

Version Control with Git and GitHub

Winter Institute in Data Science

Ryan T. Moore

2025-01-07

Introducing Git + GitHub

Workflow and Git Commands

Branches

Merging and Rebasing

Pull Requests and Forks

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 steps: `renv`, 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 ago

📁 admin	Update PS6	6 days ago
📁 code	Update pkg tests and building	6 days ago
📁 data	Make laws data longer	last year
📁 notes	Update pkg tests and building	6 days ago
📁 ps_labs	ps05 Exam class	18 days ago
📁 quiz	Initialize quiz pkg2	6 days ago
📄 .gitignore	Create full gitignore	9 months ago
📄 LICENSE	Initial commit	2 years ago
📄 README.md	Fix typo	13 days ago
📄 r-data-science.Rproj	Add Rproj file	8 months ago


Examples

 **ryantmoore** / **blockTools** Private












 Unwatch ▾ 10  ★ S

 Code  Issues 16  Pull requests 1  Projects 0  Insights  Settings

Branch: master ▾ **blockTools** / **blockTools** / Create new file Upload file

 **ryantmoore** Add tarball 0.6-2. Update all /blockTools/ files. Latest commit

..

 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.

15 / 159

Examples

🔒 [ryantmoore / blockTools](#) Private

👁 Unwatch ▾ 10 ⭐ Star 0 🍴 Fork

<> Code ⓘ Issues 16 📄 Pull requests 1 📁 Projects 0 📊 Insights ⚙ 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 `optgreedy()` 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

No one yet

Milestone

No milestone

Notifications

16 / 16

The Motivation

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- ▶ Data science jobs: provide GitHub ID

Alternatives

Git:

- ▶ Mercurial
- ▶ Concurrent Versions System (CVS)
- ▶ Subversion (SVN)
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GitHub:

- ▶ Bitbucket
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- ▶ GitKraken
- ▶ SourceForge
- ▶ ...

Workflow and Git Commands

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- ▶ Create/designate/find *repository* to track
- ▶ Make changes to code
- ▶ *Commit* changes: declare “save this snapshot”
- ▶ Send commits to GitHub (*push*)

Workflow and Product

- ▶ Include elements of the work product

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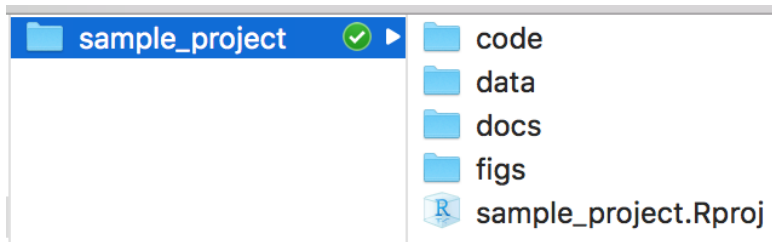
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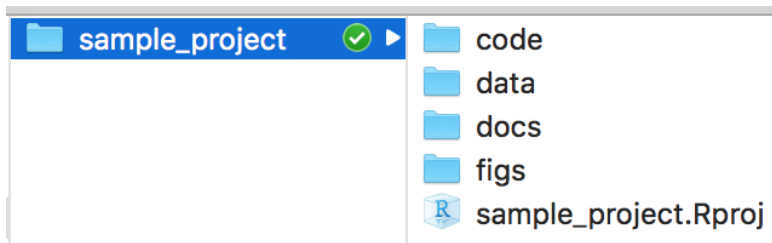
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 - ▶ Package installation
- ▶ Exclude sensitive files
 - ▶ Seriously. This is hard to undo.

Work Product: Directory Structure

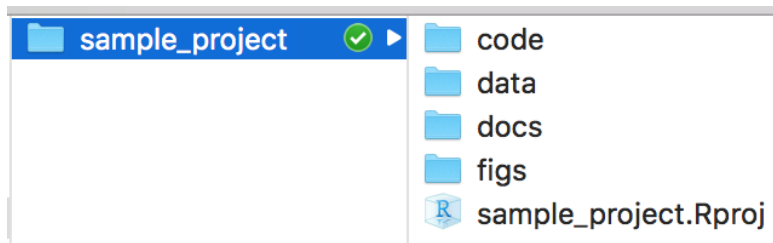


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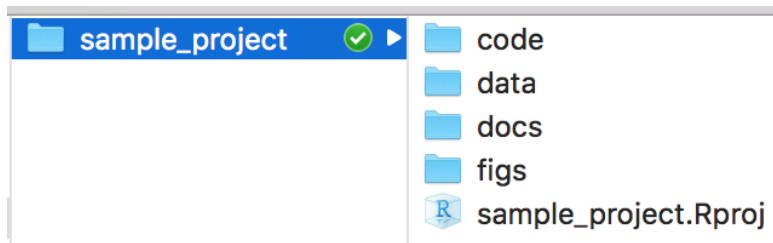
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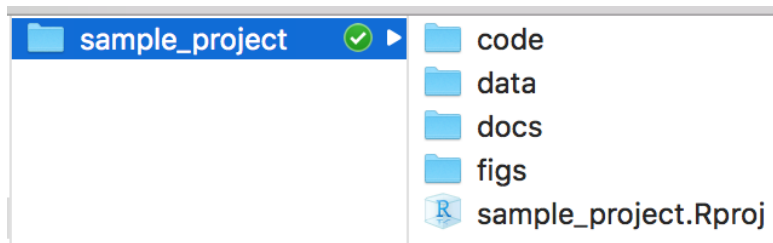
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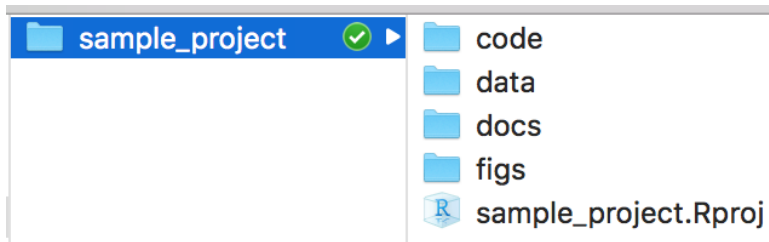
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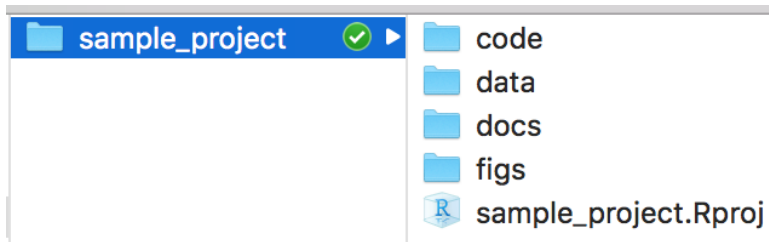


- ▶ Set up on your machine
- ▶ But `git` won't track empty directories
- ▶ Add, track an empty file
 - ▶ (How I make `ps` directories)

Work Product: Sensitive Data

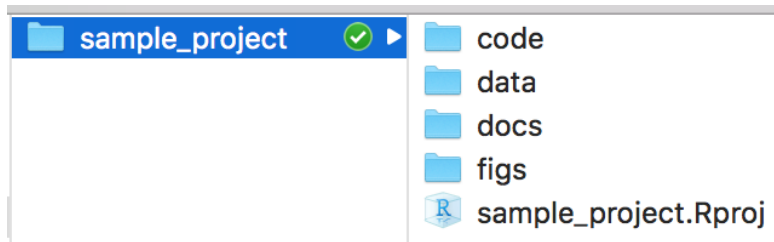


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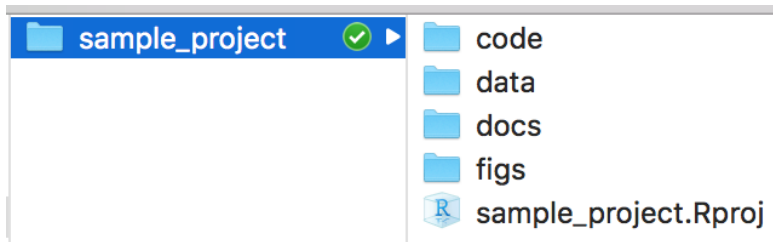
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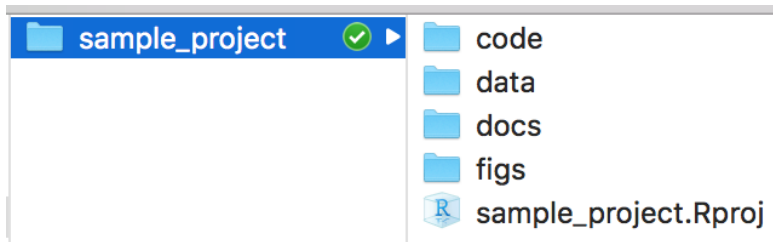
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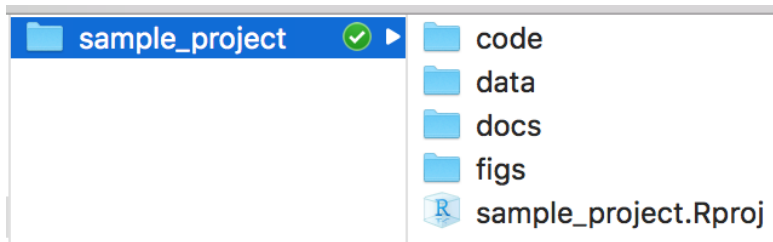
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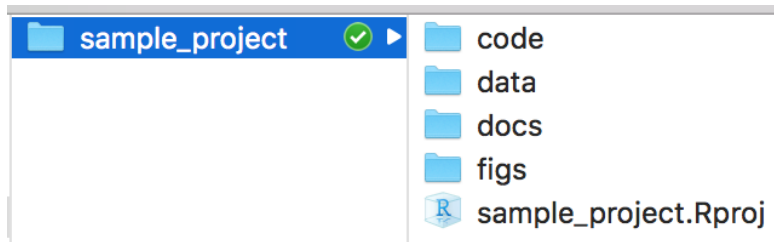
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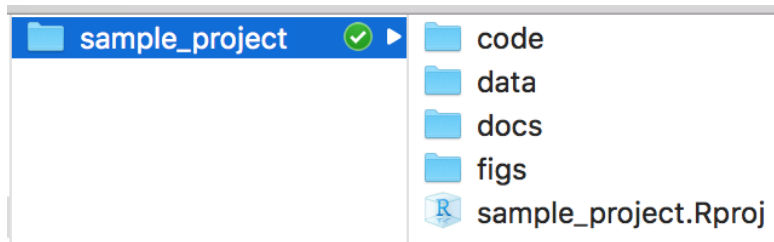
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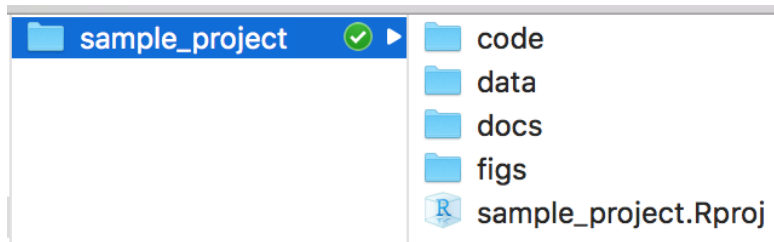
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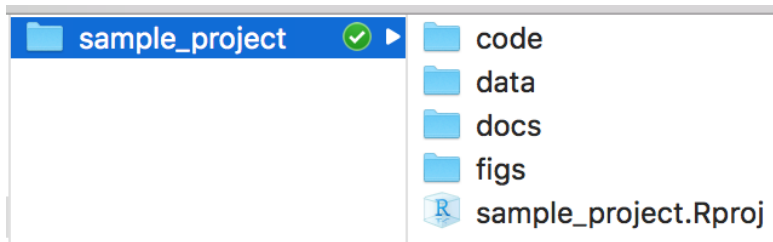
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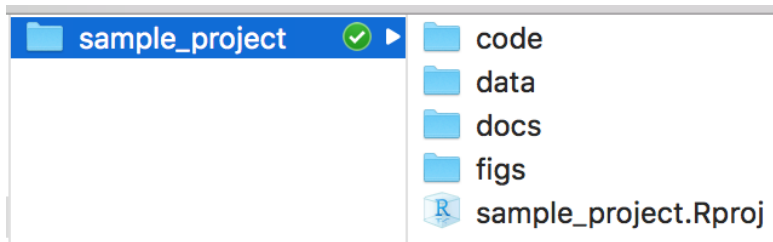
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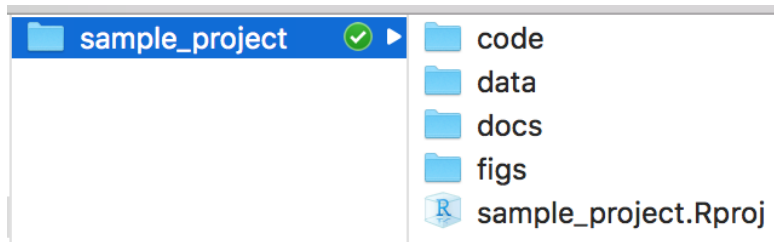
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 - ▶ `git-filter-branch`
 - ▶ (Or `bfg` from BFG Repo Cleaner)
 - ▶ Repeat for every branch

Work Product and .gitignore

To **not track**, list in .gitignore file.

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Work Product and .gitignore

My .gitignore workflow:

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- ▶ Immediately update via <https://www.gitignore.io>
- ▶ R
- ▶ L^AT_EX
- ▶ T_EX
- ▶ Python
- ▶ Data files, directories
- ▶ ...

How should I `git`?

There are many ways to `git`.

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

Some Command Line basics

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 Git BASH: `start file.R`)
- ▶ `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`

Some Command Line basics

This is how I navigate files/directories.

Some Command Line basics

This is how I navigate files/directories.

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 `.qmd`, but not identical.

Contributing to a repository

On web directly:

- ▶ Update `.gitignore`: Don't ignore `.Rproj` files

Contributing to a repository

On web directly:

- ▶ Update `.gitignore`: Don't ignore `.Rproj` files
- ▶ Edit file, Preview changes

Contributing to a repository

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- ▶ Edit file, Preview changes
- ▶ Commit

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

Contributing to a repository

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

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- ▶ Addresses a **single** issue

Different problem? Different commit.

Contributing to a repository

Using local version:

- ▶ Clone repo

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Using local version:

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- ▶ Send changes to GitHub

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```
git status
```

```
git add
```

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

```
git push
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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

```
git status
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Neurotically.

Workflow Commands

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Neurotically.

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 will suggest what to do next.

Workflow Commands

When I start,

```
git fetch
```

to bring pushed changes to my local version.

Workflow Commands

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git fetch
```

to bring pushed changes to my local version.

If needed,

```
git pull
```

to merge version on GitHub into mine.

Workflow Commands

Make changes.

Workflow Commands

Make changes. Then git:

```
git add <file>
```

```
git commit -m "Commit msg"
```

```
git push
```

Clone an extant repository

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,

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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`

Remove a file from future commits

► `git rm ps06/rtm.R`

(Repeat: *future* commits)

Branches

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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](https://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

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- ▶ (`git status` keeps me on track)

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

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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- ▶ **main**: standard name of main branch

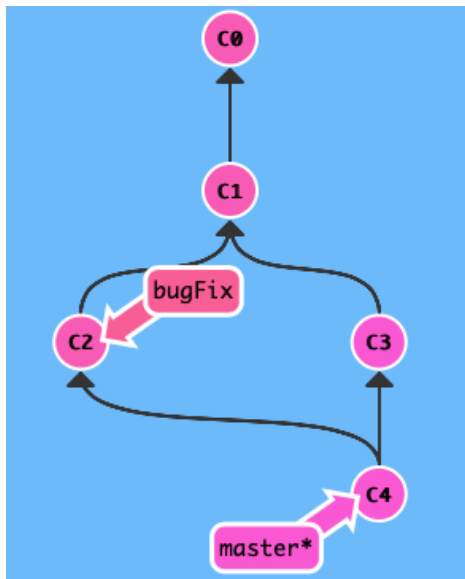
Terminology for Branches, Forks, Commits

Recall: *distributed* version control.

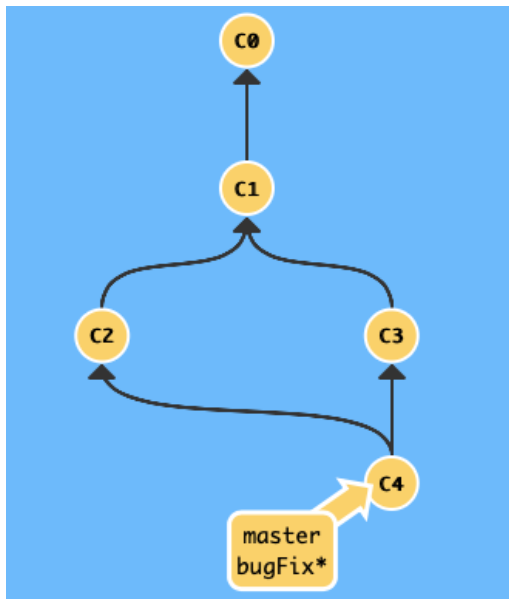
- ▶ a *remote*: non-local version of repo
- ▶ **origin**: standard name of your GitHub remote
- ▶ **upstream**: source of your clone (usually **origin**)
- ▶ **main**: standard name of main branch
- ▶ **HEAD**: most recent commit on **main** branch

Merging and Rebasing

Merging



Merging



Rebasing

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

Rebase creates a linear (unbranched) history of commits.

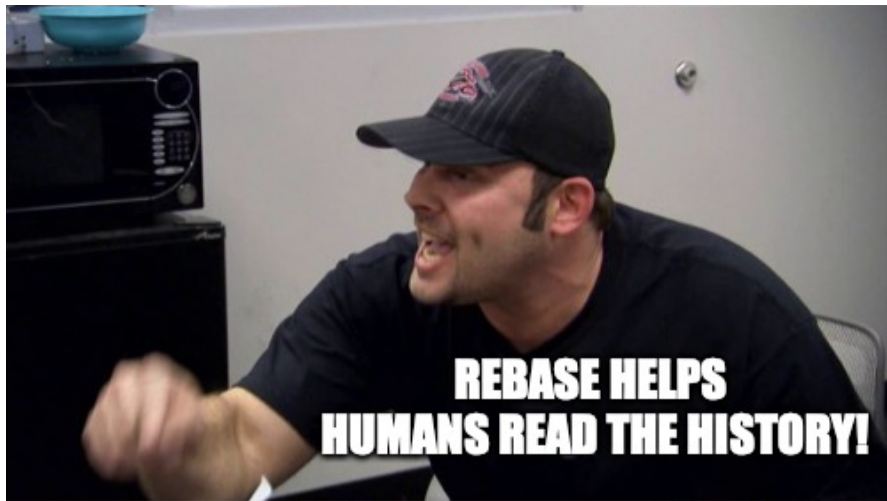
Rebasing

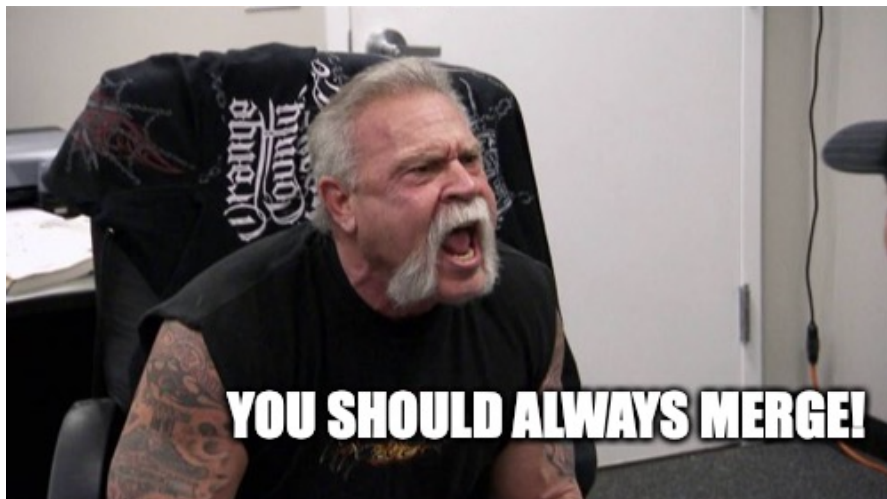
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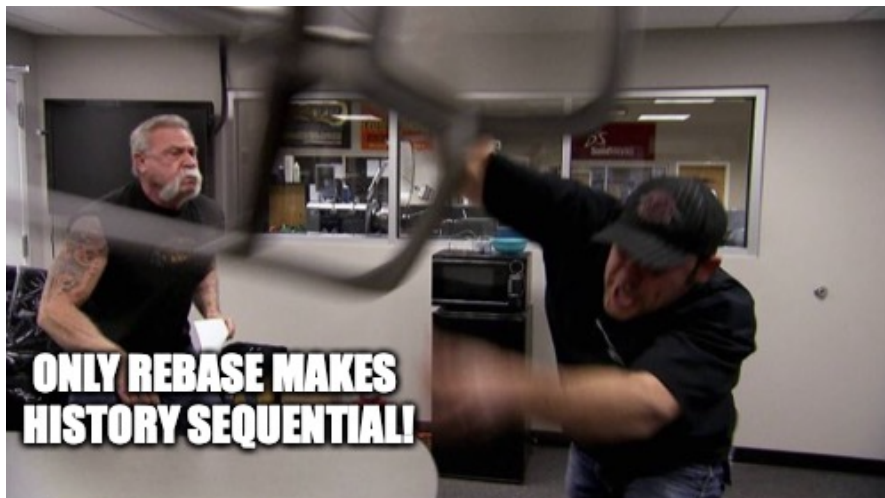
Rebase creates a linear (unbranched) history of commits.

This is a matter of some controversy.











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

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git checkout main
```

```
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```

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

Forking

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- ▶ Clone repo
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- ▶ Create branch
- ▶ Edit

Forking

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

- ▶ Clone repo
- ▶ Stay current with canonical version
- ▶ Create branch
- ▶ Edit
- ▶ 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)