

## Sometimes Merges Fail

Most of the time Git will be able to merge branches together without any problem. However, there are instances when a merge cannot be *fully* performed automatically. When a merge fails, it's called a **merge conflict**.

If a merge conflict does occur, Git will try to combine as much as it can, but then it will leave special markers (e.g. `>>>` and `<<<`) that tell you where you (yep, you the programmer!) needs to manually fix.

## What Causes A Merge Conflict

As you've learned, Git tracks *lines* in files. A merge conflict will happen when *the exact same line(s)* are changed in separate branches. For example, if you're on a `alternate-sidebar-style` branch and change the sidebar's heading to "About Me" but then on a different branch and change the sidebar's heading to "Information About Me", which heading should Git choose? You've changed the heading on both branches, so there's no way Git will know which one you actually want to keep. And it sure isn't going to just randomly pick for you!

Let's force a merge conflict so we can learn to resolve it. Trust me, it's simple once you get the hang of it! Remember that a merge conflict occurs when Git isn't sure which line(s) you want to use from the branches that are being merged. So we need to edit *the same line on two different branches*...and then try to merge them.

## Forcing A Merge Conflict!

Remember that a merge conflict occurs when *the exact same line(s) are changed in separate branches*. Let's alter the page's heading on two different branches. So Let's:

- change the heading on the `master` branch
- create a `heading-update` branch *that's located on the commit right before the recently modified `master` branch*
- change the *same* heading
- switch back to the `master` branch
- merge in the `heading-update` branch

## Change Heading On Branch 1

Since the `master` branch is just a regular ol' branch like all the rest, let's just alter the heading while we're on the `master` branch. So change the `<h1>` heading from whatever you have it to something else. For me, the heading is currently "Adventure" on line 13, and I'm changing it to "Quest".

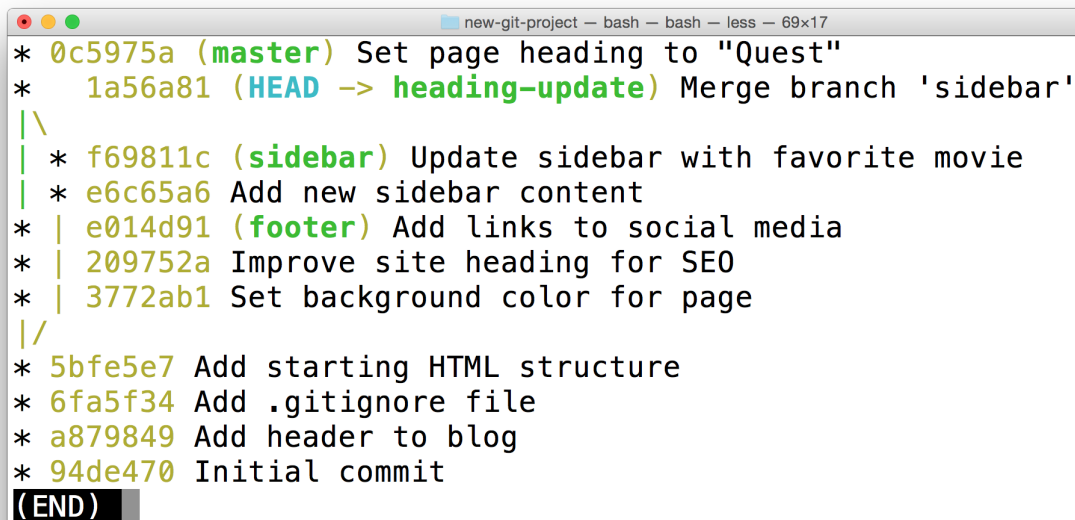
Once you've made the change, save the file and commit it to the repository.

## Change Heading On Branch 2

Now we need to create a different branch and update the heading on that branch.

Now this is important, we need to create a branch that's *not branching from the master branch*. If we make a change that branches *off* of the master branch, then *that* change will be "ahead" of this one and Git will just use that change instead of the one we just made on `master`. So we need to put the branch "in the past".

Let's just create a branch that's on the commit right *before* the most recent one. So use Git log to get the previous commit's SHA and create a branch on that commit. Here's what my Git log looks like after creating a `heading-update` branch:



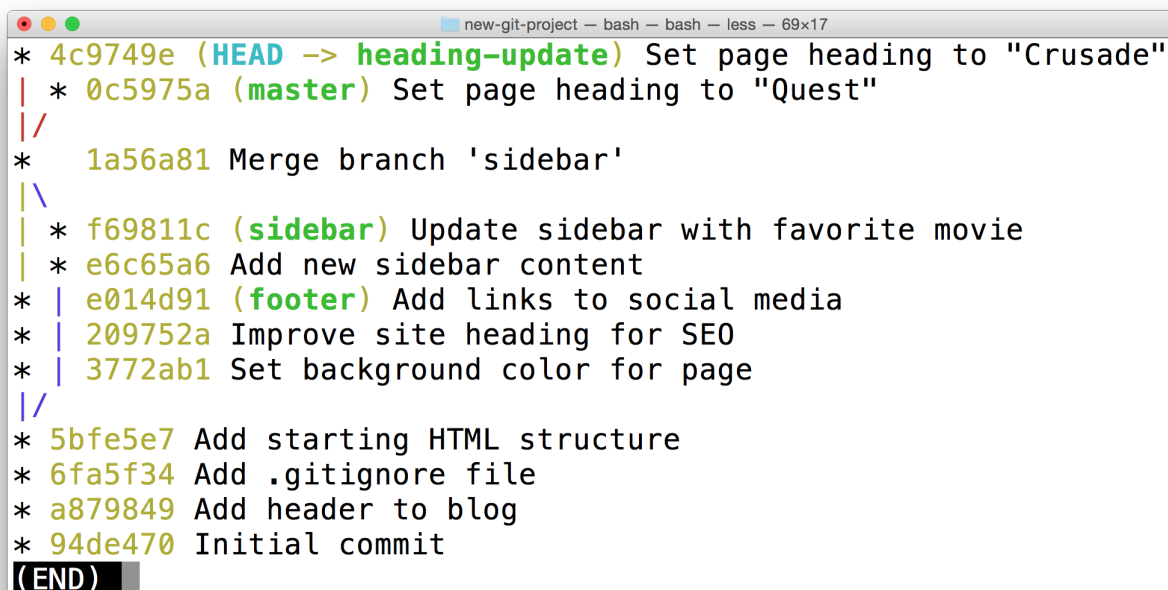
```
new-git-project — bash — bash — less — 69x17
* 0c5975a (master) Set page heading to "Quest"
* 1a56a81 (HEAD -> heading-update) Merge branch 'sidebar'
| \
| * f69811c (sidebar) Update sidebar with favorite movie
| * e6c65a6 Add new sidebar content
* | e014d91 (footer) Add links to social media
* | 209752a Improve site heading for SEO
* | 3772ab1 Set background color for page
|/
* 5bfe5e7 Add starting HTML structure
* 6fa5f34 Add .gitignore file
* a879849 Add header to blog
* 94de470 Initial commit
(END)
```

*The Terminal application showing the output of*

`git log --oneline --decorate --graph --all`. The `heading-update` branch is currently checked out.

Ok, now that we've got our branch created, we just need to update the heading, again. Now make sure you change *the exact same line* that you changed on the `master` branch. I'm changing "Adventure" on line 13 to "Crusade".

Then save the file and commit it to the repository.

A terminal window titled 'new-git-project - bash - bash - less - 69x17' displays the output of the command 'git log --oneline --decorate --graph --all'. The output shows a series of commits with their hashes and branch names in parentheses. The commits are: 4c9749e (HEAD -> heading-update) Set page heading to "Crusade", 0c5975a (master) Set page heading to "Quest", 1a56a81 Merge branch 'sidebar', f69811c (sidebar) Update sidebar with favorite movie, e6c65a6 Add new sidebar content, e014d91 (footer) Add links to social media, 209752a Improve site heading for SEO, 3772ab1 Set background color for page, 5bfe5e7 Add starting HTML structure, 6fa5f34 Add .gitignore file, a879849 Add header to blog, and 94de470 Initial commit. The output ends with '(END)' on a black background.

```
* 4c9749e (HEAD -> heading-update) Set page heading to "Crusade"
| * 0c5975a (master) Set page heading to "Quest"
|/
* 1a56a81 Merge branch 'sidebar'
| \
| * f69811c (sidebar) Update sidebar with favorite movie
| * e6c65a6 Add new sidebar content
* | e014d91 (footer) Add links to social media
* | 209752a Improve site heading for SEO
* | 3772ab1 Set background color for page
|/
* 5bfe5e7 Add starting HTML structure
* 6fa5f34 Add .gitignore file
* a879849 Add header to blog
* 94de470 Initial commit
(END)
```

*The Terminal application showing the output of*

`git log --oneline --decorate --graph --all`. Both the `master` branch and the `heading-update` branch alter the same line of the same file.

## Prepped For Merge Conflict

Ok, we're just about to cause a merge conflict, make sure you're at the same place I am:

I've made a commit on the `master` branch that changes the heading

I've made a commit on the `heading-update` branch

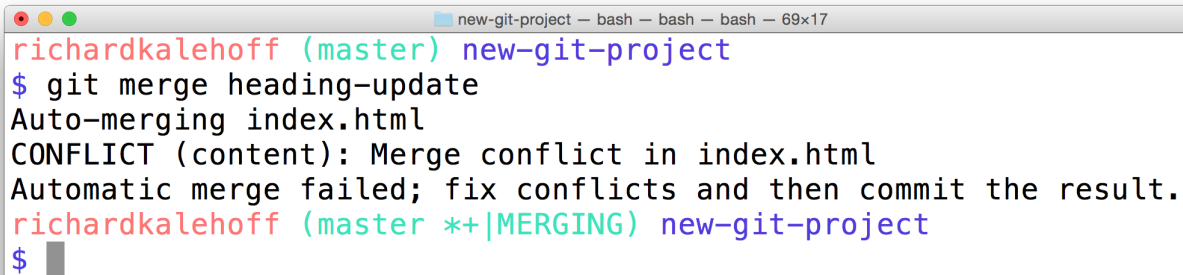
that *also* changes the heading

I am currently on the `master` branch

Make sure you're on the master branch (we could really do this on either branch, but I just have a habit of keeping the `master` branch the main one that other topic branches get merged into) and merge in the `heading-update` branch:

```
$ git merge heading-update
```

You should see the following:

A screenshot of a terminal window titled "new-git-project — bash — bash — bash — 69x17". The prompt is "richardkalehoff (master) new-git-project". The user enters "\$ git merge heading-update". The terminal shows "Auto-merging index.html" followed by "CONFLICT (content): Merge conflict in index.html" and "Automatic merge failed; fix conflicts and then commit the result.". The prompt then changes to "richardkalehoff (master \*+|MERGING) new-git-project". The user enters "\$" and the cursor is on a new line.

```
richardkalehoff (master) new-git-project
$ git merge heading-update
Auto-merging index.html
CONFLICT (content): Merge conflict in index.html
Automatic merge failed; fix conflicts and then commit the result.
richardkalehoff (master *+|MERGING) new-git-project
$
```

*The Terminal application showing the output of a merge that resulted in a merge conflict. The word "CONFLICT" appears and says that the conflict occurred in the index.html file.*

## Merge Conflict Output Explained

The output that shows in the Terminal is:

```
$ git merge heading-update
Auto-merging index.html
CONFLICT (content): Merge conflict in index.html
Automatic merge failed; fix conflicts and then commit the result.
```

Notice that right after the `git merge heading-update` command, it tries merging the file that was changed on both branches (`index.html`), but that there was a conflict. Also, notice that it tells you what happened - "Automatic merge failed; fix conflicts and then commit the result".

Remember our good friend `git status`? Well he'll come in really handy when working with merge conflicts.

#### QUESTION 1 OF 2

Try running `git status` right now. Which of the following information does it show?

- ☐ You have unmerged paths
- ☐ Unmerged paths
- ☐ fix conflicts and run "git commit"
- ☐ use "git add ..." to mark resolution

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The `git status` output tells us to that the merge conflict is inside `index.html`. So check out that file in your code editor!

```
8      <link rel="stylesheet" href="css/app.css">
9    </head>
10   <body>
11
12     <header>
13     <<<<<< HEAD
14     <h1>Quest</h1>
15     ||||| merged common ancestors
16     <h1>Adventure</h1>
17     =====
18     <h1>Crusade</h1>
19     >>>>>> heading-update
20   </header>
21
22   <div class="container">
23     <main>
24
25   </main>
```

*Code editor showing the merge conflict indicators.*

## Merge Conflict Indicators Explanation

The editor has the following merge conflict indicators:

- `<<<<<< HEAD` everything below this line (until the next indicator) shows you what's on the current branch
- `||||| merged common ancestors` everything below this line (until the next indicator) shows you what the original lines were
- `=====` is the end of the original lines, everything that follows (until the next indicator) is what's on the branch that's being merged in
- `>>>>>> heading-update` is the ending indicator of what's on the branch that's being merged in (in this case, the `heading-update` branch)

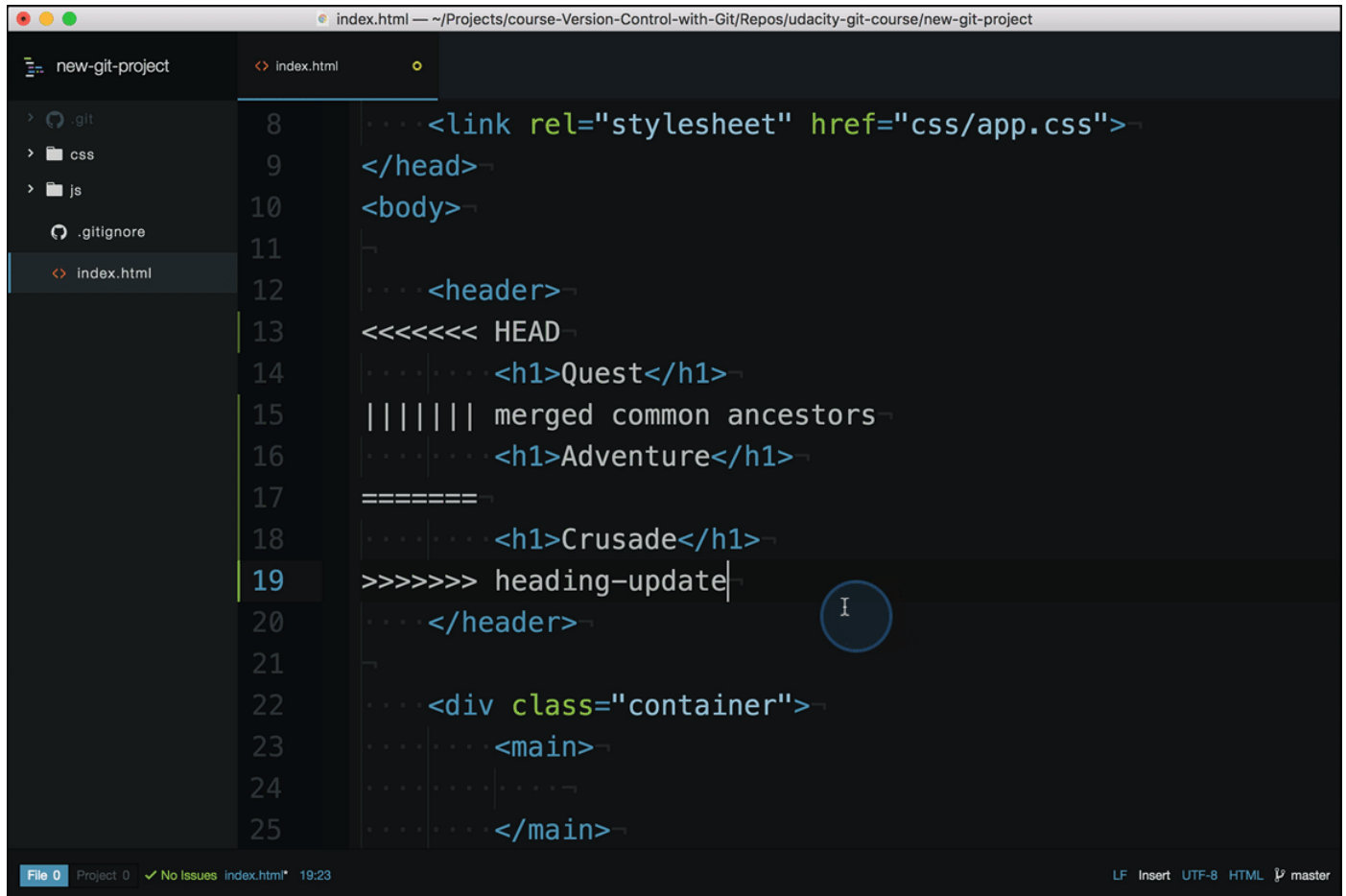
## Resolving A Merge Conflict

Git is using the merge conflict indicators to show you what lines caused the merge conflict on the two different branches as well as what the original line used to have. So to resolve a merge

conflict, you need to:

1. choose which line(s) to keep
2. remove all lines with indicators

For some reason, I'm not happy with the word "Crusade" right now, but "Quest" isn't all that exciting either. How about "Adventurous Quest" as a heading?!?



```
8      <link rel="stylesheet" href="css/app.css">
9    </head>
10   <body>
11
12     <header>
13     <<<<<< HEAD
14     <h1>Quest</h1>
15     ||||| merged common ancestors
16     <h1>Adventure</h1>
17     =====
18     <h1>Crusade</h1>
19     >>>>>> heading-update
20     </header>
21
22     <div class="container">
23     <main>
24
25     </main>
```

*Code editor where showing the merge conflict indicators being removed and the page heading being updated.*

## Commit Merge Conflict

Once you've removed all lines with merge conflict indicators and have selected what heading you want to use, just save the file, add it to the staging index, and commit it! Just like with a regular merge, this will pop open your code editor for you to supply a commit message. Just like before, it's common to use the provided merge commit message, so after the editor opens, just close it to use the provided commit message.

And that's it! Merge conflicts really aren't all that challenging once you understand what the merge conflict indicators are showing you.

#### QUESTION 2 OF 2

You've made numerous commits so far in your exploration of Git. If a merge conflict occurs in a file and you edit the file, save it, stage it, and commit it but *forget* to remove the merge conflict indicators, will Git commit the file?

Yes

No

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## Merge Conflict Recap

A merge conflict happens when the same line or lines have been changed on different branches that are being merged. Git will pause mid-merge telling you that there is a conflict and will tell you in what file or files the conflict occurred. To resolve the conflict in a file:

- locate and remove all lines with merge conflict indicators
- determine what to keep
- save the file(s)
- stage the file(s)
- make a commit

Be careful that a file might have merge conflicts in multiple parts of the file, so make sure you check the entire file for merge conflict indicators - a quick search for `<<<` should help you locate all of them.

## Further Research

- [Basic Merge Conflicts](#) from the Git book
- [How Conflicts Are Presented](#) from the Git docs



