# Introduction to Git and Github

Computing in Optimization and Statistics: Lecture 1

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MIT

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# What is git and GitHub?

- **git** is a *version control system*.
  - Other version control systems include mercurial, svn, perforce.
  - git is modern (2005) and most popular.
- **GitHub** is a service that allows you to host projects using git.

# What is a version control system?

- Software that stores "snapshots" of a project over time.
- Can be used for projects big or small, long-term or short-term.

# Why should I learn it?

- Everyone uses it.
  - We'll be using it in this class.
- Backup (in the cloud).
- Versioning with fine granularity.
- Collaboration.
  - But useful even when working by yourself.

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- git gives finer granularity: files vs. lines within a file.
- This granularity is essential when writing code.

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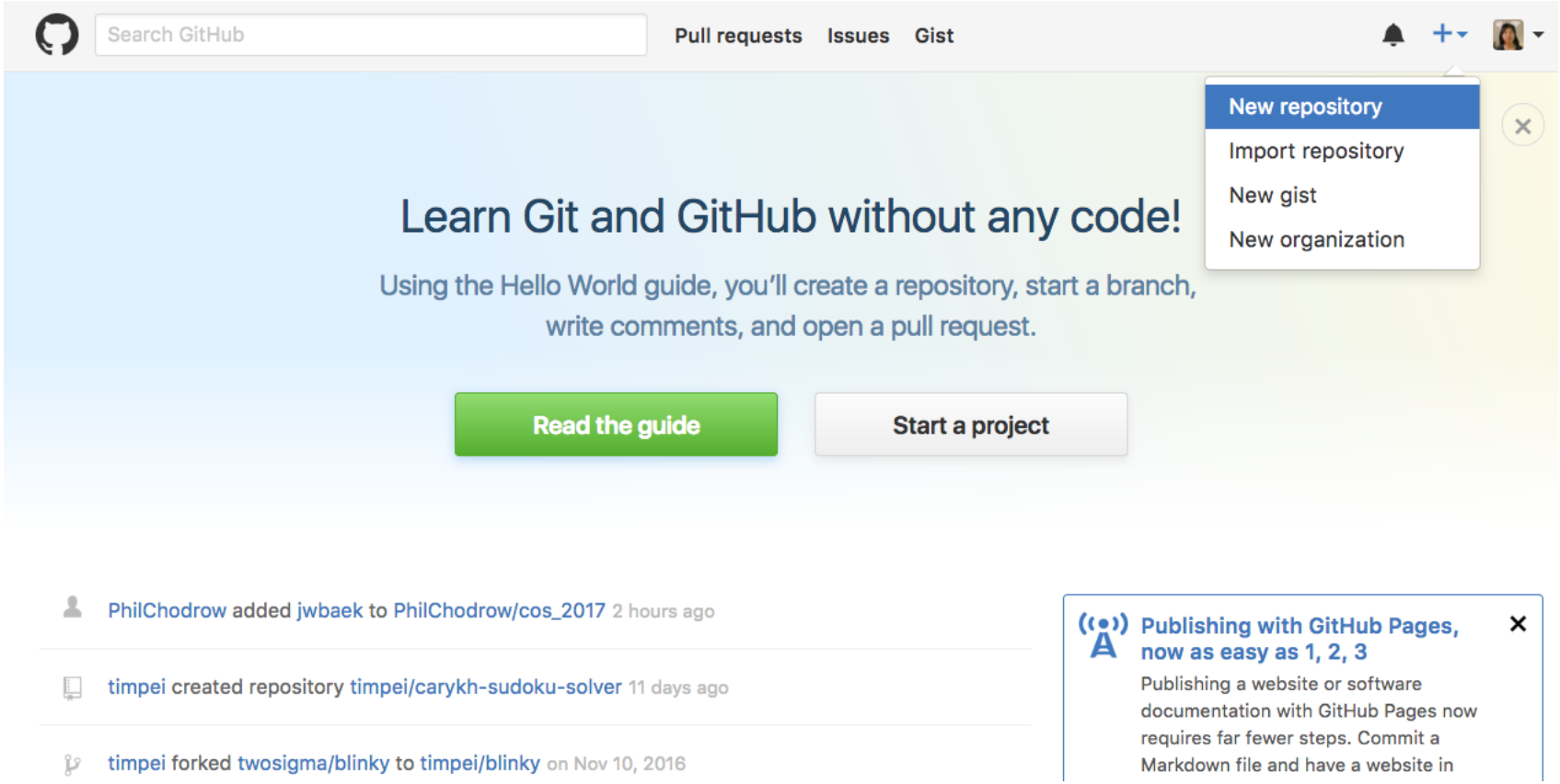
  - **HEAD:** the currently checked out commit.
- **local:** repository sitting on your local machine.
- **remote:** repository sitting on a remote server (i.e. GitHub).
- **pull:** grab changes from remote to local.
- **push:** update remote with local changes.

# Creating a new repository



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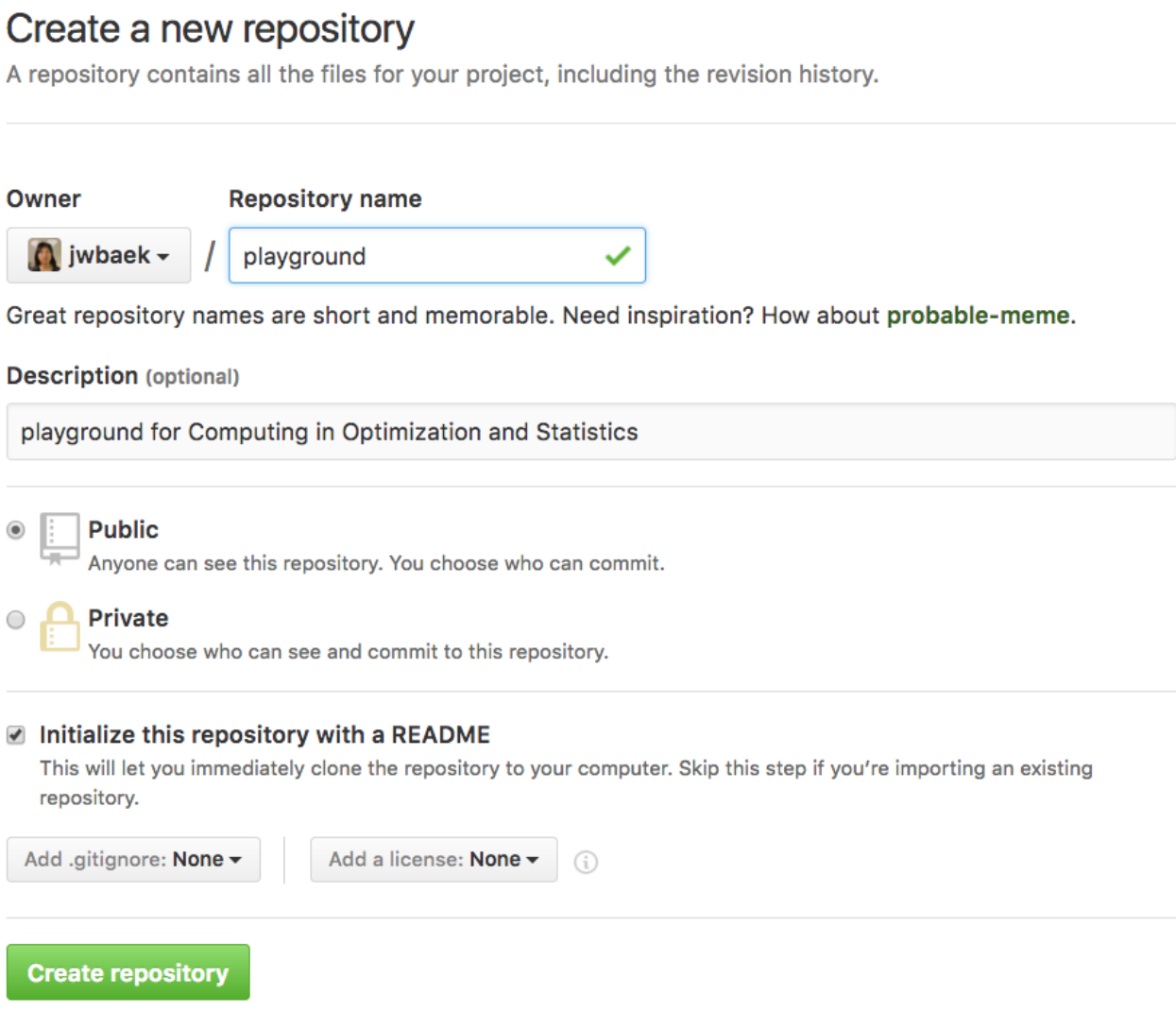

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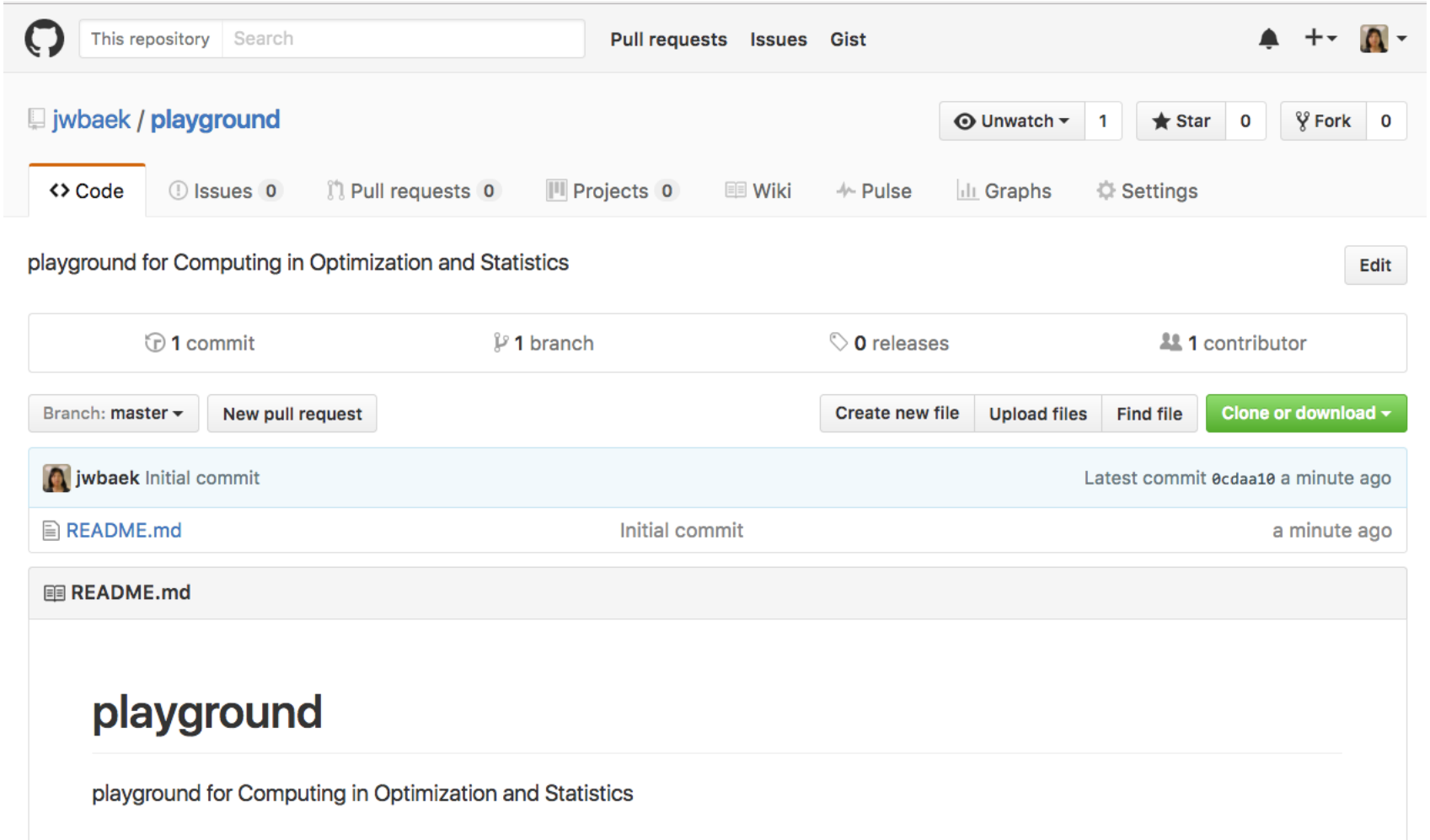

# Cloning a repository

```
$ git clone <URL>
```

- Go to any repository and copy the URL
- This will create a new directory with the same name as the repository name and clone the repo there.

```
$ git clone https://github.com/jwbaek/playground
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```

```
$ git config --global core.editor "nano"
```

# Let's make some changes

- Create a new file called new_file.txt
  - Add "This is a new file"
- Modify existing_file.txt
  - interesting $\rightarrow$ uninteresting

```
$ cd playground
$ nano new_file.txt
   This is a new file
$ nano existing_file.txt
   interesting -> uninteresting
```

# Checking the status of our files

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$ git status
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```
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:   existing_file.txt

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

new_file.txt

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

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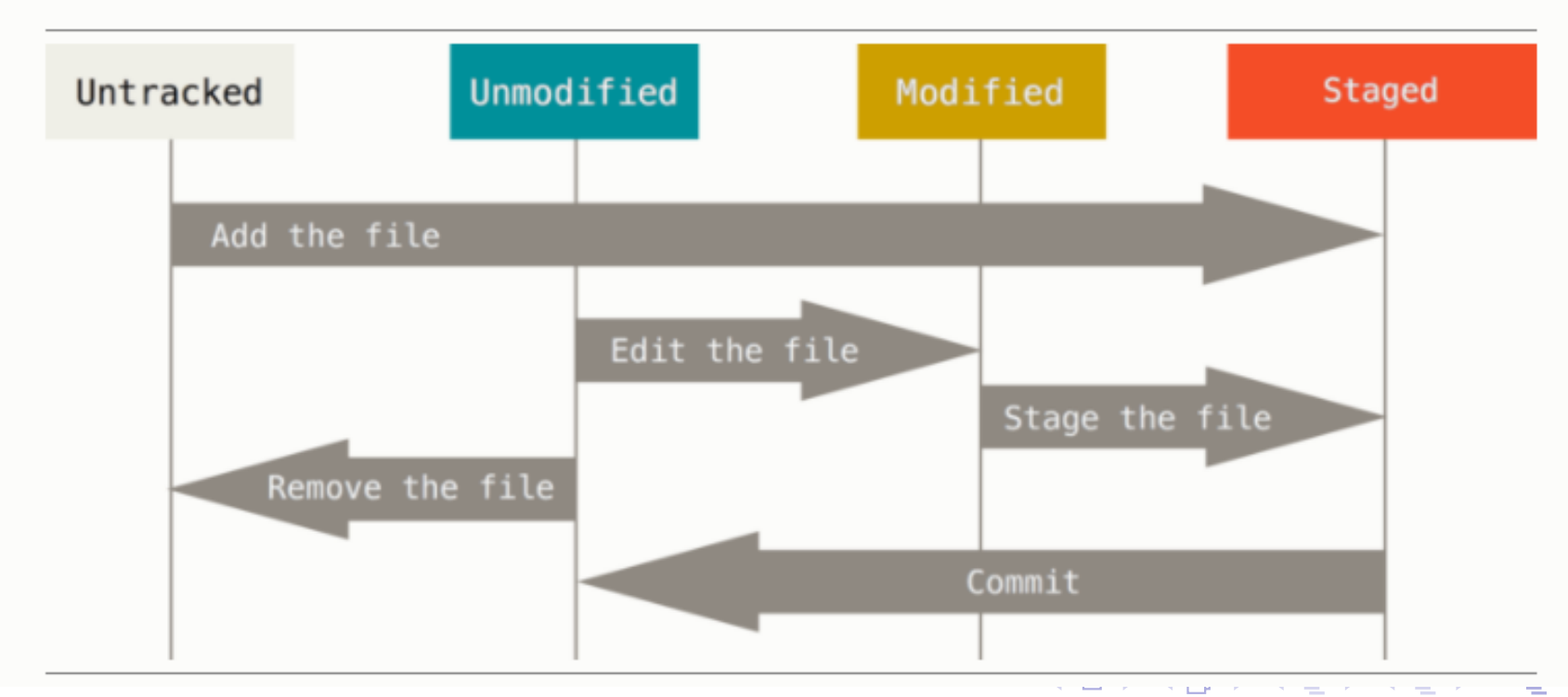

# Staging files

```
$ git add <filepath>
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```

- Any *untracked* or *modified* file that is added will be *staged*.
- Each such file will be included in the next commit.
- Use git add to either:
  - Add a new file to the repository (untracked $\rightarrow$ staged)
  - Record a change that you made to an existing file (modified $\rightarrow$ staged)

```
$ git add new_file.txt
$ git add existing_file.txt
```

# git commit

```
$ git commit -m <commit message>
```

- This creates a new snapshot of our repository with all changes that we have staged.

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- This new snapshot (commit) is saved in our local repository.
- This *does not* push our changes to the remote repository (GitHub).

# git commit

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```
$ git commit -m "Added new interesting file."
```

# git log

```
$ git log
```

```
commit ca82a6dff817ec66f44342007202690a93763949
Author: Jackie Baek <baek@mit.edu>
Date:   Mon Mar 17 21:52:11 2008 -0700

    this is my commit message

commit 085bb3bcb608e1e8451d4b2432f8ecbe6306e7e7
Author: Scott Chacon <schacon@gee-mail.com>
Date:   Sat Mar 15 16:40:33 2008 -0700

    removed unnecessary test

commit a11bef06a3f659402fe7563abf99ad00de2209e6
Author: Scott Chacon <schacon@gee-mail.com>
Date:   Sat Mar 15 10:31:28 2008 -0700

    first commit
```

# See what changed

```
$ git show
```

- Shows what changed in a single commit.

```
$ git diff
```

- Shows what changed since the last commit.

# Interacting with remote

```
$ git push
```

- Update remote repository with local commits.

```
$ git pull
```

- Updates local repository with remote commits.

# Merging

# Merging

- When we ‘git pull‘, git fetches the remote repository from GitHub and *merges* the new remote updates with our local repository.
- Even if both remote and local modified the same file, git is *usually* able to correctly merge the two copies.
- We get a **merge conflict** if both parties modified the *same parts of the same file*.

# Merging

```
$ git pull
```

```
remote: Counting objects: 3, done.
remote: Total 3 (delta 0), reused 3 (delta 0), pack-reused 0
Unpacking objects: 100% (3/3), done.
https://github.com/jwbaek/playground
   50c8ec4..0c13bac  master     -> origin/master
Auto-merging existing_file.txt
CONFLICT (content): Merge conflict in existing_file.txt
Automatic merge failed; fix conflicts and then
commit the result.
```

# Resolving Merge Conflicts

```
$ cat existing_file.txt
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What an
<<<<<<< HEAD
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=======
fun
>>>>>>> 0c13bac86a172ae60766d615f92d2b01d7bf131d
document!
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- The markers <<<<<<<, =======, >>>>>>> indicate the conflict.
- The section in between the first two markers is your local change (HEAD), while the bottom section indicates the update from remote.
- Must resolve conflict manually by editing the file, making sure to get rid of the conflict markers.

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- After resolving conflicts, we must add the file for staging and commit again.
- Git will automatically create a commit message: "Merge branch 'master' of https://github.com/jwbaek/playground"

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```
$ git add existing_file.txt
$ git commit
```

- At this point, we can push.

# Typical Workflow

Fetch remote changes.

```
$ git pull
```

(If there are any conflicts, resolve them and commit.

```
$ git add <conflicted files>
$ git commit )
```

Make changes

Stage modified and new files.

```
$ git add <files>
```

Commit changes.

```
$ git commit -m "this is my commit message"
```

Push local changes to remote.

```
$ git push
```

# Useful tips

- Google is your friend. (e.g. "How to undo merge in git".)
- Almost anything can be undone, as long as it is committed.
- Commit often, pull often.
- Each command has many options.
  - Use 'git <verb> −−help' for documentation.

Thank you!