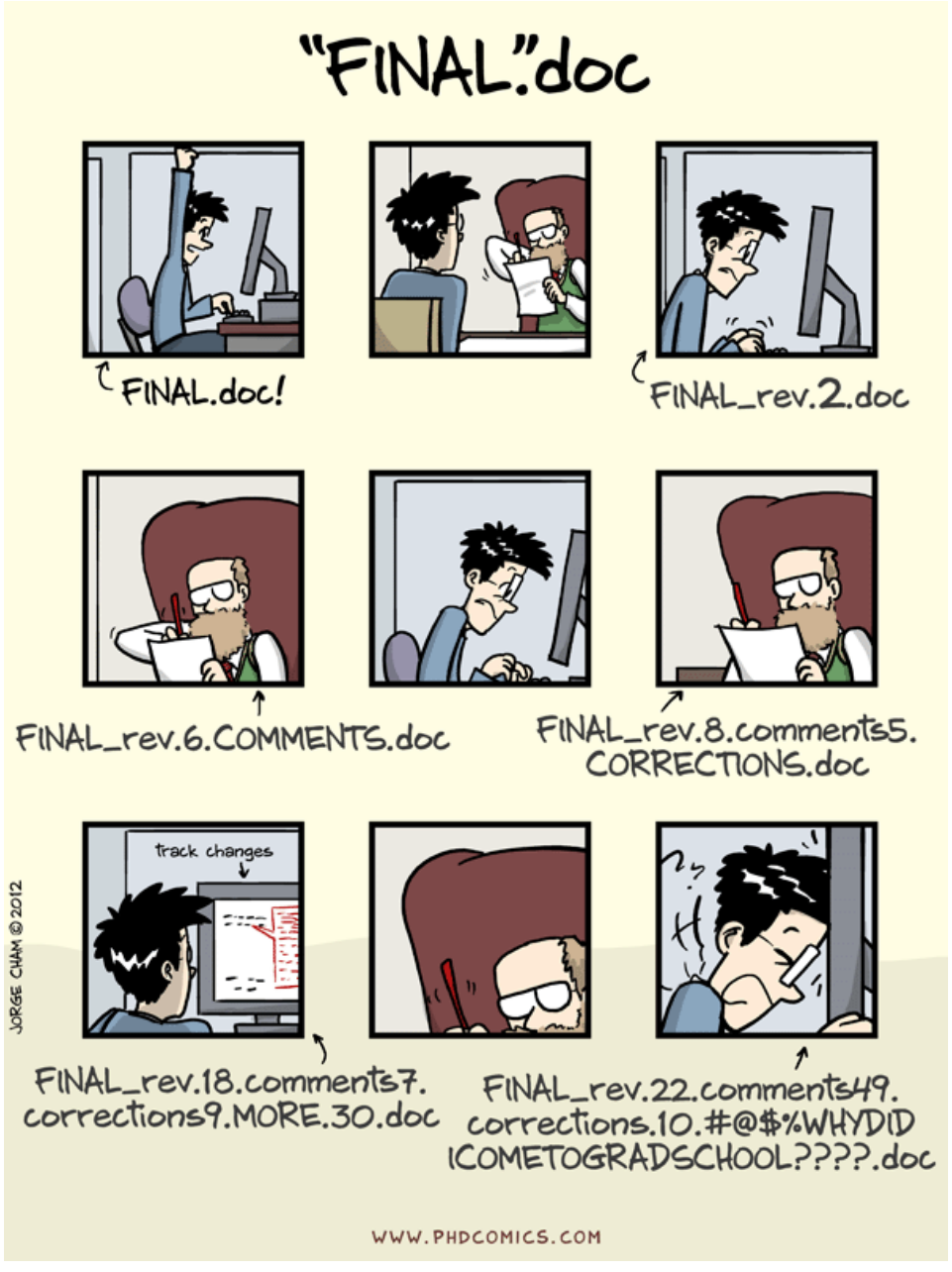
Inf1B

Version Control[1]

Fiona McNeill
adapting earlier versions by Perdita Stevens, Ewan Klein, Volker Seeker, et al.

School of Informatics

[1] Thanks to Karl Broman for much of this content



http://www.phdcomics.com/comics/archive.php?comicid=1531

Methods for tracking versions

- Don't keep track
- Save numbered zip files
- Formal version control

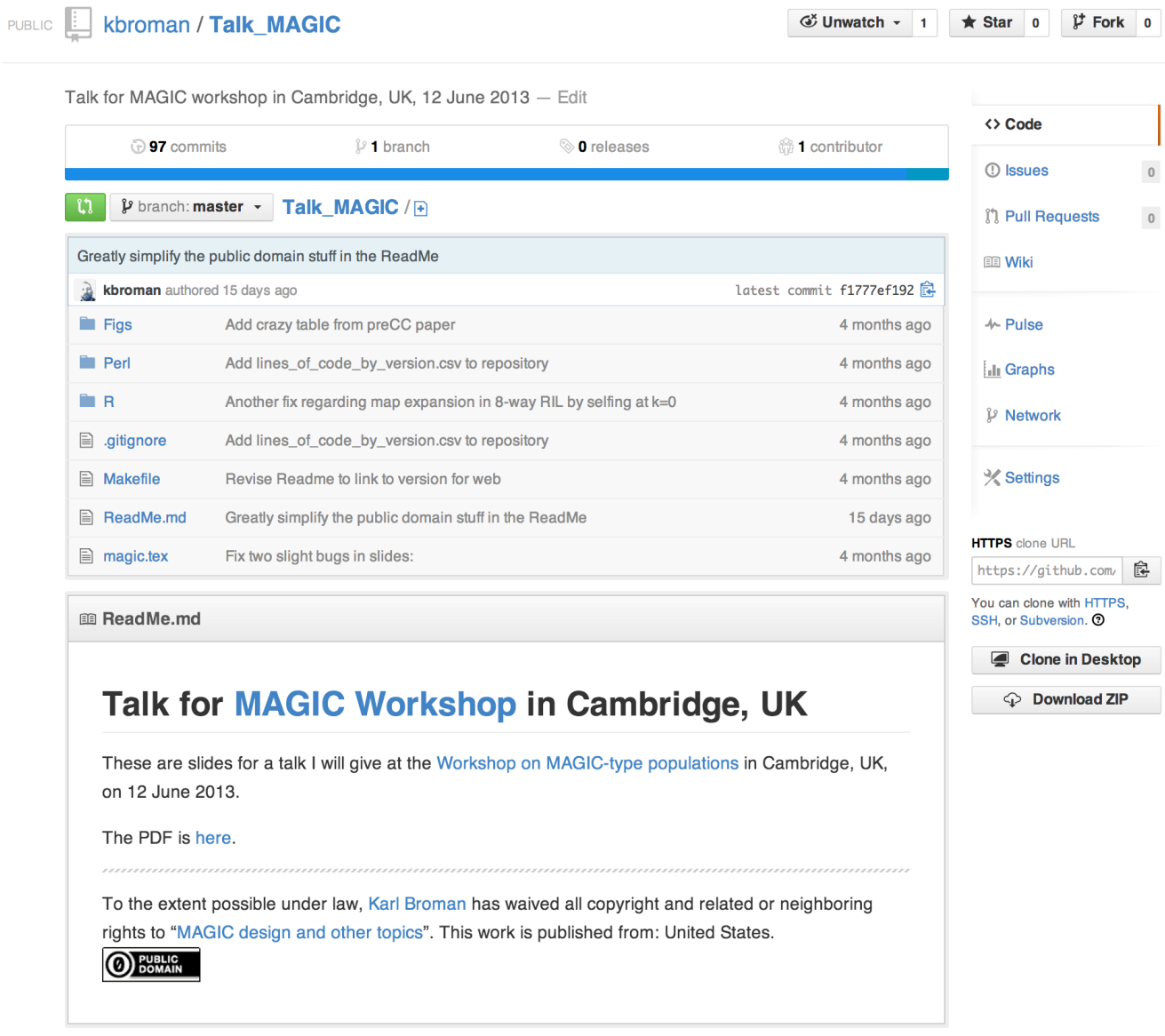
Suppose it stops working. . .

- Don't keep track
  - good luck!
- Save numbered zip files
  - Unzip versions and `diff`
- Formal version control
  - Easy to study changes back in time
  - Easy to jump back and test

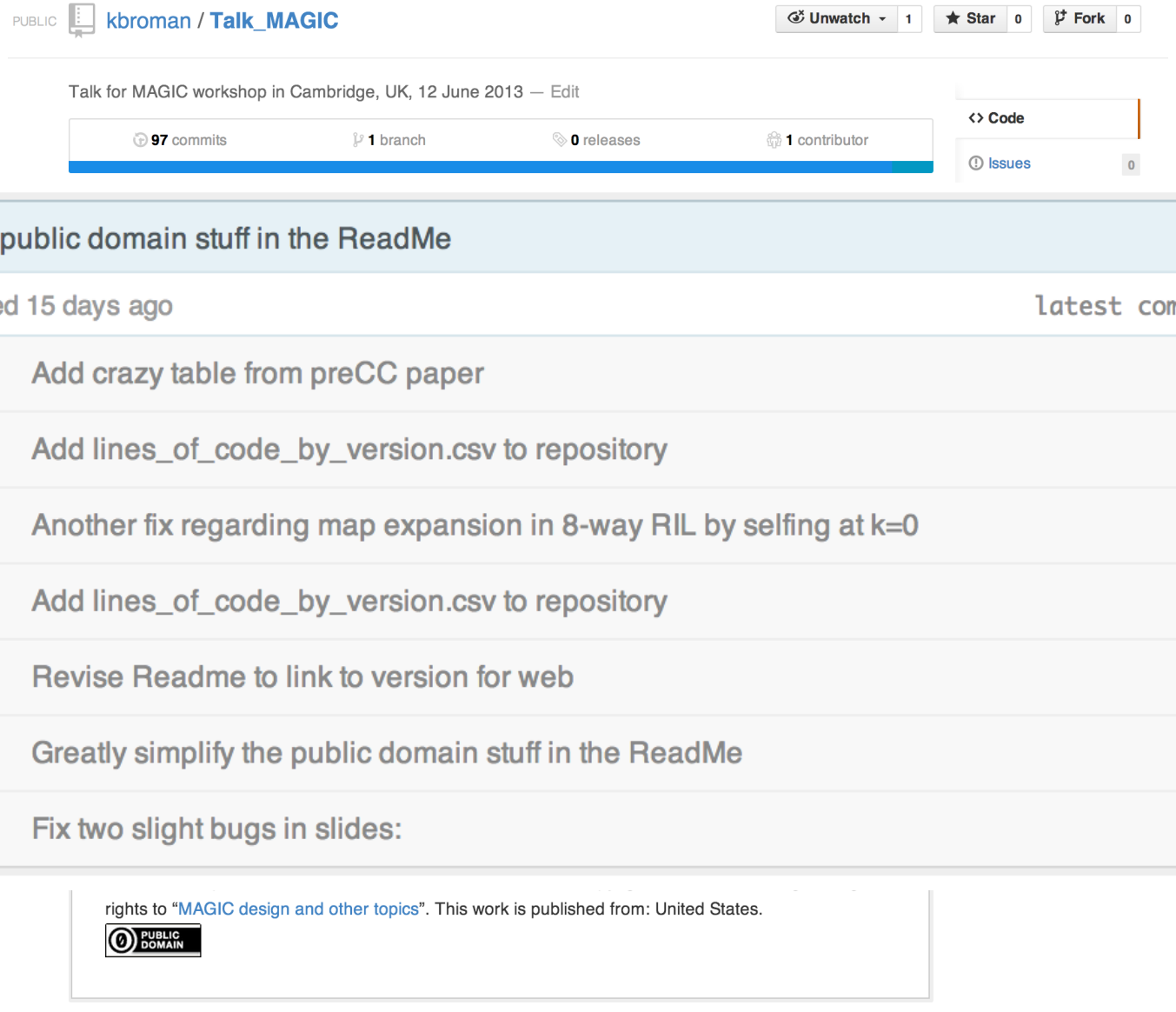
Why use formal version control?

- History of changes
- Able to go back
- No worries about breaking things that work
- Merging changes from multiple people

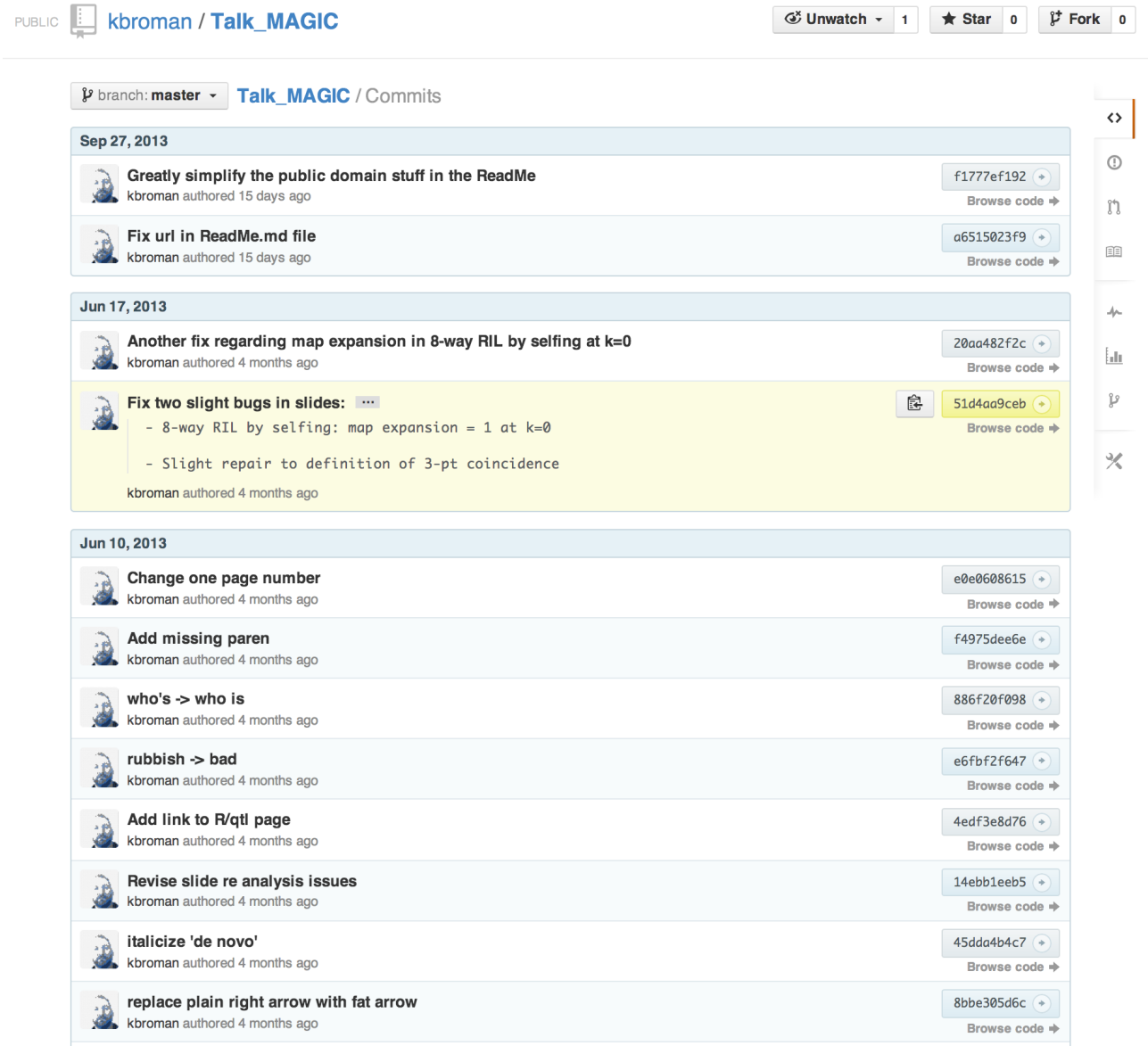
Example repository



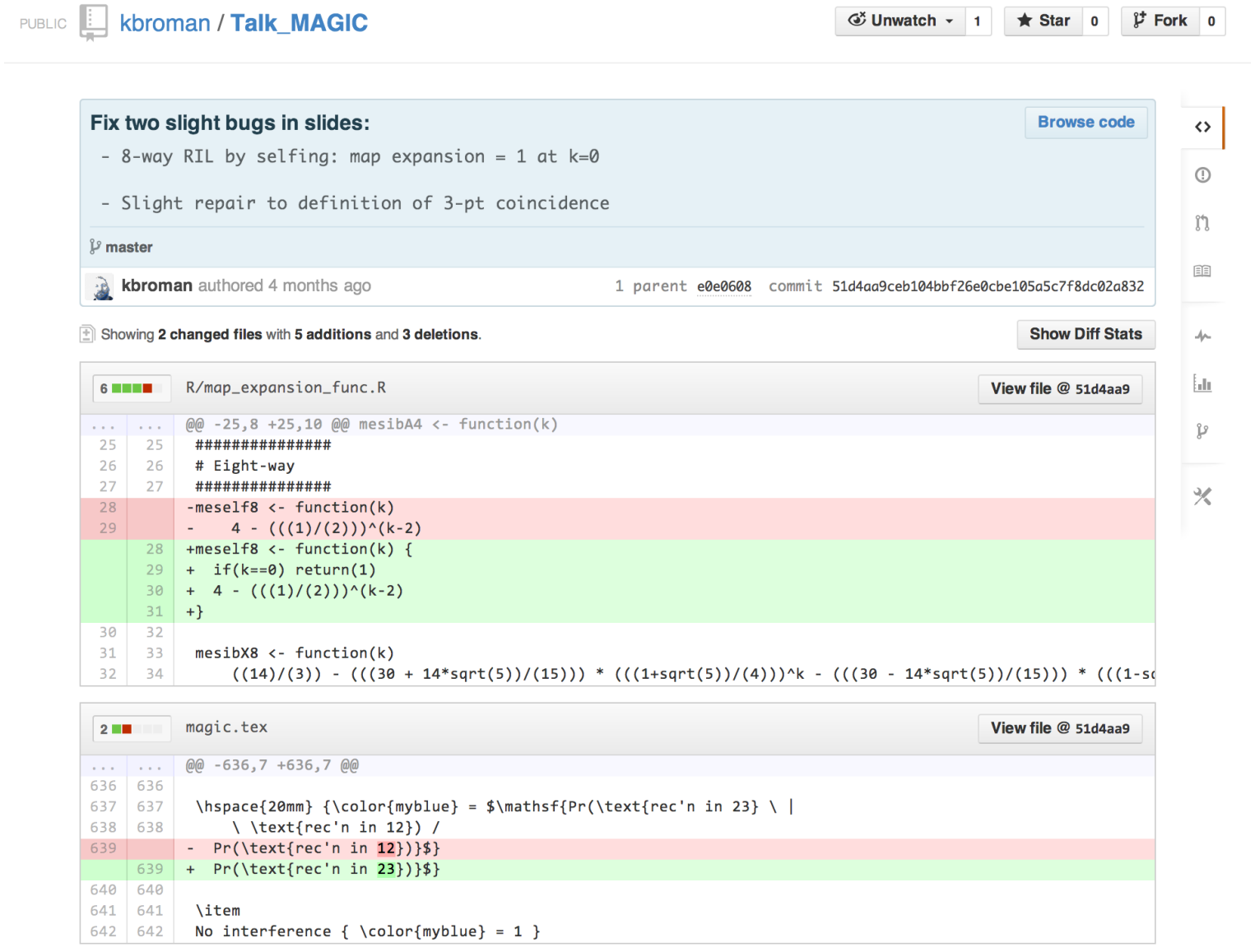
Example repository



Example history



Example commit



PUBLIC kbroman / Talk_MAGIC

Unwatch 1 | Star 0 | Fork 0

Fix two slight bugs in slides:

Browse code

```
- 8-way RIL by selfing: map expansion = 1 at k=0

- Slight repair to definition of 3-pt coincidence
```

master

kbroman authored 4 months ago 1 parent e0e0608 commit 51d4aa9ceb104bbf26e0cbe105a5c7f8dc02a832

Showing **2 changed files** with **5 additions** and **3 deletions**. Show Diff Stats

6 R/map_expansion_func.R View file @ 51d4aa9

```
...  ...  @@ -25,8 +25,10 @@ mesibA4 <- function(k)
25   25    ################
26   26    # Eight-way
27   27    ################
28        -meself8 <- function(k)
29        -    4 - (((1)/(2)))^(k-2)
     28   +meself8 <- function(k) {
     29   +  if(k==0) return(1)
     30   +  4 - (((1)/(2)))^(k-2)
     31   +}
30   32
31   33    mesibX8 <- function(k)
32   34        ((14)/(3)) - (((30 + 14*sqrt(5))/(15))) * (((1+sqrt(5))/(4)))^k - (((30 - 14*sqrt(5))/(15))) * (((1-sq
```

2 magic.tex View file @ 51d4aa9

```
...  ...  @@ -636,7 +636,7 @@
636  636
637  637   \hspace{20mm} {\color{myblue} = $\mathsf{Pr(\text{rec'n in 23} \ |
638  638       \ \text{rec'n in 12}) /
639       -  Pr(\text{rec'n in 12})}$}
     639   +  Pr(\text{rec'n in 23})}$}
640  640
641  641   \item
642  642   No interference { \color{myblue} = 1 }
```

What is git?

- Formal version control system
- Developed by Linus Torvalds (developer of Linux)
  - used to manage the source code for Linux
- Tracks any content (but mostly plain text files)
  - source code
  - data analysis projects
  - manuscripts
  - websites
  - presentations

Why use git?

- It's fast
- You don't need access to a server
- Amazingly good at merging simultaneous changes
- Everyone's using it

What is GitHub?

- A home for git repositories
- Interface for exploring git repositories
- Real open source
  - immediate, easy access to the code
- Like facebook or a public portfolio for programmers
- Free 2-year "micro" account for students
  - education.github.com
- (Bitbucket.org is an alternative)
  - free private repositories

Why use GitHub?

- It takes care of the server aspects of git
- Graphical user interface for git
  - Exploring code and its history
  - Tracking issues
- Facilitates:
  - Learning from others
  - Seeing what people are up to
  - Contributing to others' code
- Lowers the barrier to collaboration
  - "There's a typo in your documentation." vs.
    "Here's a correction for your documentation."

Basic use

- Change some files
- See what you've changed

```
git status
git diff
git log
```

- Indicate what changes to save

```
git add
```

- Commit to those changes

```
git commit
```

Basic use

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- Push the changes to GitHub

  ```
  git push
  ```

Basic use

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- Pull changes from your collaborator

  ```
  git pull
  ```

Basic use

- Change some files
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  git status
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  ```

- Push the changes to GitHub

  ```
  git push
  ```

- Pull changes from your collaborator

  ```
  git fetch
  git merge
  ```

Initialize repository

- Create (and cd to) a working directory
  - For example, `~/Docs/Talks/Graphs`
- Initialize it to be a git repository
  - `git init`
  - Creates subdirectory `~/Docs/Talks/Graphs/.git`

```
$ mkdir ~/workspace/inf1b/booklibrary
$ cd ~/workspace/inf1b/booklibrary
$ git init
Initialized empty Git repository in ~/workspace/inf1b/
    booklibrary/.git/
```

Produce content

- Create a `README.md` file

```
## Software to manage a library of book data

This software was originally created as part of the
Inf1b coursework and has since been extended.

The data is taken from the
[goodreads website](https://www.goodreads.com/).
```

Incorporate into repository

- Stage the changes using `git add`

```
$ git add README.md
```

Incorporate into repository

- Now commit using `git commit`

```
$ git commit -m "Initial commit of README.md file"
[master (root-commit) 32c9d01] Initial commit of README
    .md file
 1 file changed, 7 insertions(+)
 create mode 100644 README.md
```

- The `-m` argument allows one to enter a message
- Without `-m`, `git` will spawn a text editor
- Use a meaningful message
- Message can have multiple lines, but make 1st line an overview

A few points on commits

- Use frequent, small commits
- Don't get out of sync with your collaborators
- Commit the sources, not the derived files
  (.java sources not generated .class files)
- Use a `.gitignore` file to indicate files to be ignored

```
*~
.idea
*.iml
out
```

Using git on an existing project

- `git init`
- Set up `.gitignore` file
- `git status` (did you miss any?)
- `git add .` (or name files individually)
- `git status` (did you miss any?)
- `git commit`

Removing/moving files

For files that are being tracked by git:

- Use `git rm` instead of just `rm`
- Use `git mv` instead of just `mv`

```
$ git rm myfile
$ git mv myfile newname
$ git mv myfile SubDir/
$ git commit
```

First use of git

```
$ git config --global user.name "Jane Doe"
$ git config --global user.email "janedoe@wisc.edu"

$ git config --global color.ui true

$ git config --global core.editor emacs

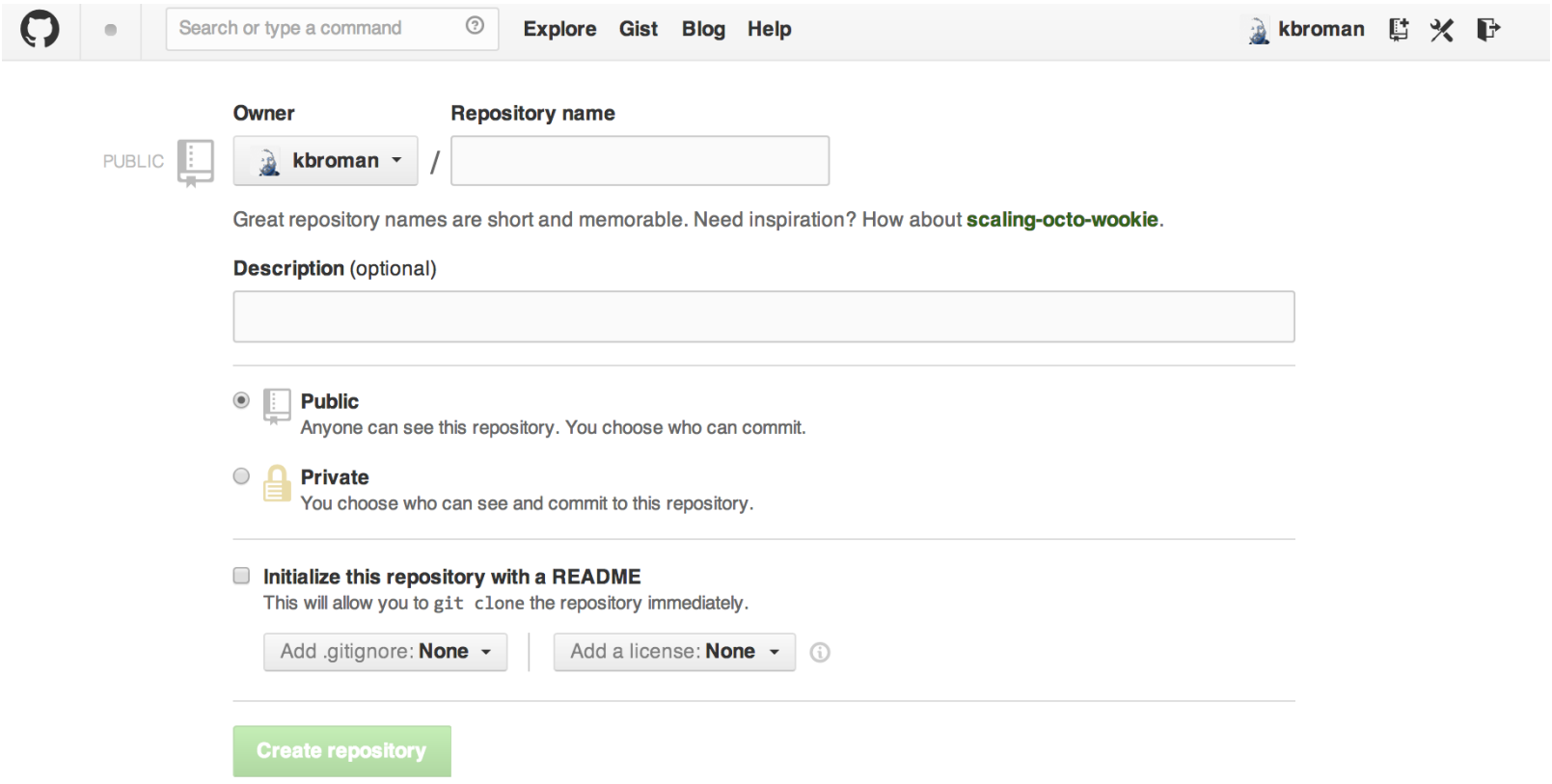
$ git config --global core.excludesfile ~/.
    gitignore_global
```

Set up GitHub repository

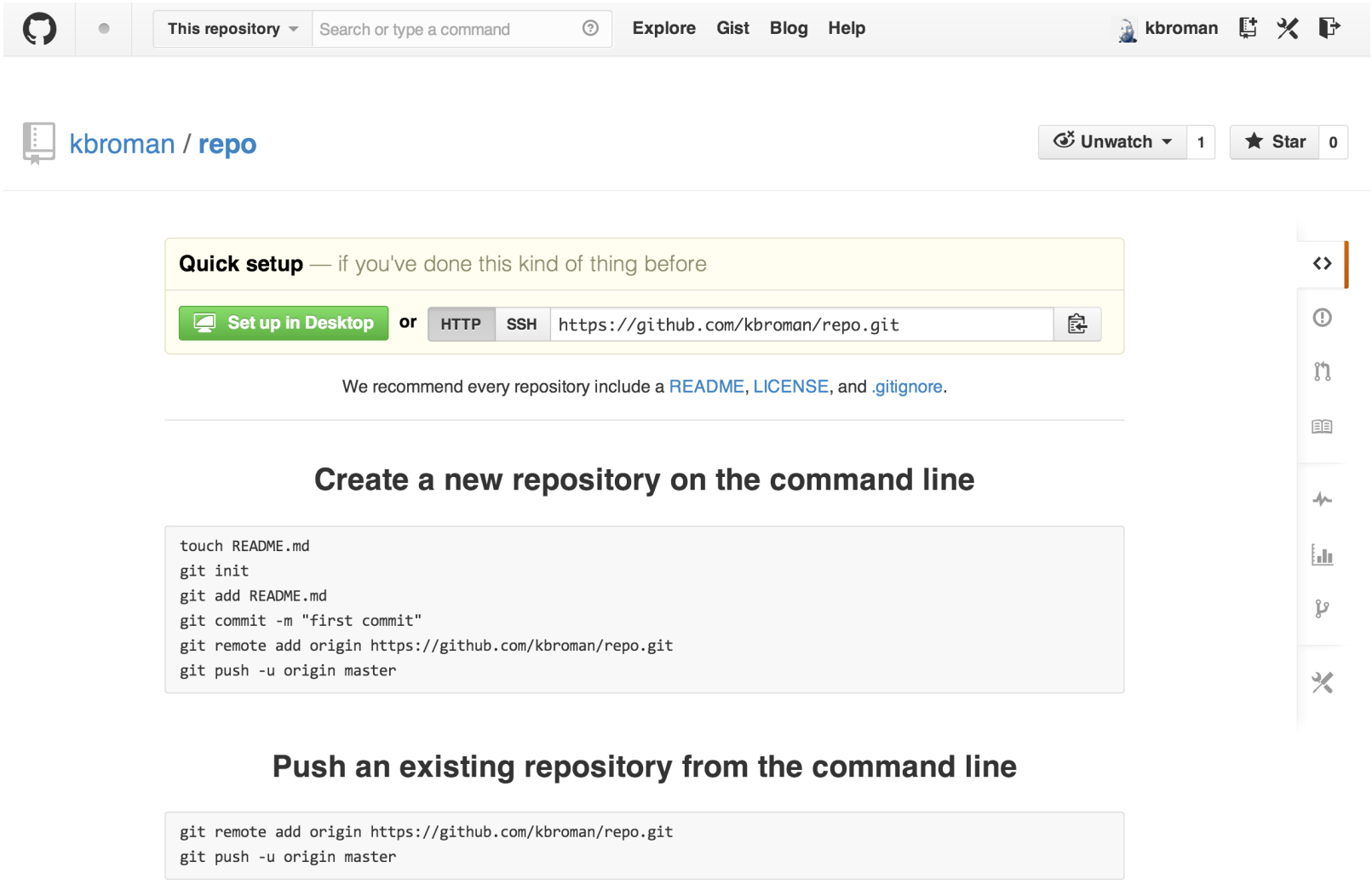
- Get a GitHub account
- Click the "Create a new repo" button
- Give it a name and description
- Click the "Create repository" button
- Back at the command line:

```
git remote add origin https://github.com/username/repo
git push -u origin master
```

Set up GitHub repository



Set up GitHub repository



Configuration file

Part of a `.git/config` file:

```
[remote "origin"]
    url = https://github.com/kbroman/qtl.git
    fetch = +refs/heads/*:refs/remotes/origin/*

[branch "master"]
    remote = origin
    merge = refs/heads/master

[remote "brian"]
    url = git://github.com/byandell/qtl.git
    fetch = +refs/heads/*:refs/remotes/brian/*
```

Branching and merging

- Use branches to test out new features without breaking the working code.

```
git branch devel
git branch
git checkout devel
```

- When you're happy with the work, merge it back into your master branch.

```
git checkout master
git merge devel
```

Issues and pull requests

- Problem with or suggestion for someone's code?
  - Point it out as an Issue
- Even better: Provide a fix
  - Fork
  - Clone
  - Modify
  - Commit
  - Push
  - Submit a Pull Request

Suggest a change to a repo

- Go to the repository:

  `http://github.com/someone/repo`

- Fork the repository

  Click the "Fork" button

- Clone your version of it

  `git clone https://github.com/username/repo`

- Change things locally, `git add`, `git commit`

- Push your changes to *your* GitHub repository

  `git push`

- Go to *your* GitHub repository

- Click "Pull Requests" and "New pull request"

Pulling a friend's changes

- Add a connection

```
git remote add friend git://github.com/friend/repo
```

- If you trust them, just pull the changes

```
git pull friend master
```

- Alternatively, fetch the changes, test them, and *then* merge them.

```
git fetch friend master
git branch -a
git checkout remotes/friend/master
git checkout -b friend
git checkout master
git merge friend
```

- Push them back to your GitHub repo

```
git push
```

Merge conflicts

Sometimes after `git pull friend master`

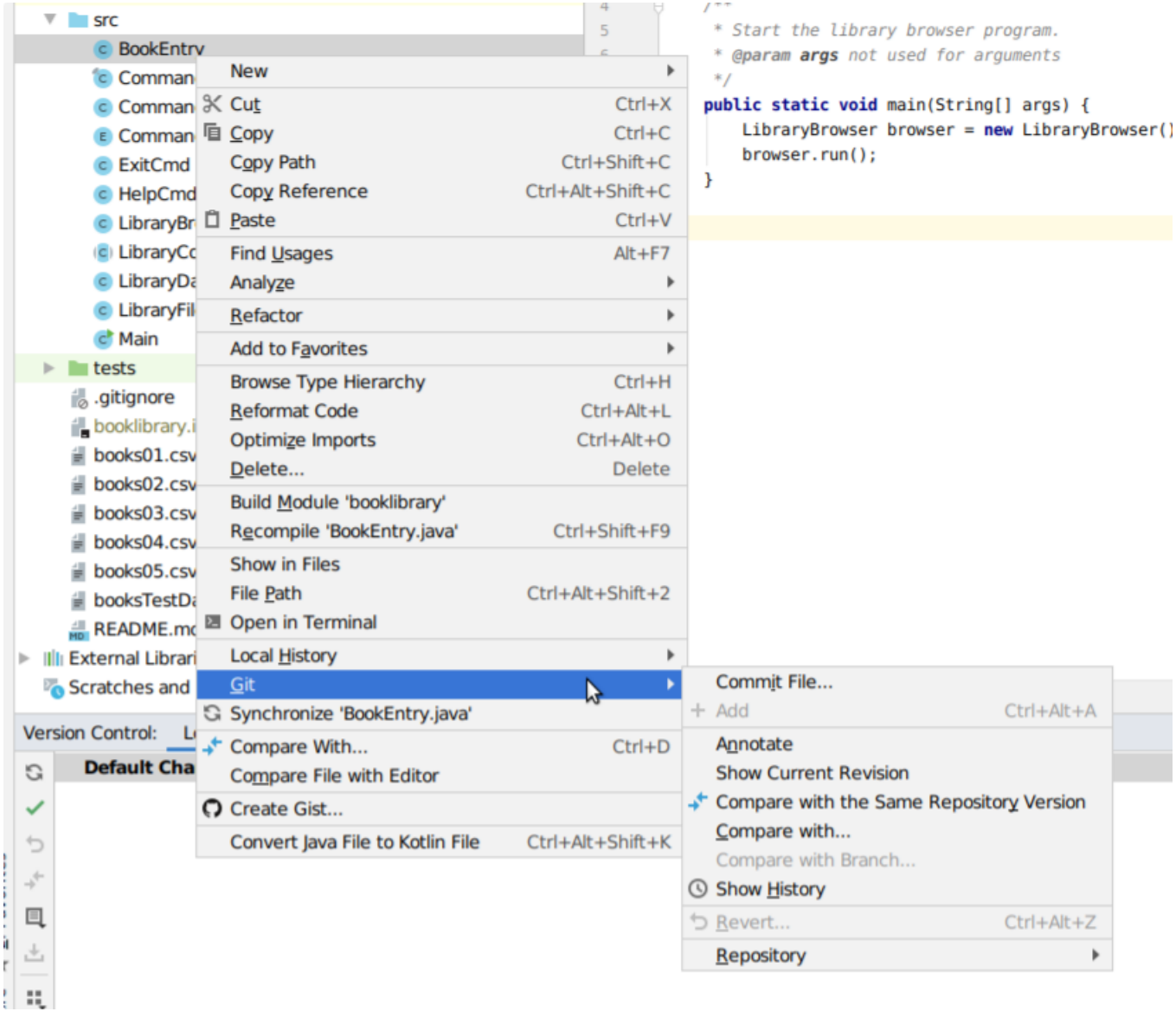
```
Auto-merging README.md
CONFLICT (content): Merge conflict in README.md
Automatic merge failed; fix conflicts and then commit
    the result.
```

Inside the file you'll see:

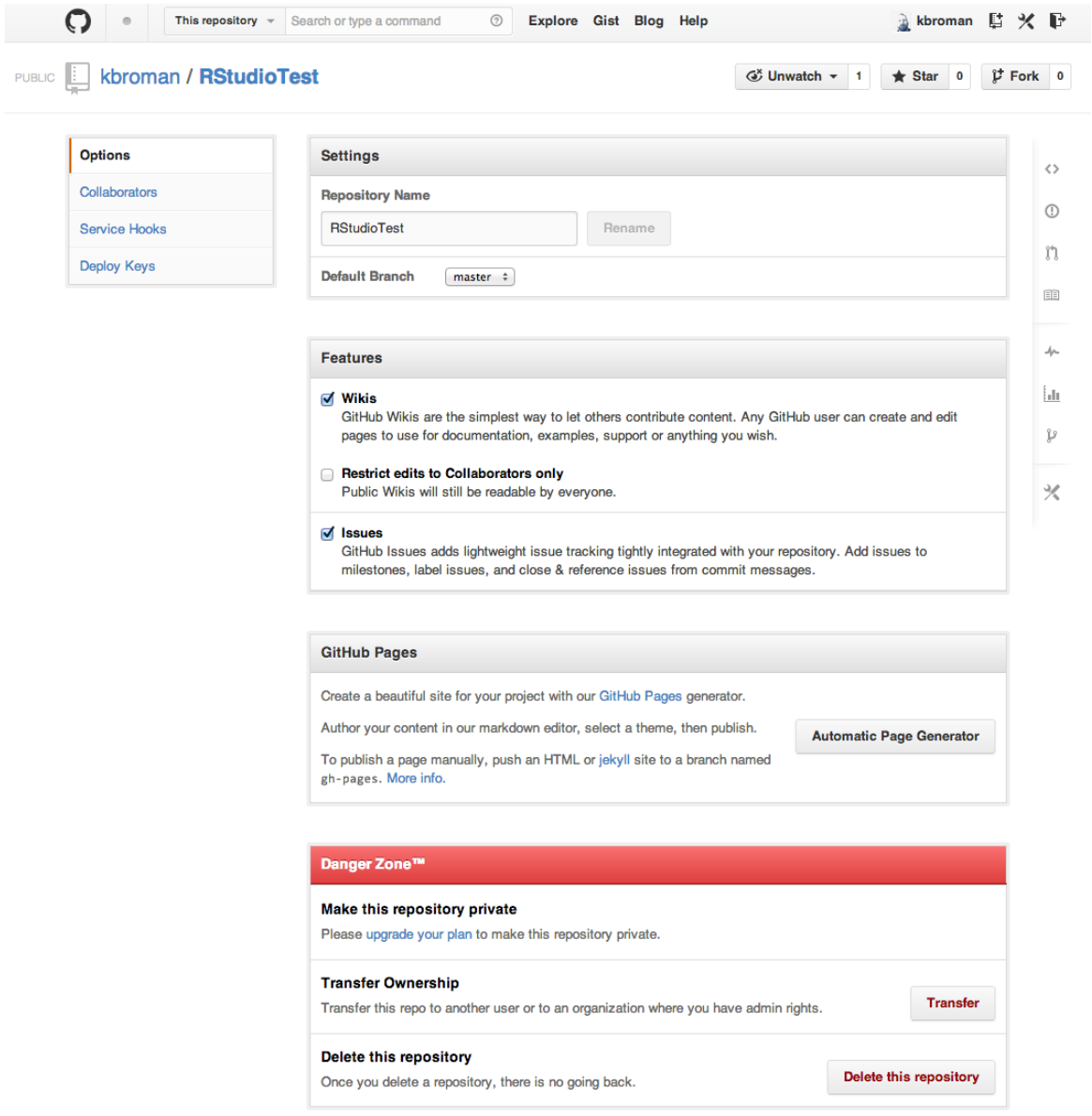
```
<<<<<<< HEAD
A line in my file.
=======
A line in my friend's file
>>>>>>> 031389f2cd2acde08e32f0beb084b2f7c3257fff
```

Edit, add, commit, push, submit pull request.

git/GitHub with IntelliJ



Delete GitHub repo



Open source means everyone can see my stupid mistakes.

Version control means everyone can see every stupid mistake I've ever made.

Reading

Online Resources

- **Github Documentation and Tutorials**
  `http://try.github.io/`