Activity 4: Git and GitHub

Introduction

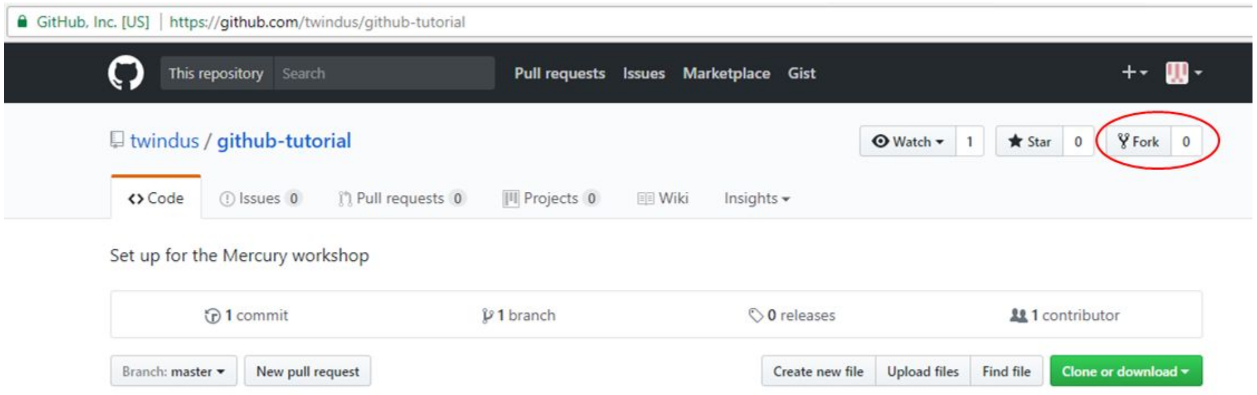
In this activity, you will make a GitHub account, clone a working repository, and perform some basic tasks that are common in using GitHub and git as a community repository. Note that git and GitHub are extremely powerful and only a very small subset of the capabilities are shown in this exercise.

Make your own GitHub account

- In a browser go to https://github.com
- Fill in the blanks for Username, Email and Password (remember the password since you will need it later)
- Choose the “Unlimited public repositories for free” button and click “Continue”
- You can either fill in the survey and click “Continue” or click “Skip this step” (next to the “Continue” button at the bottom of the page)
- You will get an email to verify your email address. Click on the link in the email and log into your account.
- You now have a fully functioning account! (Although you can modify the behavior of your repository using the “Settings” option, please don’t do that for this exercise.)

Make a fork (or copy or clone or branch) of an existing GitHub repository to your GitHub account

- Find an existing repository that you want to work on. For our purposes, use the repository at https://github.com/twindus/github-tutorial (i.e. go to this link).
- Click on the “Fork” button on the upper right corner of the screen:



Set up for the Mercury workshop

- This will create a clone of the repository into *your* GitHub account and put your active browser page on *your* repository. This will allow you to make your own changes to the content of the repository.

Set up a few things on your local git repository
So far, you have only interacted with GitHub. To most effectively make changes in a repository, it is most useful to have a copy (or clone) of the repository on your computer.

To do this, you will first need to open an appropriate "window" on your computer and set up your git repository:

- If you are on a Windows machine, go to the Start Menu and start the application "Git Bash".
- If you are on a Mac, you should start the "Terminal" application (located in Applications/Utilities).

Either one of these will open a window where you can type in commands. For the rest of the exercise, we will call this window the "command window".

Now we need to configure git so it knows a bit about you. The first command below is setting your email address and the second one sets your name (this can be anything that you would like it to be, but most people use their real names so that others can tell who is working on a repository). These particular commands are setting options in a file names .gitconfig in your home directory and will be what is used for ALL of your git repositories. In the command window, type

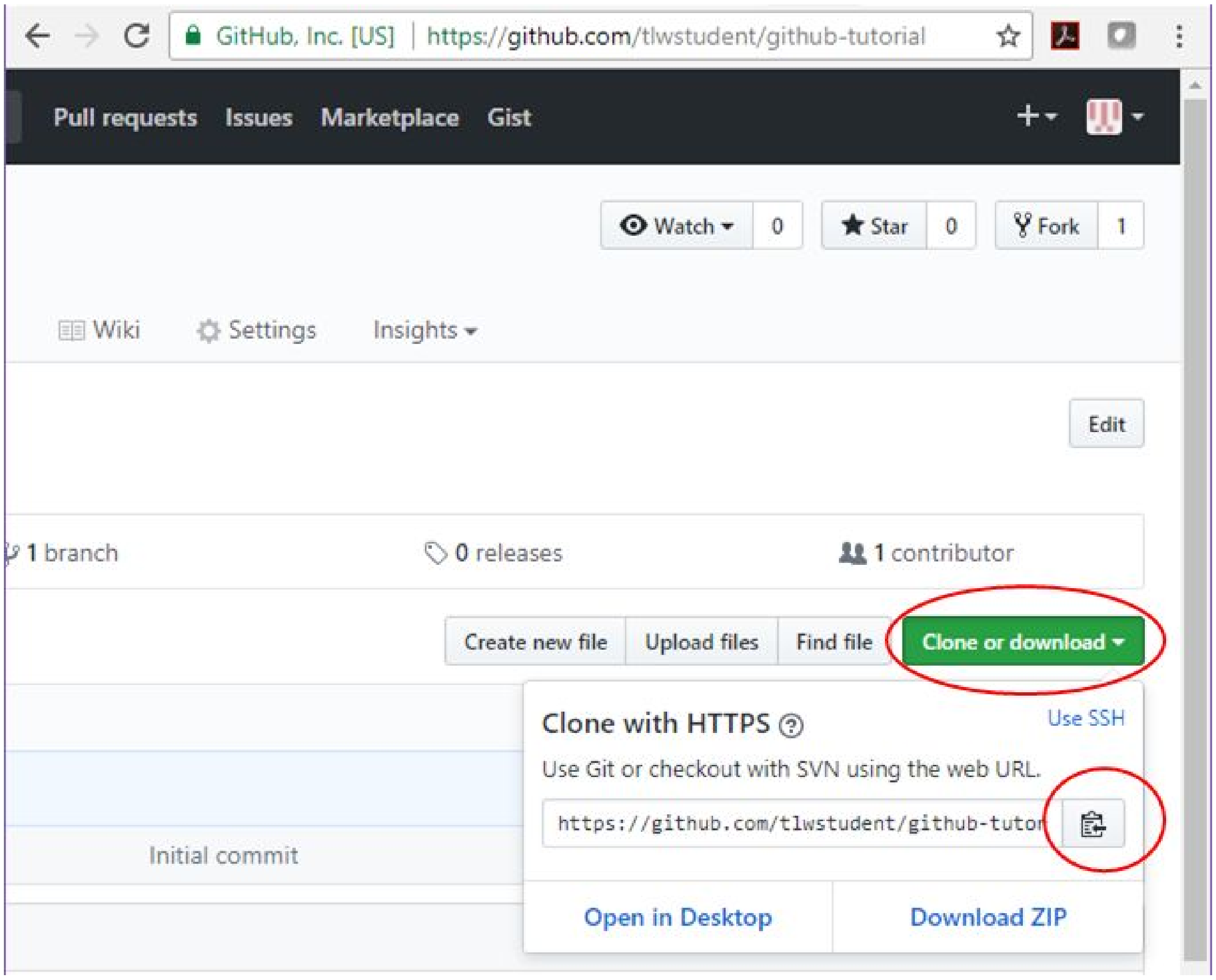
```
git config --global user.email you@example.com
git config --global user.name "Your Name"
```

Make sure that you substitute in your actual e-mail for `you@example.com` and your real name for `Your Name`. You will need the quotes around `Your Name`.

Make a clone on your laptop machine

To clone your repository onto your computer:

- You will need to know the repository address (or remote address) to take the information from. Go to your repository in GitHub on your browser and click on the green "Clone or download" button. Once the pop-up window opens, click on the clipboard icon to copy the URL into the clipboard (*make sure to grab the URL and not the ssh address*):



- Now, go to the command window. We will make a clone of the repository in GitHub to your local machine. We will make a folder in your (Desktop) folder to make sure we know where it is. Type:

  ```
  cd (Desktop)
  mkdir molssi-day2
  cd molssi-day2
  git clone <url>
  ```

  where you should substitute the location of your Desktop folder for (Desktop). Also, `<url>` should be replaced with the url above (you can paste it into the command window or type it from the browser window - in the example above the `<url>` is https://github.com/tlwstudent/github-tutorial) **Do not use the url to the left! Use the one for your repository!**

- You should now have a copy of the repository on your computer. To get into the directory where the files are located, type:

  ```
  cd github-tutorial
  ```

  If you then type:

  ```
  ls
  ```

  into the command window, you will get a list of the files that are in the repository.

It is important here to note that you have not just made a copy of the files onto your local machine, but also into the local git repository on your computer! So, for a while, we are going to work on your local files and on the local git repository. Once we have things like we want them in the local git repository, we will make the changes into GitHub.

Making a change in a file

The next thing we will do is to make some changes in a couple of the files and commit them into the local git repository. Note that we can make as many changes to the files as we want without any fear of changing the repository until we use a "`git`" command. Even then, there are ways (that we won't go into for this short tutorial) to recover from most commands. So, have no fear of trying things out! This is how you learn!

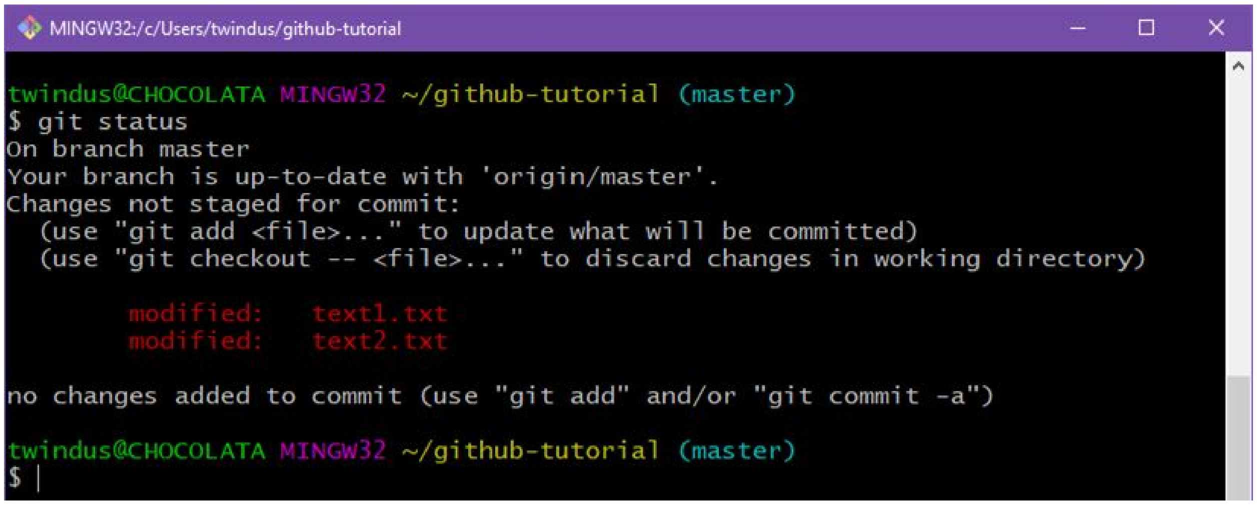
- Using a text editor (like Atom, TextWrangler or Notepad++), open up the file **text1.txt**.
- Make any changes that you like - change words, delete sentences, add text, etc.
- Save and close the file.
- Open up the file **text2.txt** and again make any changes that you like, save and close the file.

At this point, you have only made changes to your local files, but not to the local git repository.

Now, let's learn a command that is very useful to get an overall view of what has changed from your files and the local git repository. Type:

```
git status
```

You will see something similar to the following:

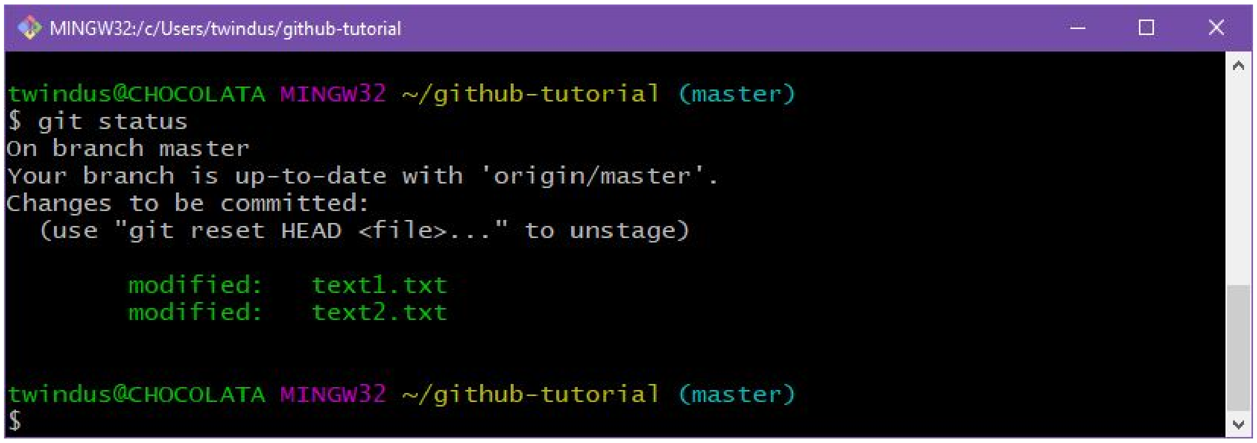


```
twindus@CHOCOLATA MINGW32 ~/github-tutorial (master)
$ git status
On branch master
Your branch is up-to-date with 'origin/master'.
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git checkout -- <file>..." to discard changes in working directory)

        modified:   text1.txt
        modified:   text2.txt

no changes added to commit (use "git add" and/or "git commit -a")

twindus@CHOCOLATA MINGW32 ~/github-tutorial (master)
$ |
```

Note that it tells us that we have two files that have been modified. They have not yet been added into the local repository. Also note that while git recognizes that **text1.txt** and **text2.txt** have been modified, they are "not staged for commit". It turns out that we actually have three local areas we need to be concerned about: the local files, the local git repository and a git staging area that we haven't discussed before. Think of the staging area as a place where we let git knows which files we are going to commit to the local repository (because we may not want to commit all of the files that we are going to make changes on). To add these files to the staging area, we type:

```
git add text1.txt text2.txt
git status
```

This should give us:



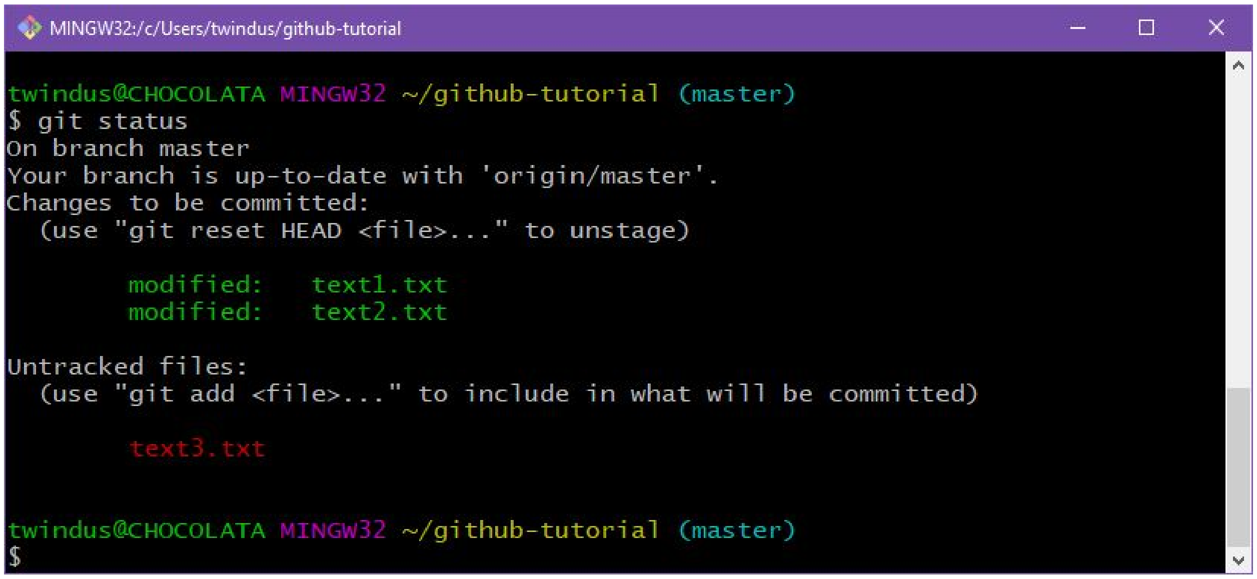
```
twindus@CHOCOLATA MINGW32 ~/github-tutorial (master)
$ git status
On branch master
Your branch is up-to-date with 'origin/master'.
Changes to be committed:
  (use "git reset HEAD <file>..." to unstage)

        modified:   text1.txt
        modified:   text2.txt


twindus@CHOCOLATA MINGW32 ~/github-tutorial (master)
$
```

The two files are now in the staging area and could be committed to the local repository. But before we do that, let's add another file.

Add a file
Let's say that we decide we want to add another file that has some of our other favorite text in it to share with our fellow students. So, let's make another file.

- Open your text editor (if it is not already open), and open a new file.
- Put in any text that you would like.
- Save the file as **text3.txt** and close it. (Make sure that the file that you created is in the directory with the other local files.)

In the command window, type "`git status`". You should see something like this:

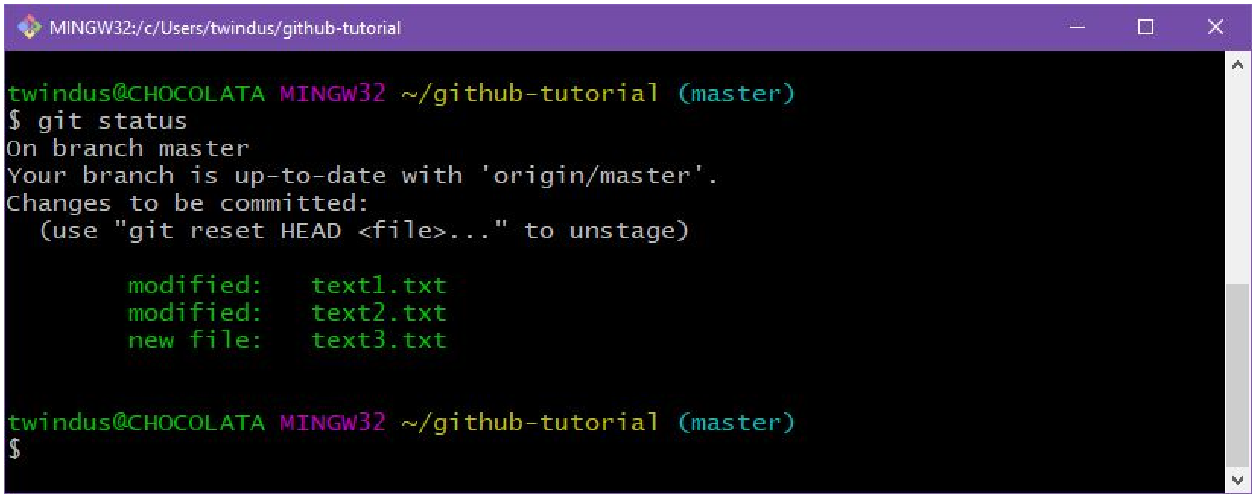


```
twindus@CHOCOLATA MINGW32 ~/github-tutorial (master)
$ git status
On branch master
Your branch is up-to-date with 'origin/master'.
Changes to be committed:
  (use "git reset HEAD <file>..." to unstage)

        modified:   text1.txt
        modified:   text2.txt

Untracked files:
  (use "git add <file>..." to include in what will be committed)

        text3.txt


twindus@CHOCOLATA MINGW32 ~/github-tutorial (master)
$
```

Note that in addition to the two files that we modified and that are in the staging area, we now have an "Untracked file" - **text3.txt**. It is untracked because git knows nothing about it! So, we need to tell git that we want this file to be part of the repository. To do that, type:

```
git add text3.txt
git status
```

You should see something like:



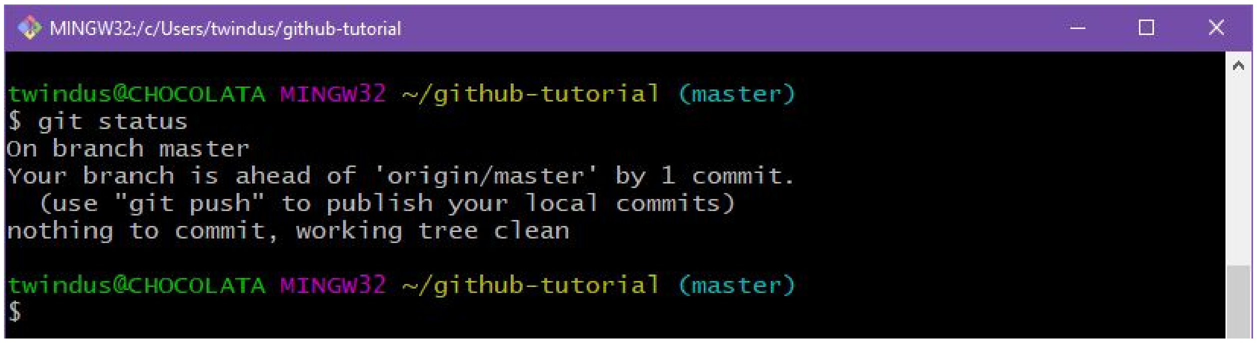
```
twindus@CHOCOLATA MINGW32 ~/github-tutorial (master)
$ git status
On branch master
Your branch is up-to-date with 'origin/master'.
Changes to be committed:
  (use "git reset HEAD <file>..." to unstage)

        modified:   text1.txt
        modified:   text2.txt
        new file:   text3.txt


twindus@CHOCOLATA MINGW32 ~/github-tutorial (master)
$
```

Note now that **text3.txt** has been added to the staging area and is ready to be committed. It has not yet been committed, though.

Committing changes to the local repository
Now that we have all of the changes and additions that we want into the staging area, we are ready to put those changes into the repository. This is done by typing:

```
git commit -m "some simple modifications and additions"
```

The text in the quotes can be whatever message that you would like to give. The message should usually be more descriptive than this one is - the idea is to give you some idea of what the changes were. Now type "`git status`" again. You should see something like:



```
twindus@CHOCOLATA MINGW32 ~/github-tutorial (master)
$ git status
On branch master
Your branch is ahead of 'origin/master' by 1 commit.
  (use "git push" to publish your local commits)
nothing to commit, working tree clean

twindus@CHOCOLATA MINGW32 ~/github-tutorial (master)
$
```

Note that it says that there is nothing to commit. It also says, “Your branch is ahead of ‘origin/master’ by 1 commit.” This is saying that you have made 1 commit to your local repository (a “branch” of your GitHub repository) that is not in your GitHub repository (‘origin/master’).

We could repeat making changes to our files and committing changes to our local repository until we have made all of the changes that we want. We can do as many “`git commit`” commands as we need to get the files as we want them. Once this is done, we are ready to push our changes back up to the GitHub repository.

Push our changes from our local git repository up to our GitHub account
Type:

```
git push origin master
```

`origin` means the place where the local repository was taken from - our GitHub account in this case - and `master` means the local branch that we want to push - by default, your local git repository is called master.

Sometimes this command will hang (wait a minute or two though since sometimes other things on your computer can cause the hang). If so, type <ctrl-c> (hold the “ctrl” and “c” button at the same time) to cancel the current command. Then type:

```
git config --global core.askpass "git-gui--askpass"
git push origin master
```

This may take a few minutes to run, but should pop up a window to ask you for your GitHub username and password. When it does this, fill these in and hit “Login”.

If you still aren’t getting anything, type:

```
GIT_CURL_VERBOSE=1 git push origin master
```

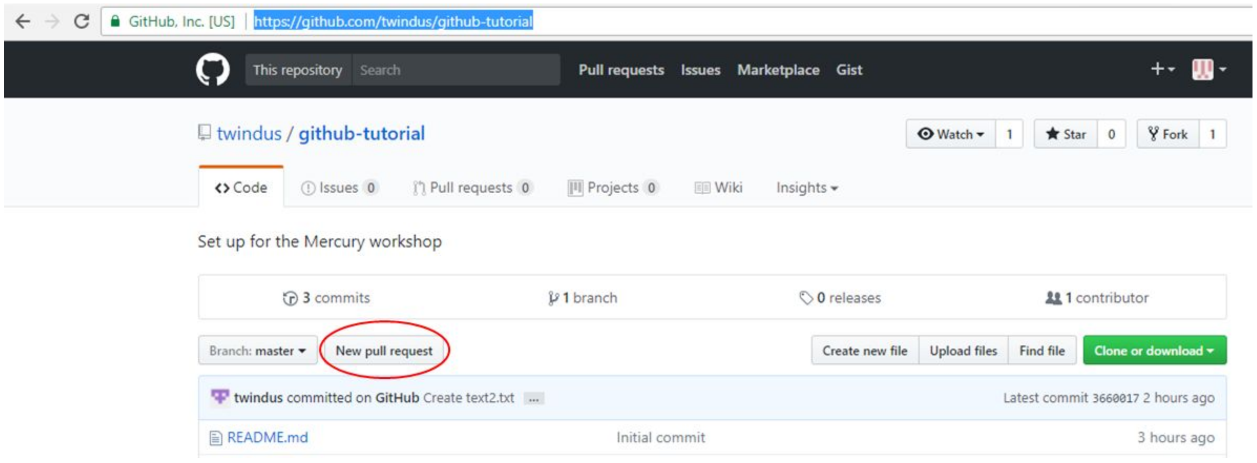
and call one of the instructors for help.

You can check to see if your GitHub repository has been updated by going to the browser with your GitHub repository in it and refreshing the browser screen. You should see the message for the commit on **text1.txt** and **text2.txt**, and you should also see the new file **text3.txt**.

Requesting your changes be made to the upstream repository (the one you originally forked from)

Your changes are now in *your* GitHub repository. However, if you have made changes that you would like to get back into the upstream repository (the one you originally forked from), you will now need to do a pull request. This is basically notifying the originator of the upstream repository that you would like some changes merged into the upstream repository. The originator can decide whether or not to include some or all of the changes into the upstream repository. To start the pull request:

- In your browser, go to either *your* GitHub repository or the upstream GitHub repository (https://github.com/twindus/github-tutorial). For the purposes of this tutorial go to the upstream repository since it is a bit different if you start from *your* repository.
- Click on the “New pull request” button:

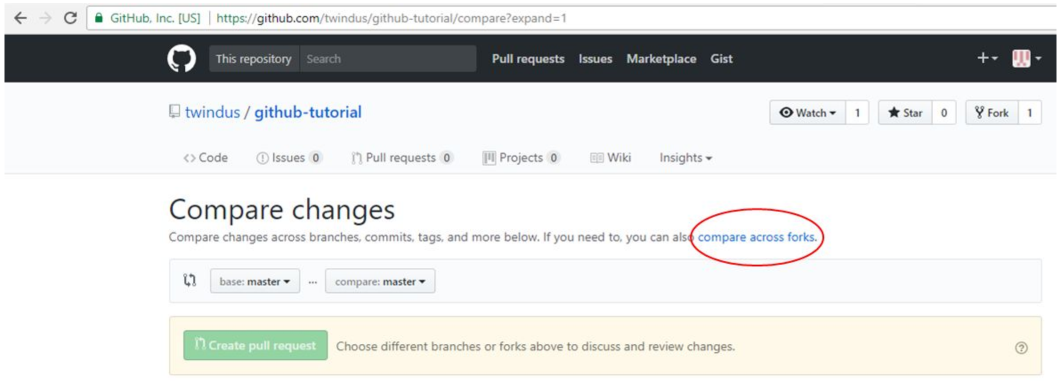


Set up for the Mercury workshop

twindus committed on GitHub Create text2.txt ... Latest commit 3660017 2 hours ago

README.md Initial commit 3 hours ago

- On the resulting page, click the “compare across forks” link:

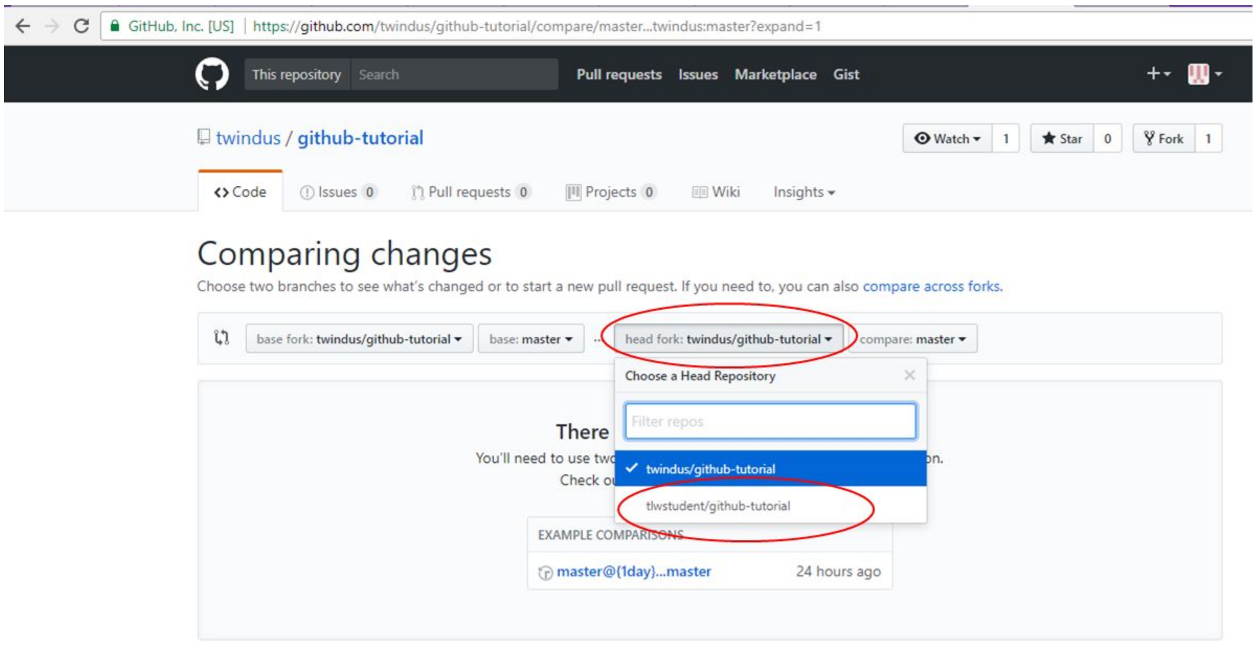

https://github.com/twindus/github-tutorial/compare?expand=1
twindus / github-tutorial
Compare changes

Compare changes across branches, commits, tags, and more below. If you need to, you can also compare across forks.

base: master
compare: master
Create pull request

Choose different branches or forks above to discuss and review changes.

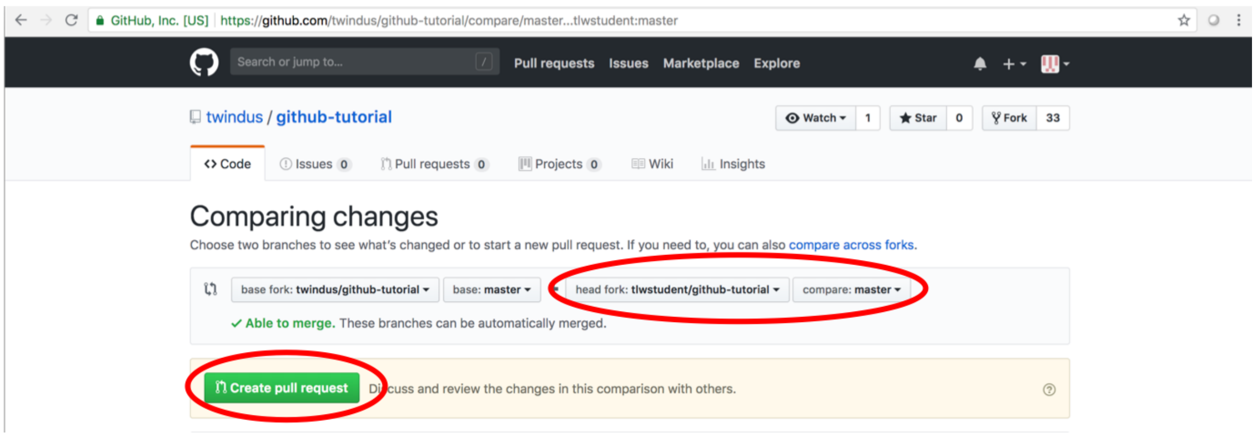
- Next, you need to pick your fork to compare against. So, click on “head fork:” and choose your fork:


https://github.com/twindus/github-tutorial/compare/master...twindus:master?expand=1
twindus / github-tutorial
Comparing changes

Choose two branches to see what’s changed or to start a new pull request. If you need to, you can also compare across forks.

base fork: twindus/github-tutorial
base: master
head fork: twindus/github-tutorial
compare: master
Choose a Head Repository
Filter repos
twindus/github-tutorial
tlwstudent/github-tutorial
EXAMPLE COMPARISONS
master@{1day}...master
24 hours ago

- Next click on the green “Create pull request” button:


https://github.com/twindus/github-tutorial/compare/master...tlwstudent:master

twindus / github-tutorial

Comparing changes

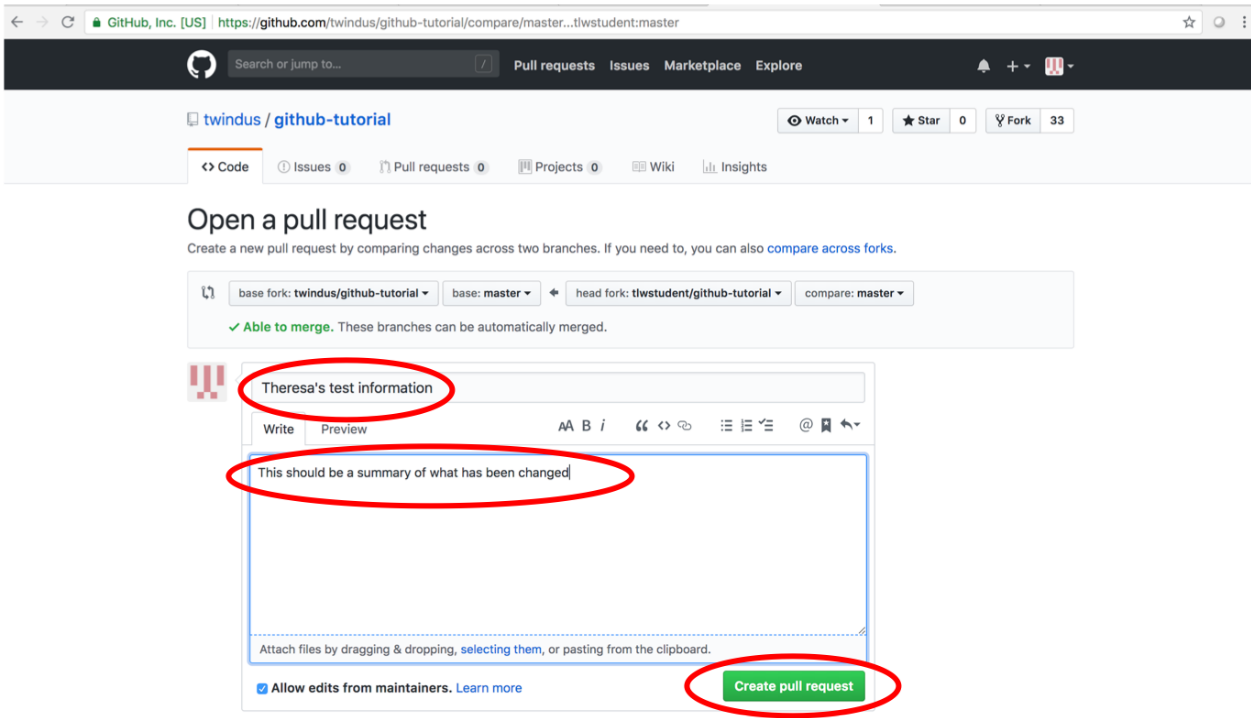
Choose two branches to see what's changed or to start a new pull request. If you need to, you can also compare across forks.

base fork: twindus/github-tutorial · base: master · head fork: tlwstudent/github-tutorial · compare: master

✓ Able to merge. These branches can be automatically merged.

Discuss and review the changes in this comparison with others.

- On the resulting page, put in a title, some comment about what the pull request is in the comment box and click on the green "Create pull request" button.


https://github.com/twindus/github-tutorial/compare/master...tlwstudent:master

twindus / github-tutorial

Open a pull request

Create a new pull request by comparing changes across two branches. If you need to, you can also compare across forks.

base fork: twindus/github-tutorial · base: master · head fork: tlwstudent/github-tutorial · compare: master

✓ Able to merge. These branches can be automatically merged.

Theresa's test information

This should be a summary of what has been changed

Attach files by dragging & dropping, selecting them, or pasting from the clipboard.

☑ Allow edits from maintainers. Learn more

- Now it will be up to the originator of the upstream repository to decide whether to merge your code into his/her repository.

*******Let the instructors know when you get to this point. We will have a short break while everyone gets to this point*******

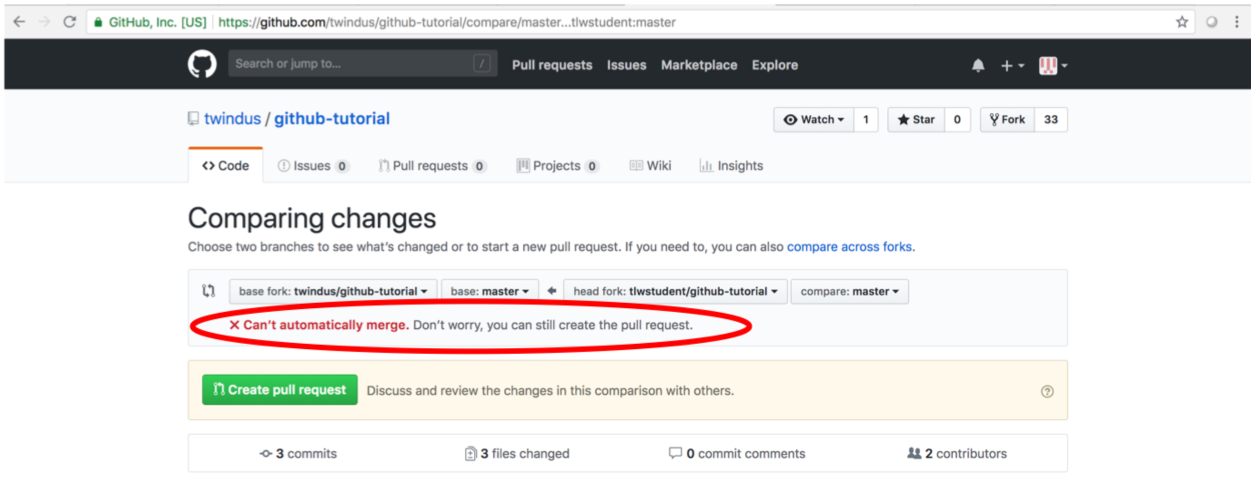
Resolving conflicts with the upstream repository

Often times when you are working in a collaborative project, someone else may change the same files that you are working on. If their changes get merged into the upstream repository before yours do, this can cause a "merge conflict" in your repository. In other words, your version is now out of date with changes that have happened in the upstream repository.

To show you how to resolve a conflict, we first have to make a conflict that can't be merged. Note that most changes can be merged pretty easily. However things like changing the same line in the same file or deleting files will create conflicts that will need a bit more attention. Easy conflicts can be dealt with in GitHub. For more extensive conflicts, it is probably easier to resolve (and may be required to be resolved) on your local git repositories on your computer. We will only focus on the first type in this tutorial.

For this simple example, the instructors have updated the upstream repository to change the first line of **text1.txt**. To create a conflict edit the first line of the **text1.txt** file on your computer, commit the changes and push the changes to GitHub. (Look at the examples above if you have forgotten how to do this.)

Now go to your GitHub repository in your browser, refresh the browser, and try to do a new pull request. You should see something like the following:


GitHub, Inc. [US] https://github.com/twindus/github-tutorial/compare/master...tlwstudent:master

twindus / github-tutorial

Comparing changes

Choose two branches to see what's changed or to start a new pull request. If you need to, you can also compare across forks.

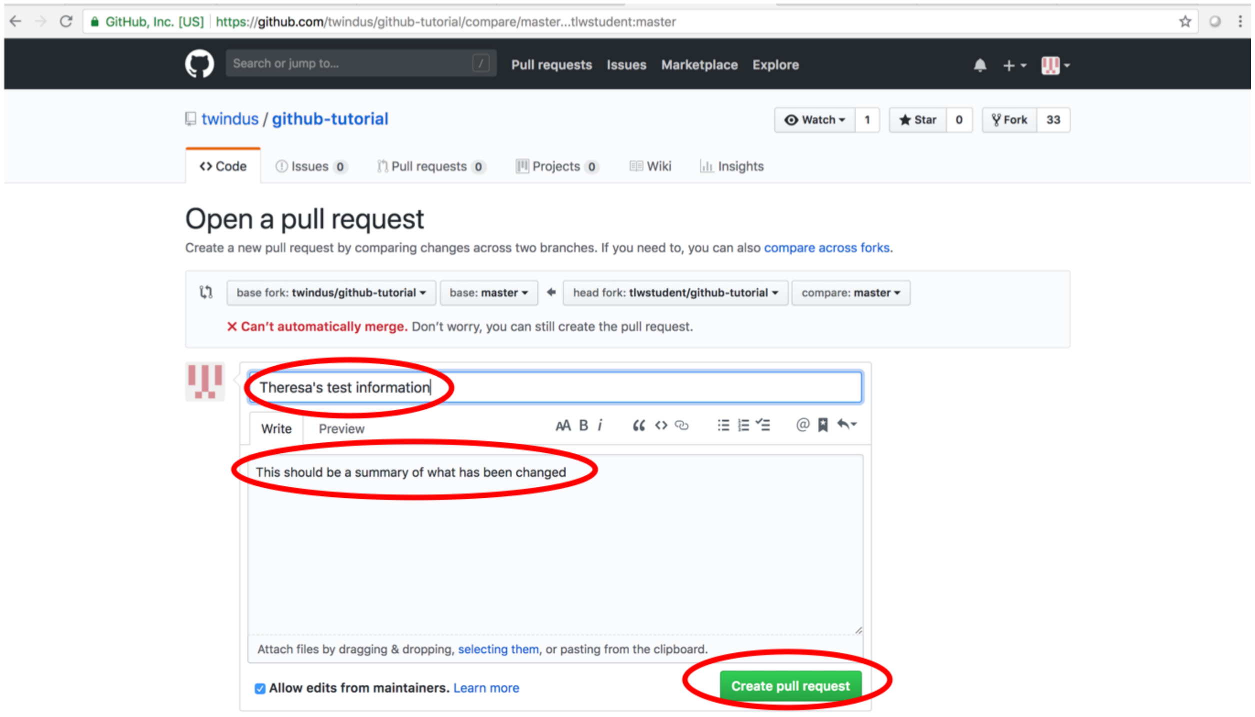
base fork: twindus/github-tutorial ▾ base: master ▾ ← head fork: tlwstudent/github-tutorial ▾ compare: master ▾

✕ Can't automatically merge. Don't worry, you can still create the pull request.

Create pull request — Discuss and review the changes in this comparison with others.

3 commits · 3 files changed · 0 commit comments · 2 contributors

- Click on the green "Create pull request" button. You should get a screen similar to the creation of your first pull request, but it will say that you can't automatically merge.


GitHub, Inc. [US] https://github.com/twindus/github-tutorial/compare/master...tlwstudent:master

twindus / github-tutorial

Open a pull request

Create a new pull request by comparing changes across two branches. If you need to, you can also compare across forks.

base fork: twindus/github-tutorial base: master ← head fork: tlwstudent/github-tutorial compare: master

✕ Can't automatically merge. Don't worry, you can still create the pull request.

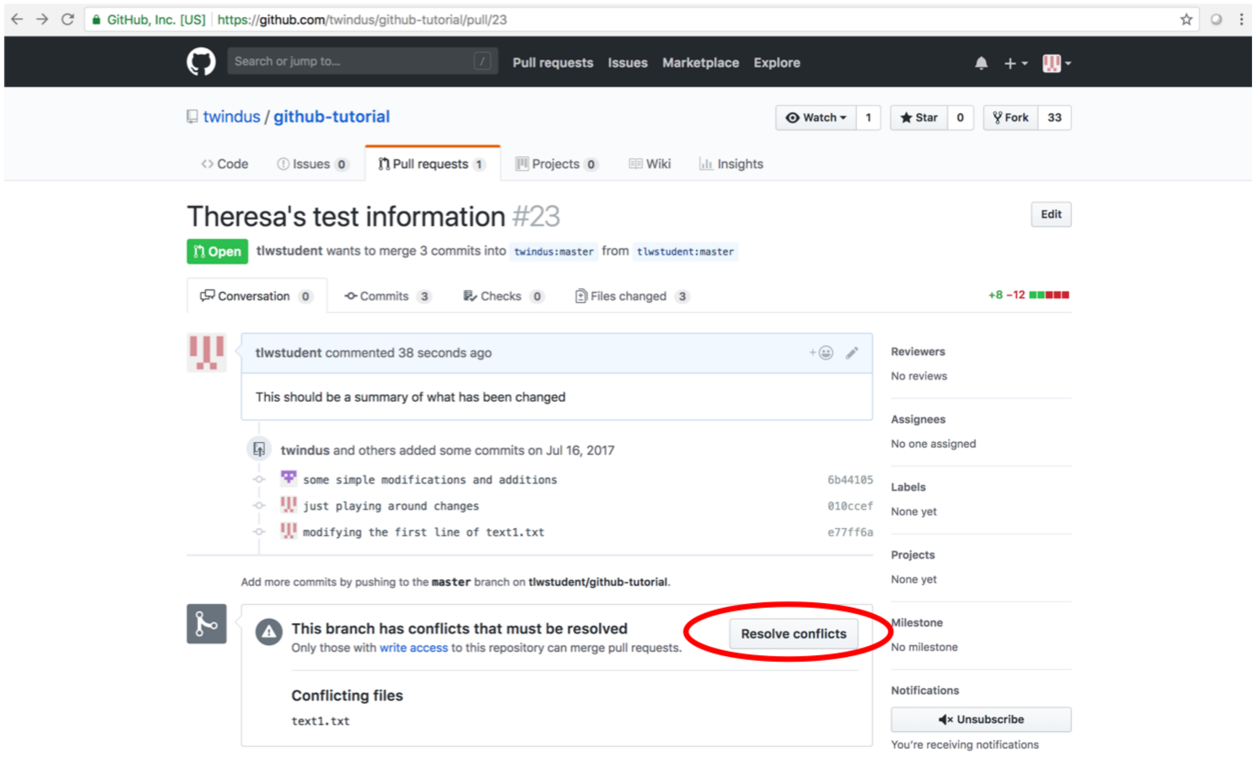
Theresa's test information

This should be a summary of what has been changed

Attach files by dragging & dropping, selecting them, or pasting from the clipboard.

✓ Allow edits from maintainers. Learn more

- Fill in the title, description of the pull request, and click the green "Create pull request" button. You should get a screen like the following:


GitHub, Inc. [US] https://github.com/twindus/github-tutorial/pull/23

twindus / github-tutorial

Theresa's test information #23

Open tlwstudent wants to merge 3 commits into `twindus:master` from `tlwstudent:master`

tlwstudent commented 38 seconds ago

This should be a summary of what has been changed

twindus and others added some commits on Jul 16, 2017

```
some simple modifications and additions    6b44105
just playing around changes                010ccef
modifying the first line of text1.txt      e77ff6a
```

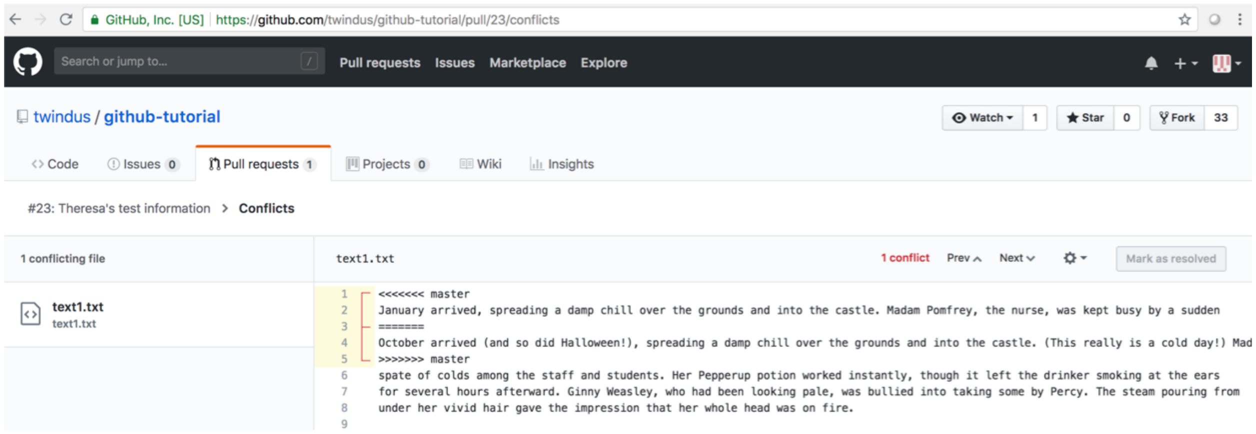
Add more commits by pushing to the **master** branch on **tlwstudent/github-tutorial**.

This branch has conflicts that must be resolved
Only those with write access to this repository can merge pull requests.

Conflicting files
`text1.txt`

Reviewers: No reviews
Assignees: No one assigned
Labels: None yet
Projects: None yet
Milestone: No milestone
Notifications: You're receiving notifications

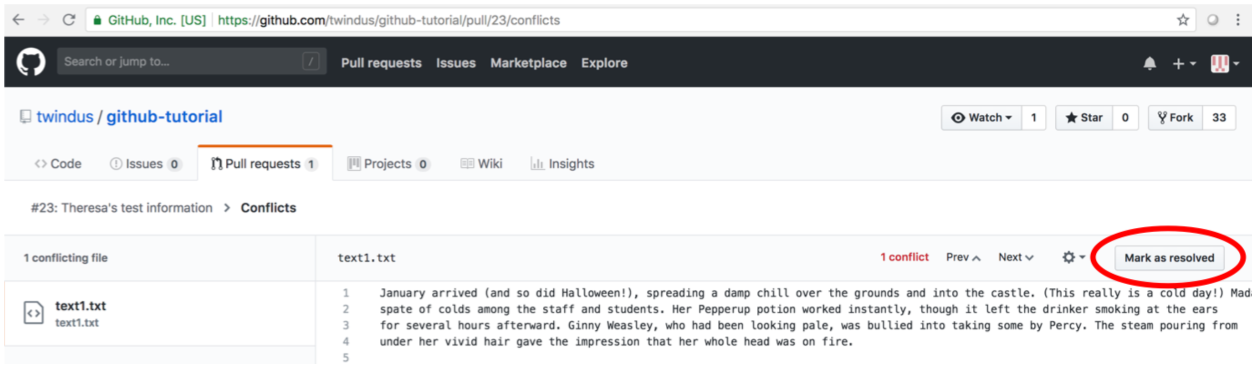
- Click on the "Resolve conflicts" button. You will get a screen like the following:



text1.txt

```
1  <<<<<<< master
2  January arrived, spreading a damp chill over the grounds and into the castle. Madam Pomfrey, the nurse, was kept busy by a sudden
3  =======
4  October arrived (and so did Halloween!), spreading a damp chill over the grounds and into the castle. (This really is a cold day!) Mad
5  >>>>>>> master
6  spate of colds among the staff and students. Her Pepperup potion worked instantly, though it left the drinker smoking at the ears
7  for several hours afterward. Ginny Weasley, who had been looking pale, was bullied into taking some by Percy. The steam pouring from
8  under her vivid hair gave the impression that her whole head was on fire.
9
```

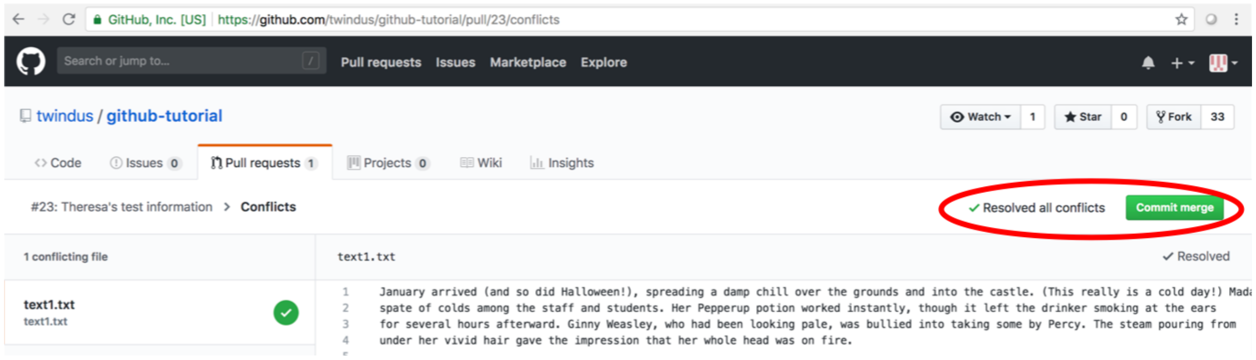
- Lines 1-5 on this output is where the conflict is and it needs to be resolved before the merge can happen. The first “<<<<<<< master” indicates that your changes in your master branch will be in the next line (line 2). The “=======” in line 3 indicates that it is the end of your changes and the next line/lines are from the repository that you are trying to merge into. Finally, line 5 “>>>>>>> master” indicates the branch you are trying to merge into - the upstream master repository in this case.
- Now you need to delete lines 1, 3, and 5 and do a manual merge of lines 2 and 4. In general, it usually easiest to take the line that is the closest to what you want as a final line and modify that line. (Note that in a more general case, there are likely multiple lines that need to modified instead of just one line from each file.)
- Once you are done with your editing, click on the “Mark as resolved” button:



text1.txt

```
January arrived (and so did Halloween!), spreading a damp chill over the grounds and into the castle. (This really is a cold day!) Mad
spate of colds among the staff and students. Her Pepperup potion worked instantly, though it left the drinker smoking at the ears
for several hours afterward. Ginny Weasley, who had been looking pale, was bullied into taking some by Percy. The steam pouring from
under her vivid hair gave the impression that her whole head was on fire.
```

- If everything went well, then there should be a “Resolved all conflicts” message and a green button labeled “Commit merge”:



text1.txt

```
January arrived (and so did Halloween!), spreading a damp chill over the grounds and into the castle. (This really is a cold day!) Mada
spate of colds among the staff and students. Her Pepperup potion worked instantly, though it left the drinker smoking at the ears
for several hours afterward. Ginny Weasley, who had been looking pale, was bullied into taking some by Percy. The steam pouring from
under her vivid hair gave the impression that her whole head was on fire.
```

- If there are still more issues to resolve, you should look through the rest of the file to see if there are other conflicts. In general, there could also be more conflicts in other files. They will show up in the left hand column and you will need to click on the file name and resolve the conflicts in that file as well. Continue this process until you get the "Resolved all conflicts" message.
- Once all of the conflicts are resolved, click on the green "Commit merge" button.
- Now it will again be up to the originator of the upstream repository to decide whether to merge your code into his/her repository.

Final thoughts

Again, this is a very short exercise and doesn't show all of the many features that are important when using repositories. In particular, it doesn't show how to directly merge new changes from the upstream repository into your local repository on your computer. This is very important when working on collaborative projects where many people are contributing to the software on a regular basis. You will need to keep you working repository up to date with the upstream repository.

Some tutorials that may be of use to you if you want to take your skills farther are:

http://qjcg.github.io/2015-06-22-caltech-git/
https://guides.github.com/activities/hello-world/
https://gist.github.com/jaseemabid/1321592 (a list of git and GitHub resources)
https://help.github.com/articles/git-and-github-learning-resources/