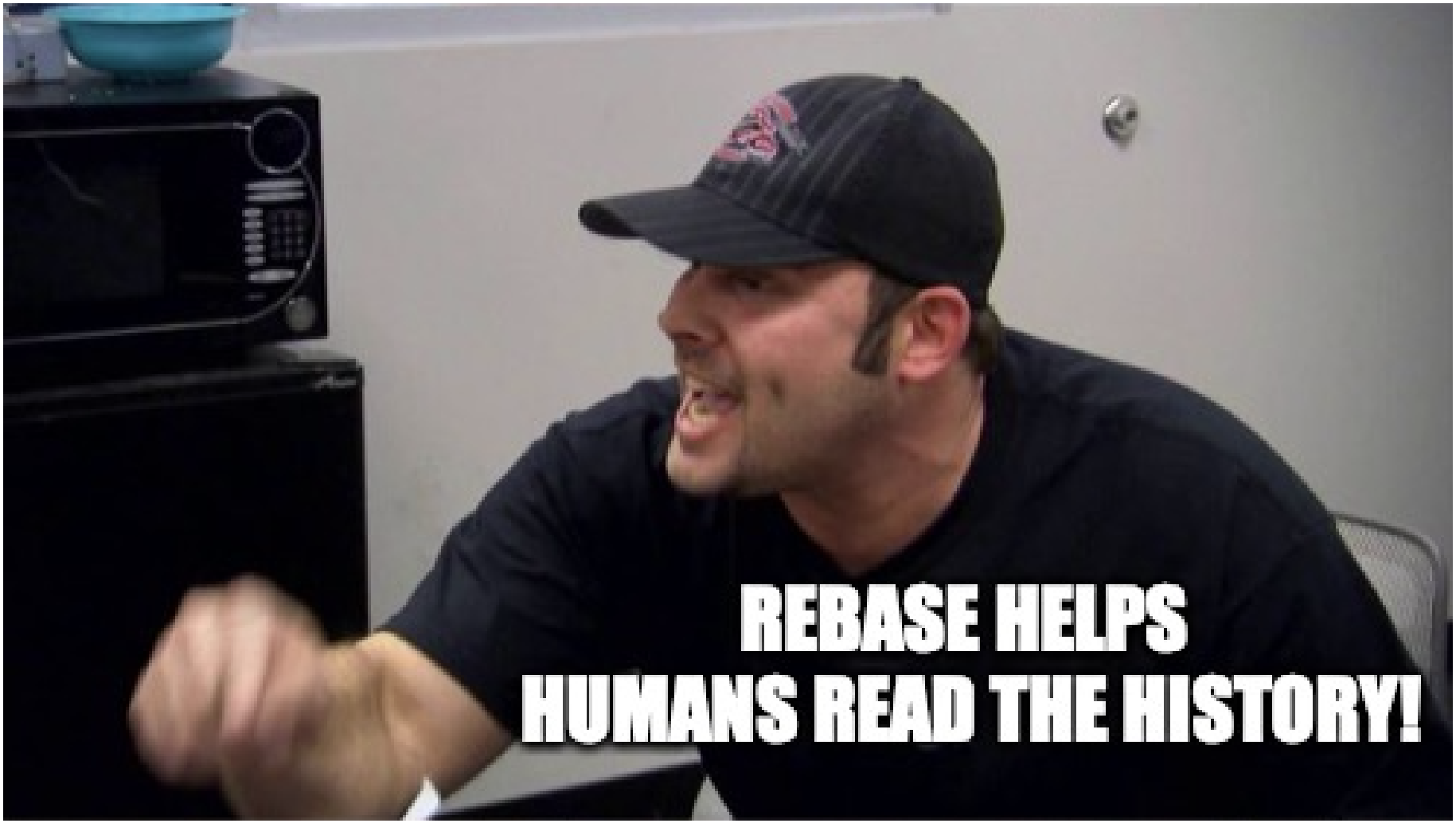
Rebasing

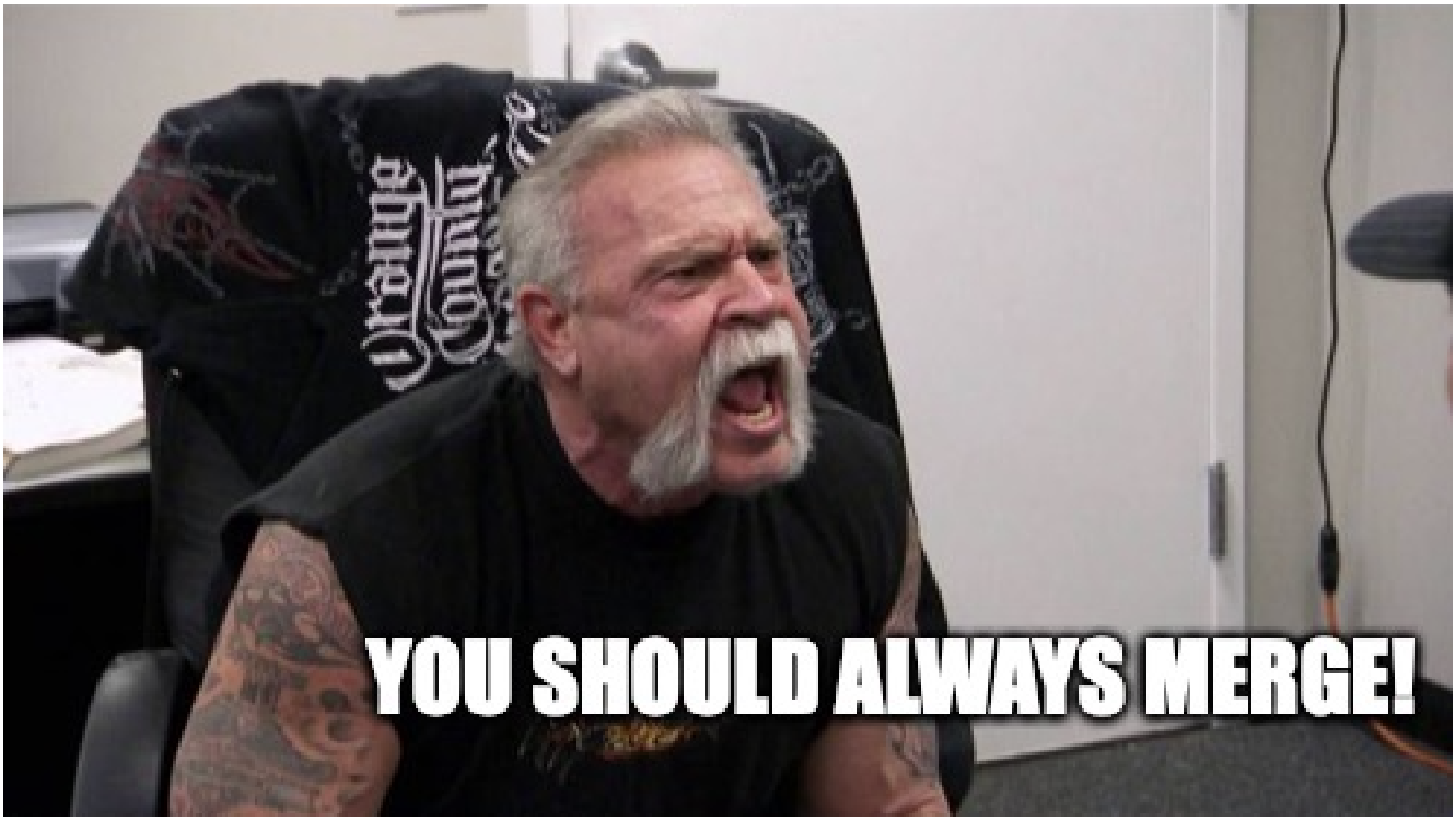
Rebasing: another way to combine `main` and `subbranch`.

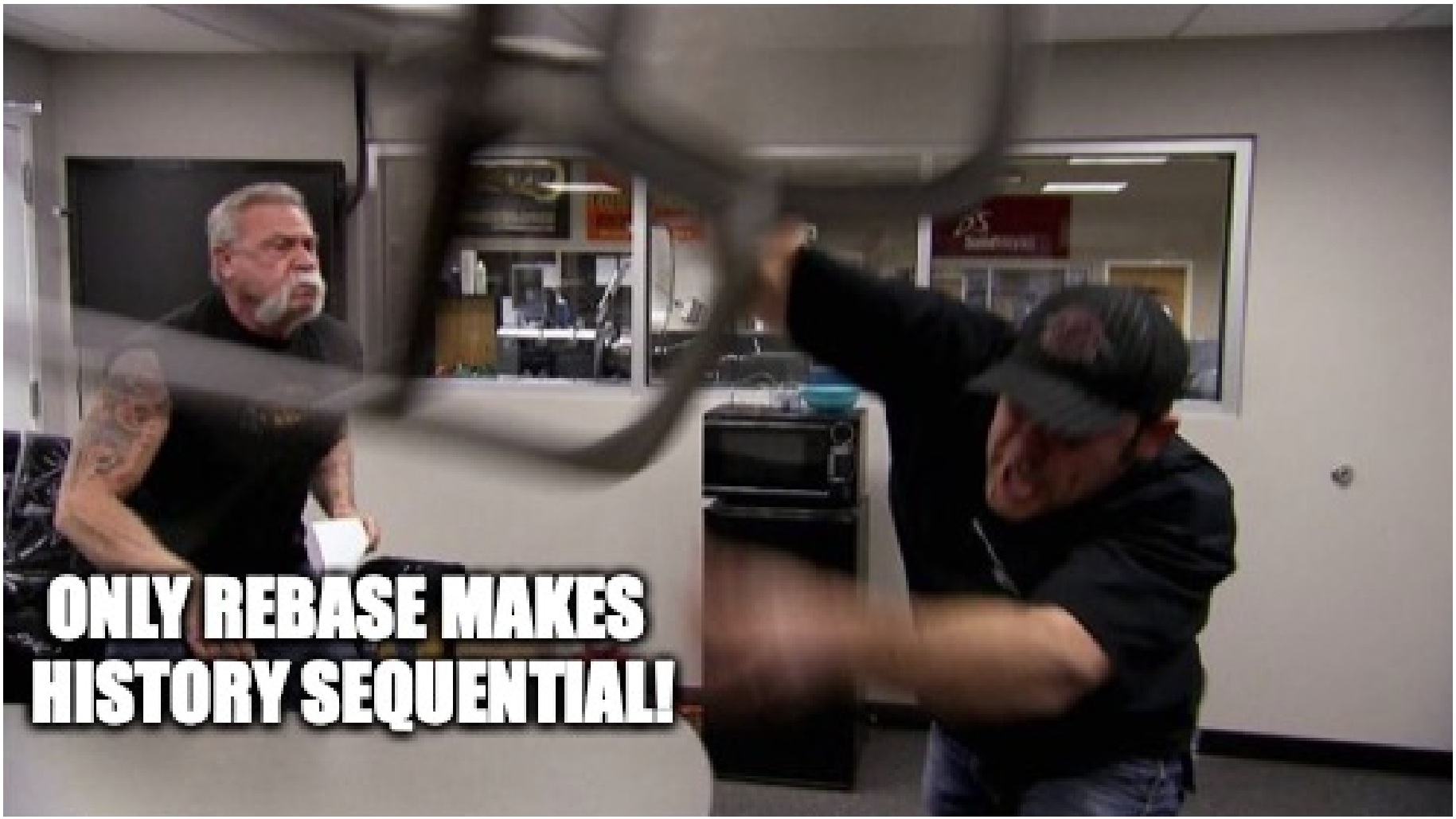
Rebase creates a linear (unbranched) history of commits.

This is a matter of some controversy.


STOP THIS REBASING.


REBASE HELPS
HUMANS READ THE HISTORY!


YOU SHOULD ALWAYS MERGE!


ONLY REBASE MAKES
HISTORY SEQUENTIAL!


YOU'RE CHANGING THE HISTORY!
imgflip.com

How to Merge

From `main` branch,

```
git merge subbranch
```

will merge the work done on `subbranch` into the `main` branch.

How to Rebase

From `subbranch`,

```
git rebase main
```

will add work of `subbranch` as a downstream commit of `main`.

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From `subbranch`,

```
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But then, update `main` by moving to `main`, then rebasing:

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git checkout main
git rebase subbranch
```

How to Rebase

From `subbranch`,

```
git rebase main
```

will add work of `subbranch` as a downstream commit of `main`.

But then, update `main` by moving to `main`, then rebasing:

```
git checkout main
git rebase subbranch
```

Now, branches are in sync, same commit.

To learn branching,

https://learngitbranching.js.org

- Complete Intro Sequence 1-3 (*Intro*, *Branching*, and *Merging*)
- (Bonus: Get through level 4, *Rebasing*)
- Read every message terminal, in terminal, and file list each step.

Pull Requests and Forks

Pull Requests

Issues, focused on branches and merging.

Pull Requests

Issues, focused on branches and merging.

Three components:

- Conversation
- Commits
- Diffs

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Forking

Fork: your *copy* of a repo you don't control

- Clone repo
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- Issue pull request

Forking

Fork: your *copy* of a repo you don't control

- Clone repo
- Stay current with canonical version
- Create branch
- Edit
- Issue pull request
- (Then, later pushes update pull request)