Merge Practice

Practice resolving a conflict between revisions.

A Common Problem

1. Developer A **clones** a repo from Github, or "**pulls**" latest rev from Github. Now he is up to date!
2. Developer A starts work on his local copy.
3. Developer B **pushes** a change to some files in the **same repo** to Github.
4. Developer A commits his work and does "**git push**".

What Happens?

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```
dev-A> git commit -m "add tests for ..."

dev-A> git push
```

! [rejected] master -> master (fetch first)
error: failed to push some refs to https://github.com/...
hint: Updates were rejected because the remote contains work that you do not have locally. This is usually caused by another repository pushing to the same ref.
You may want to first integrate the remote changes (e.g., 'git pull ...') before pushing again.

Exercise

We will deliberately create a **conflict** by editing the README.md in two copies of same repo:

Github using Github's online editor

Your local clone of the same repo

Then try to **discover** the differences and **resolve them**.

Exercise: create a conflict

Use your **git-commands** repo on Github (any repo is OK):

1. On Github, edit README.md using Github's online editor.

   Add some lines near the top. Example:

   ```
   **The Ultimate Guide to Using Git**
   For The Impatient.
   ```

   Commit the change (green **Commit** button)

2. In your local repo, edit README.md

   Make some different changes near the top

   Commit

   Edit again, make more changes, and commit again.

Exercise: try to push

3. In your local repo, enter: **`git push`**

   What happens?

   What is the message from git?

Exercise: fetch remote changes

4. Update your "tracking branch" for origin/master:

```
git fetch
```

*This fetches the latest revisions from Github into your tracking branch (**origin/master**) but does not merge them into your local branch (**master**).*

Now you need to compare the two branches (both are on your computer) and merge them.

Exercise: compare branches

5. See a graph of the differences: `gitk --all`

6. View the differences line-by-line (this is also shown in gitk when you click on a file in the commit) in a terminal window:

```
git diff master origin/master
```

"diff" format

diff is a standard Linux/Unix command that shows diffs is a standard format. Can be used to create patches, too!

```
diff --git a/README.md b/README.md
index 21b69e8..09b0702 100644
--- a/README.md
+++ b/README.md
@@ -1,10 +1,8 @@
-Text from version a of file (local version)
-
+Text from version b of file (remote version)
---
```

Exercise: merge differences

And hope you are lucky! This may not work.

cmd> **`git merge --no-commit`**

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

`--no-commit` gives you a chance to review the results, even if automatic merge succeeds.

Exercise: edit and fix conflicts

7. Open an editor and examine the result of all files that contained merged lines, even if auto-merge succeeds.

Part(s) containing a conflict will look like this:

```
<<<<<<<<< HEAD
The text from your local version
=========
Conflicting text from the remote version
>>>>>>>>> refs/remotes/origin/master
```

Note: Sometimes auto-merge creates bugs by successfully merging parts of code that are incompatible!

Mark Conflict as Resolved

Use "git status" to see that there is a conflict

```
cmd> git status
Unmerged paths:
  (use "git add <file>..." to mark
resolution)
both modified:   README.md
```

If you are satisfied that it is fixed, then...

```
cmd> git add README.md
```

```
cmd> git commit
```

(git opens an editor. You should write a **good commit message** explaining the merge.)

I Give Up!

If the merge creates too many conflicts to fix, you can "undo" the merge and try something else.

```
cmd> git merge --abort
```

End Notes

Understanding diffs

"**`diff`**" is a Unix command to show differences between text files. It shows:

- lines **changed** (differences)
- lines **added** in one file
- lines **deleted** in one file

diff may show surrounding identical lines for ***context,*** to make it easier to identify the "diff" in code.

Example: make 2 copies of a text file. Change one copy (add lines, change lines, delete lines). Run diff:

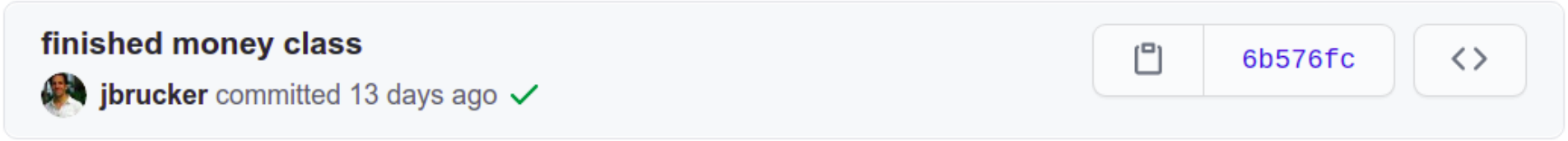
```
cmd>  diff  a.txt  b.txt
```

Diffs on Github

(Demo in class.)

Click on "commits" link on a repository.

Find an interesting commit and click the hash (6b57...)



Github shows changes from previous commit.

"git pull" = "git fetch" + "git merge"

"git pull" performs two commands:

`git fetch` - fetch updates from a remote repository.
It saves the remote in a separate branch named:

`origin/master` or `origin/branchname`

`git merge` - merge two development histories.

If you don't specify which branches to merge,

the default is HEAD and origin/tracking_branch_name

git fetch and diff

It is safer to use "git fetch" first.

1. fetch the remote branch: **`git fetch`**
2. in your local repo, the branch you just fetched is named **`origin/master`** or **`origin/branch-name`**
3. view differences between working copy and remote:

   `git diff origin/master`

   == or ==

4. view differences between local HEAD and remote:

   `git diff HEAD origin/master`

Visual Merge Tools

You can use a graphical diff viewer to both view and resolve differences. It is easier to comprehend.

```
IDE:   Eclipse, IntelliJ, VS Code

Tools: Meld, Diffuse
```

meld and diffuse are good tools known by git.

```
cmd> git help mergetool
```

I use meld and diffuse. Sometimes I use vi (editor).

```
cmd> git mergetool --tool=diffuse
```