

# Gitting Started

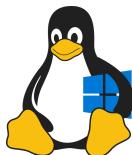
## An Introduction to Git

K. Müller<sup>1</sup> J. Verzijden<sup>2</sup>

<sup>1</sup>MasterCLASS  
E.T.S.V. Scintilla

<sup>2</sup>Scintilla Operator Team  
E.T.S.V. Scintilla

October 6, 2026



Let's imagine...

Alice



Bob



# About us



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# Contents

- ① Theoretical
  - Why Git?
  - History
  - Concepts of Git
  - Principles of Git
- ② Installation
- ③ Configuration
- ④ Practical

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# Why Git?

- Solves the problems from the intro.

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- It's efficient and fast

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- Solves the problems from the intro.
- It's efficient and fast
- It's the most used VCS<sup>a</sup> in the world<sup>b</sup>

---

<sup>a</sup>Version Control System

<sup>b</sup>According to Stackoverflow, see [here](#) (2023)

Version control systems used by responding developers:

| Name                       | 2015                 | 2017                 | 2018                 | 2022                 |
|----------------------------|----------------------|----------------------|----------------------|----------------------|
| Git                        | 69.3%                | 69.2%                | 87.2%                | 93.9%                |
| <a href="#">Subversion</a> | 36.9%                | 9.1%                 | 16.1%                | 5.2%                 |
| <a href="#">TFVC</a>       | 12.2%                | 7.3%                 | 10.9%                | <a href="#">[ii]</a> |
| <a href="#">Mercurial</a>  | 7.9%                 | 1.9%                 | 3.6%                 | 1.1%                 |
| <a href="#">CVS</a>        | 4.2%                 | <a href="#">[ii]</a> | <a href="#">[ii]</a> | <a href="#">[ii]</a> |
| <a href="#">Perforce</a>   | 3.3%                 | <a href="#">[ii]</a> | <a href="#">[ii]</a> | <a href="#">[ii]</a> |
| <a href="#">VSS</a>        | <a href="#">[ii]</a> | 0.6%                 | <a href="#">[ii]</a> | <a href="#">[ii]</a> |
| <a href="#">ClearCase</a>  | <a href="#">[ii]</a> | 0.4%                 | <a href="#">[ii]</a> | <a href="#">[ii]</a> |
| Zip file backups           | <a href="#">[ii]</a> | 2.0%                 | 7.9%                 | <a href="#">[ii]</a> |
| Raw network sharing        | <a href="#">[ii]</a> | 1.7%                 | 7.9%                 | <a href="#">[ii]</a> |
| Other                      | 5.8%                 | 3.0%                 | <a href="#">[ii]</a> | <a href="#">[ii]</a> |
| None                       | 9.3%                 | 4.8%                 | 4.8%                 | 4.3%                 |

VCS usage according to a survey by Stack Overflow<sup>a</sup>

---

<sup>a</sup>Source: [Git on Wikipedia](#)

# The origin story



- Linus Torvalds<sup>a</sup>

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# The origin story



- Linus Torvalds<sup>a</sup>
- 2005
- VCS for the Linux kernel
- *The stupid content tracker*

---

<sup>a</sup>Source of the photo: [WikiMedia](#)

# Concepts of Git

---

<sup>1</sup> *repository* on Wiktionary

# Concepts of Git

- Repository (repo)
  - A location for storage<sup>1</sup>
  - In this case, storage of files
  - Just a folder on your computer, e.g. `/home/johanv/my-repo`

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  - Description of changes
  - Metadata: author, timestamp, message, parent
  - Hash: Its unique identifier

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- Remote
  - The same repository in a different location
    - Really remote (`https://github.com/instructure/canvas-lms`)
    - Locally remote (`/home/kasperm/some-repo/`)

---

<sup>1</sup> *repository* on Wiktionary

# Principles of Git

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  - ✓ *Fix styling of logout button*
  - ✗ *fix*
  - ✗ *Meep*
- Commit messages should be in imperative tense
  - ✓ *Add page layout*
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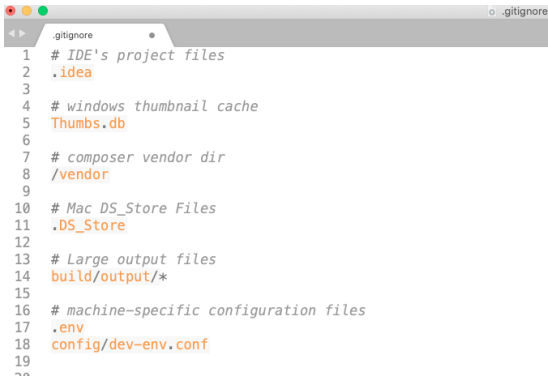
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# Ignoring certain files - Gitignore

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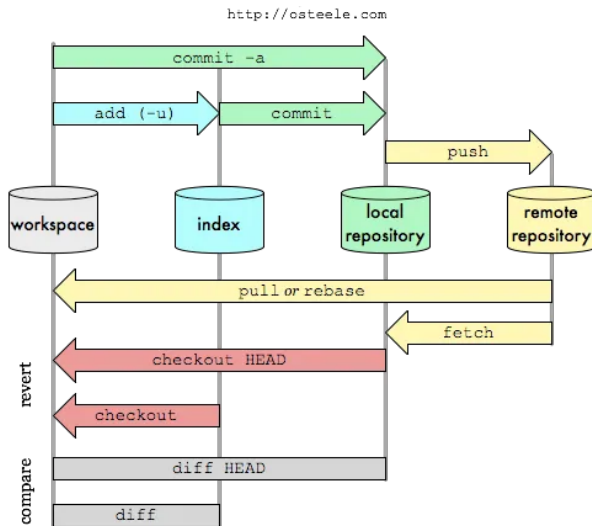
- Changes in compiled or other binary files can't be tracked
- Build artifacts clutter your commits

*Solution:* .gitignore

A screenshot of a code editor window titled ".gitignore". The editor shows a list of files and directories to be ignored, with line numbers 1 through 19 on the left. The content of the file is as follows:

```
1 # IDE's project files
2 .idea
3
4 # windows thumbnail cache
5 Thumbs.db
6
7 # composer vendor dir
8 /vendor
9
10 # Mac DS_Store Files
11 .DS_Store
12
13 # Large output files
14 build/output/*
15
16 # machine-specific configuration files
17 .env
18 config/dev-env.conf
19
20
```

# Git Workflow

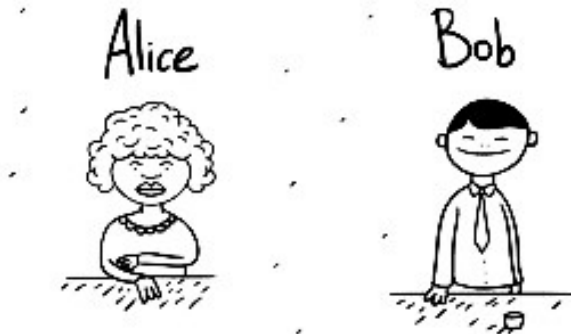


# Let's take another look (at the situation)

Let's see how Git actually solves the problem in the introduction.

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Some options:

- Pure Git GUI<sup>2</sup> clients:

---

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  - Github Desktop (only for Mac & Windows)

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  - See <https://git-scm.com/downloads/guis> for more

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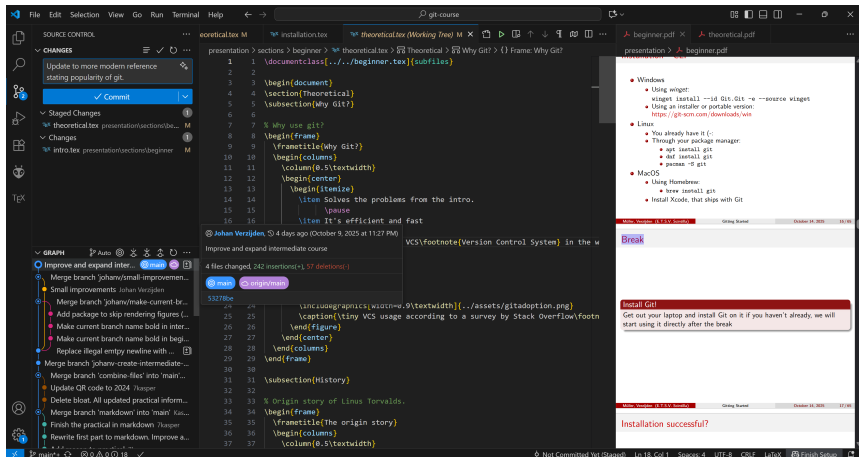
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- Pure Git GUI<sup>2</sup> clients:
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  - Github Desktop (only for Mac & Windows)
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  - See <https://git-scm.com/downloads/guis> for more
- Most IDEs have a Git GUI built-in

---

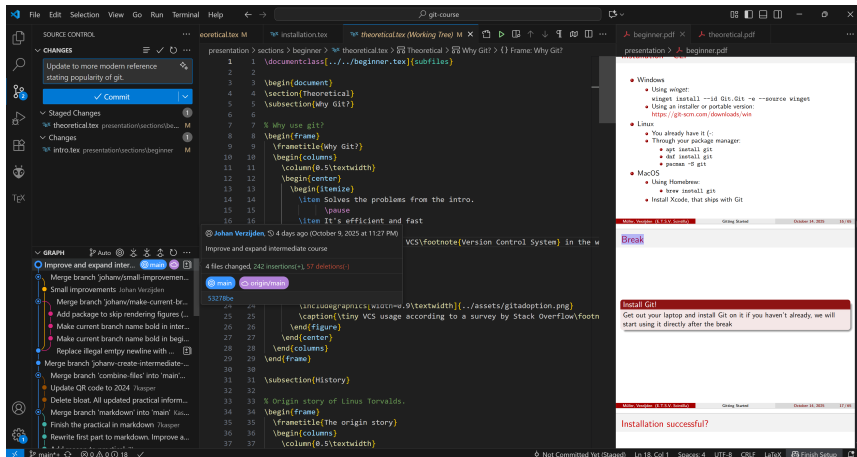
<sup>2</sup>Graphical User Interface

# Installation - GUI Showcase



## <sup>3</sup>Command Line Interface

# Installation - GUI Showcase



Nice and all, but we will use the CLI<sup>3</sup>.

<sup>3</sup>Command Line Interface

# Installation - CLI

# Installation - CLI

- Windows

- Using *winget*:

- ```
winget install --id Git.Git -e --source winget
```

- Using an installer or portable version:

- <https://git-scm.com/downloads/win>

# Installation - CLI

- Windows

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- Linux

- You already have it (-:
  - Through your package manager:

- ```
apt install git
```
    - ```
dnf install git
```
    - ```
pacman -S git
```

# Installation - CLI

## • Windows

- Using *winget*:

```
winget install --id Git.Git -e --source winget
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- Using an installer or portable version:

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## • Linux

- You already have it (-:
- Through your package manager:

- `apt install git`
- `dnf install git`
- `pacman -S git`

## • MacOS

- Using Homebrew:
  - `brew install git`
- Install Xcode, that ships with Git

## Install Git!

Get out your laptop and install Git on it if you haven't already, we will start using it after 5 minutes

# Installation successful?

# Installation successful?

```
johanv@my-machine: ~$ git
usage: git [-v | --version] [-h | --help] [-C <path>] [-c <name>=<value>]
          [--exec-path[=<path>]] [--html-path] [--man-path] [--info-path]
          [-p | --paginate | -P | --no-pager] [--no-replace-objects] [--bare]
          [--git-dir=<path>] [--work-tree=<path>] [--namespace=<name>]
          [--super-prefix=<path>] [--config-env=<name>=<envvar>]
          <command> [<args>]
```

These are common Git commands used in various situations:

start a working area (see also: `git help tutorial`)

|       |                                                                |
|-------|----------------------------------------------------------------|
| clone | Clone a repository into a new directory                        |
| init  | Create an empty Git repository or reinitialize an existing one |

work on the current change (see also: `git help everyday`)

|         |                                                       |
|---------|-------------------------------------------------------|
| add     | Add file contents to the index                        |
| mv      | Move or rename a file, a directory, or a symlink      |
| restore | Restore working tree files                            |
| rm      | Remove files from the working tree and from the index |

examine the history and state (see also: `git help revisions`)

|        |                                                            |
|--------|------------------------------------------------------------|
| bisect | Use binary search to find the commit that introduced a bug |
| diff   | Show changes between commits, commit and working tree, etc |
| grep   | Print lines matching a pattern                             |
| log    | Show commit logs                                           |

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# Configuration

Why:

- Let git know who's editing.
- Let git know how to do some things.
- Usually only change after setup.

How:

- Using commands:

```
git config --global core.editor 'nano'
```

```
git config --global <setting> <value>
```

What:

| Setting            | Advised value             |
|--------------------|---------------------------|
| core.editor        | nano / <preferred editor> |
| user.name          | <your name>               |
| user.email         | <your email address>      |
| user.useConfigOnly | true                      |
| init.defaultBranch | main                      |
| pull.ff            | true                      |

# Configuration - File structure

Read `git help config` or `man git config` for all configuration options.

You can also edit using an editor:

`git config --global --edit:`

```
[core]
  editor = nano
[init]
  defaultBranch = main
[user]
  useConfigOnly = true
  name = Alice
  email = alice@example.com
[pull]
  ff = true
```

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# What else is possible?

- Working securely with SSH and GPG keys
- Working with different identities (e.g. work and personal)
- Quickly stashing changes to switch where you are working on.
- Finding bugs with a binary search (bisect)
- Getting specific features from branches (cherry-pick)
- Neatly organising history (rebase)
- Including other repositories as dependancies (submodules)

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**Come back next year for the intermediate course! :-)**

# Common Git Commands - Cheat sheet

git ...

- init
- add [<filenames>]
- commit [-m '<message>']
- switch [-c] <branch name>
- log [ --graph --oneline]
- push
- pull
- fetch
- clone <path/URL>
- blame <file> [--color-by-age]
- revert <commit>
- reset [--hard] <commit>

# Sources for future reference

- `git help <command>`
- `man gittutorial`
- [gitimmersion.com](https://gitimmersion.com)

Think of a question later on? Feel free to reach out to us!

## **MasterCLASS**

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# Practical - Goals

- Show the typical flow of working with git.
- Show you most important commands and their uses in a short time
- Show a bit of markdown and a summary for optimal learning result ;-)

## Practical - Documentation

We are taking a break now. Feel free to continue installing and configuring now. The information is also included with the QR below. After the short break we will both help with questions regarding anything :-)

Feel free to work on your own or in pairs. If there are many questions on a certain topic we might do a class-wide explanation.



[docs.scintilla.utwente.nl/masterclass/GitCourse2025](https://docs.scintilla.utwente.nl/masterclass/GitCourse2025)

# Tutorial

# Starting a new project

Using Git Bash or other terminal we start by creating a regular folder to hold our project. Then setup the repository by doing an init.

```
$ mkdir my-summary  
$ cd my-summary  
$ git init
```

Let's start our project with a file. We will create the file *README.md*. This is a markdown type file. Markdown is a simple filetype that allows for formatted text. It is likely you already know quite a bit of markdown as it is also used in for instance Discord and (to a lesser extend) in WhatsApp.

The *README.md* file is special. For developers this is often an entry point to understand what the repository is about. On many websites such as Gitlab the *README.md* file will also be shown (formatted) on the front page of your repository website.

# Your first file

Let's add some content to the *README.md* file:

```
# Git Course Summary
```

```
This _README.md_ file will contain some markdown  
text detailing what I learned during the Git  
Course.
```

We can now save the file. Note that at this point the file is only changed in your *workspace*.

# Your first commit

- We move the created file to the index:  
`$ git add README.md`
- And we do our first commit!  
`$ git commit -m 'Initial commit'`

# Your first commit



- We move the created file to the index:  
`$ git add README.md`
- And we do our first commit!  
`$ git commit -m 'Initial commit'`
- On the left you see the commit tree. Currently we are on the first commit inside the main branch.
- You can also see your first commit:  
`$ git log`  
`$ git log --oneline`

# Changing something

Let's add some text to the *README.md* file:

```
[...]
```

```
## How to commit
```

1. Add, delete or change files
2. You can stage your files by doing ``git add filename`` or stage everything with ``git add -A``
3. Commit using ``git commit -m 'message'``, be sure to provide a good description of the changes.

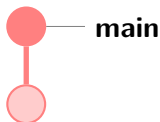
We can now save the file. Note that at this point the file is again only changed in your *workspace*. Try to add it to the index and then make a second commit.

# Your second commit

 **main**

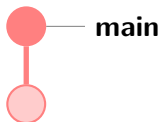
- We can move all files onto the index by using:  
`$ git add -A`
- And perform the second commit:  
`$ git commit -m 'Add the section: how to commit'`

# Your second commit



- We can move all files onto the index by using:  
`$ git add -A`
- And perform the second commit:  
`$ git commit -m 'Add the section: how to commit'`
- If everything went well we now have the tree on the left. The reference HEAD is now pointing to the second commit.

# Branching out



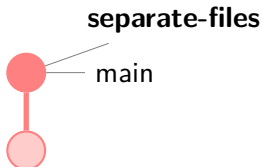
It is useful to develop larger features in a separate branch of your repository. This helps working together as well as giving the ability to switch between versions of your codebase.

Let's say we want to move our 'How to commit' section to a different file. We start by switching to a new branch:

(the `-c` argument means create)

```
$ git switch -c separate-files
```

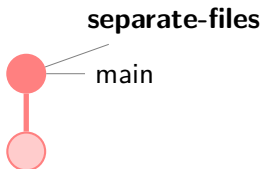
# A new branch



The create command bases the new branch on the branch you were in. So at this moment the *separate-files* branch and the *main* branch are identical. We did switch to the *separate-files* branch, this is also visible in the terminal. Any new commits will be pushed to the current branch.

Let's give that a try!

# Separating the files



- Make a new file *TUTORIAL.md* and copy the *How to commit* section over from *README.md*.
- Delete that part in the *README.md* file.
- Commit all changes:  

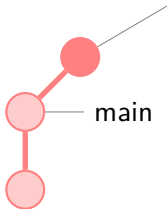
```
$ git add -A'
```

```
$ git commit -m 'Move "How to commit" to TUTORIAL.md'
```

# Separating the files

**separate-files**

**main**

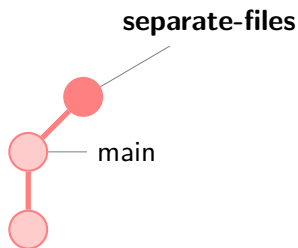


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- Commit all changes:  

```
$ git add -A'
```

```
$ git commit -m 'Move "How to commit" to TUTORIAL.md'
```
- The *separate-files* branch now has an extra commit on it and is no longer the same as the *main* branch.

# More commits



- Add a small header in *TUTORIAL.md* explaining what is in the file.
- Commit this change:  

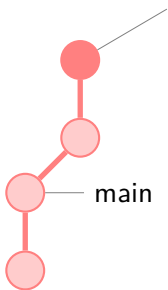
```
$ git commit -am 'Add file info for TUTORIAL.md'
```

*Note: the -a option on git commit automatically adds all changed files to the index, but it does **not** track new files!*

# More commits

separate-files

main



- Add a small header in *TUTORIAL.md* explaining what is in the file.
- Commit this change:  

```
$ git commit -am 'Add file info for TUTORIAL.md'
```

*Note: the -a option on git commit automatically adds all changed files to the index, but it does **not** track new files!*
- The branch now has 2 extra commits.
- Change and save something in the *README.md* file.
- Now we want to edit something unrelated to the separate files. We try switching back to the main branch, can you?  

```
$ git switch main
```

# Switching branches

You cannot switch branches when your workspace is not 'clean'. You basically have a few options at this point.

- 1 Commit the last change of your workspace to the branch.
- 2 Clean all files in your workspace to the last commit (i.e. delete all changes since the last commit):  
`$ git reset --hard`
- 3 Stash your changes (explained in intermediate course)

# Switching branches

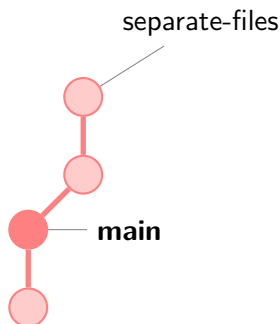
You cannot switch branches when your workspace is not 'clean'. You basically have a few options at this point.

- ❶ Commit the last change of your workspace to the branch.
- ❷ Clean all files in your workspace to the last commit (i.e. delete all changes since the last commit):  
`$ git reset --hard`
- ❸ Stash your changes (explained in intermediate course)

Try the second option and switch again using:

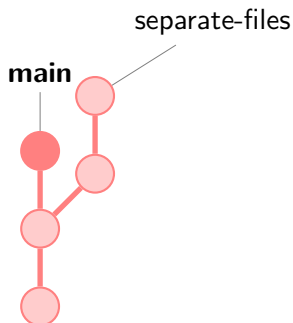
```
$ git switch main
```

# Pushing to main



- Your reference is now back at the *main* branch. Notice how your files have also reverted back. *Note: Do not worry, you can freely switch between the branches. As long as you don't reset or clean everything no code is ever lost when using git.*
- Let's add a commit on the main branch. Go into *README.md* and add:  
`**TUTORIAL.md** - Basic tutorial on how to commit.`
- Commit changes:  
`$ git commit -am 'Add file description for TUTORIAL.md'`

# Pushing to main



- Your reference is now back at the *main* branch. Notice how your files have also reverted back. *Note: Do not worry, you can freely switch between the branches. As long as you don't reset or clean everything no code is ever lost when using git.*
- Let's add a commit on the main branch. Go into *README.md* and add:  
`**TUTORIAL.md** - Basic tutorial on how to commit.`
- Commit changes:  
`$ git commit -am 'Add file description for TUTORIAL.md'`
- The *main* branch now has another commit.

# Merging

Git allows us to do non-linear code editing. We can keep pushing different features to the separate branches. We can switch, compare and do all sorts of different things with this.

Eventually there comes a point where we might want to get all changes of a branch (for instance separating the *TUTORIAL.md* file) into another branch (for instance the *main* branch). We do this with merging.

# Merging

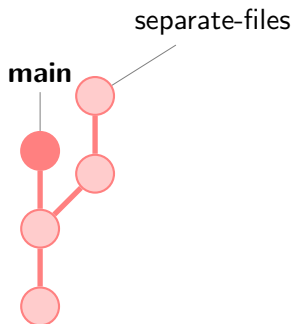
Git allows us to do non-linear code editing. We can keep pushing different features to the separate branches. We can switch, compare and do all sorts of different things with this.

Eventually there comes a point where we might want to get all changes of a branch (for instance separating the *TUTORIAL.md* file) into another branch (for instance the *main* branch). We do this with merging.

To merge the *separate-files* branch onto the current (*main*) branch perform:

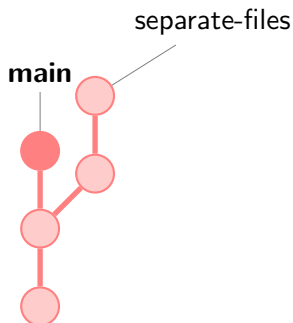
```
$ git merge separate-files
```

# Merging - Conflict



- Merging a branch can go automatically. But not now. Since both *separate-files* and *main* have more recent changes to *README.md* we have a conflict that needs to be resolved.
- Go through *README.md* and find the conflict. With your IDE or by deleting the GIT messages you can fix your code to get the wanted result from both branches.
- When you are done fixing the *README.md* file add it to the index:  
`$ git add -A`

# Merging - Conflict

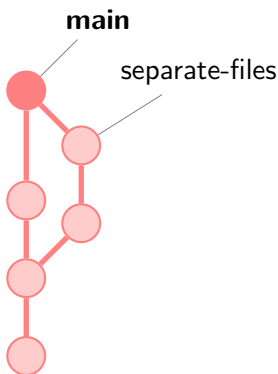


- Now continue the merge:

```
$ git merge --continue
```

*Note: When all conflicts are resolved you will be asked to provide a message. Providing this message (by closing the file) will make a new merge commit.*

# Merging - Conflict



- Now continue the merge:  
`$ git merge --continue`  
*Note: When all conflicts are resolved you will be asked to provide a message. Providing this message (by closing the file) will make a new merge commit.*
- We now see a new commit on `main` and all the history of `separate-files` is also pulled in.

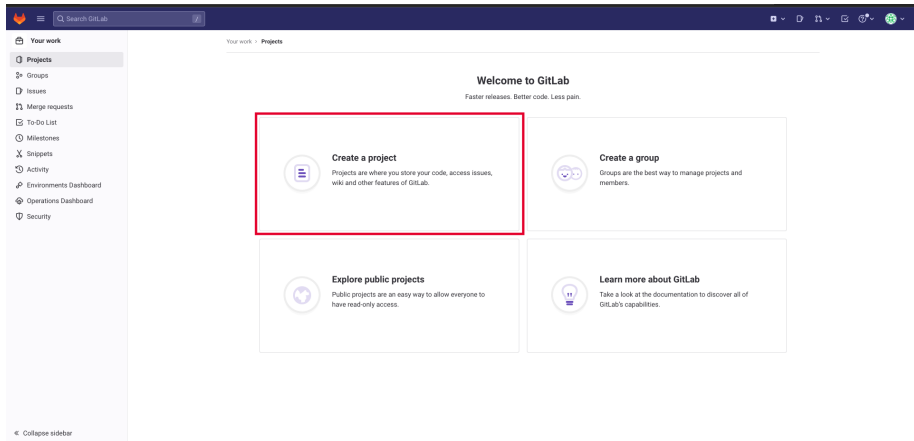
# Working together

Now we have the basics of committing and branches down. A real power of Git is working together with other people. Git allows us to clone a remote repository and then push our commits and branches to that. Any repository can be setup as remote if there is Git server running or SSH access to it. However we almost always see a dedicated git server in use.

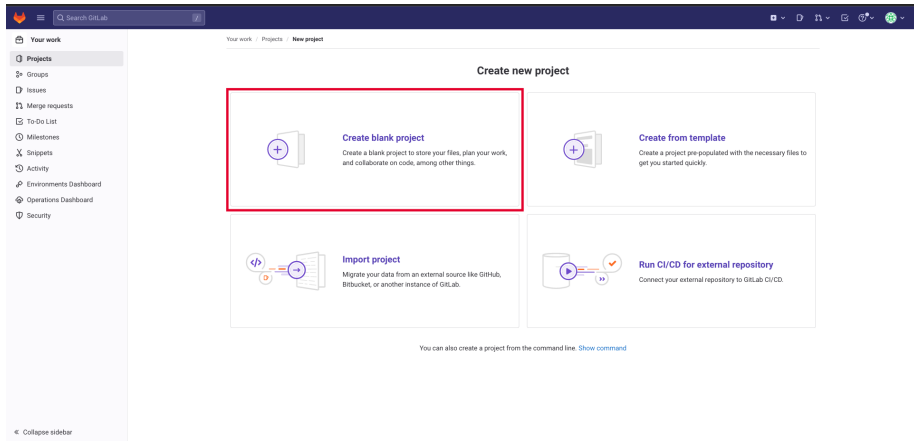
For open source projects we usually see the remote repository hosted on a public website such as <https://github.com>. Closed source (such as company projects) are very often self-hosted with something like <https://gitlab.com>. We will now use utwente's gitlab server to host our source code because you already have an account there and you can share with other students.

Go to <https://gitlab.utwente.nl> and sign in with your student number (e.g. s2037335) and password.

# Create repository on Gitlab



# Create repository on Gitlab



The screenshot shows the GitLab web interface. On the left is a sidebar with navigation links: Your work, Projects (selected), Groups, Issues, Merge requests, To-Do List, Milestones, Snippets, Activity, Environments Dashboard, Operations Dashboard, and Security. The main content area is titled 'Create new project' and contains four options:

- Create blank project** (highlighted with a red box): Create a blank project to store your files, plan your work, and collaborate on code, among other things.
- Create from template**: Create a project pre-populated with the necessary files to get you started quickly.
- Import project**: Migrate your data from an external source like GitHub, Bitbucket, or another instance of GitLab.
- Run CI/CD for external repository**: Connect your external repository to GitLab CI/CD.

At the bottom, a note states: 'You can also create a project from the command line. [Show command](#)'.

# Create repository on Gitlab

The screenshot shows the GitLab web interface for creating a new project. The left sidebar contains navigation links: Your work, Projects, Groups, Issues, Merge requests, To-Do List, Milestones, Snippets, Activity, Environments Dashboard, Operations Dashboard, and Security. The main content area is titled 'Create blank project' and includes the following sections:

- 1 Project name:** A text input field containing 'My awesome project'. Below it, a note states: 'Must start with a lowercase or uppercase letter, digit, emoji, or underscore. Can also contain dots, pluses, dashes, or spaces.'
- Project URL and Project slug:** The Project URL is 'https://gitlab.utwente.nl/<number>/' and the Project slug is 'my-awesome-project'.
- Want to organize several dependent projects under the same namespace?** A link to 'Create a group' is provided.
- 2 Visibility Level:** Three radio button options are shown:
  - ☒ **Private**: Project access must be granted explicitly to each user. If this project is part of a group, access is granted to members of the group.
  - ☐ **Internal**: The project can be accessed by any logged in user except external users.
  - ☐ **Public**: The project can be accessed without any authentication.
- 3 Project Configuration:** Two checkboxes are shown:
  - ☐ **Initialize repository with a README**: Allows you to immediately clone this project's repository. Skip this if you plan to push up an existing repository.
  - ☐ **Enable Static Application Security Testing (SAST)**: Analyze your source code for known security vulnerabilities. [Learn more.](#)

At the bottom, there are two buttons: 'Create project' and 'Cancel'.

# Create repository on Gitlab

My awesome project

Project 'My awesome project' was successfully created.

**My awesome project**  
Project ID: 9405

**Invite your team**  
Add members to this project and start collaborating with your team.  
[Invite members](#)

**The repository for this project is empty**  
You can get started by cloning the repository or start adding files to it with one of the following options.

[Clone](#) [Upload File](#) [New file](#) [Add README](#) [Add LICENSE](#) [Add CHANGELOG](#) [Add CONTRIBUTING](#) [Add Wiki](#) [Configure Integrations](#)

**Command line instructions**  
You can also upload existing files from your computer using the instructions below.

**Git global setup**

```
git config --global user.name "John Doe"
git config --global user.email "johndoe@example.com"
```

**Create a new repository**

```
git clone https://gitlab.utwente.nl/<number>/my-awesome-project.git
cd my-awesome-project
git switch -c main
touch README.md
git add README.md
git commit -m "add README"
git push -u origin main
```

**Push an existing folder**

« Collapse sidebar

# Set up remote tracking locally

On our local repository we will add a reference to the remote repository we just created:

```
$ git remote add origin https://gitlab.utwente.nl/<s-number>/<project-name>.git
```

# Push to remote

If we look at the Gitlab page we will not see any of the files we made. That is because we have not yet pushed our commits to the remote. Let's synchronise these repositories:

```
$ git push -u origin main
```

*Note: you may need to provide login information. On a public repository everyone can download but only members can push changes to it.*

# Look at repository on Github/Gitlab

You will now see your files and README on the remote repository!

The screenshot shows the Gitlab web interface for a repository named "Git-Example". The interface is divided into several sections:

- Left Sidebar:** Contains navigation links for Project, Pinned, Issues, Merge requests, Manage, Plan, Code, Build, Secure, Deploy, Operate, Monitor, Analyze, Settings, and Help.
- Header:** Displays the repository name "Git-Example" and a search bar.
- Breadcrumb:** Shows the path "main > git-example /".
- Commit History:** A table listing recent commits. The most recent commit is titled "Merge branch 'separate-files'" by "7kaspar" 9 hours ago. It lists two files: "README.md" and "TUTORIAL.md".
- Project Information:** A sidebar on the right showing project details: 5 Commits, 1 Branch, 0 Tags, 5 KiB Project Storage, and a README file. It also lists enabled features like Auto DevOps and provides links to add LICENSE, CHANGELOG, CONTRIBUTING, Kubernetes cluster, Wiki, and Configure Integrations.

| Name        | Last commit                           | Last update |
|-------------|---------------------------------------|-------------|
| README.md   | Merge branch 'separate-files'         | 9 hours ago |
| TUTORIAL.md | Move "How to commit" to TUTORIAL..... | 9 hours ago |

**Git Course Summary**

This README .md file will contain some markdown text detailing what I learned during the Git Course.

**TUTORIAL.md** - Basic tutorial on how to commit.

# Inviting other developers

As previously said; since the repository is public everyone on utwente can see and copy the code. To allow people on private repositories or to allow them to also push changes to the remote you can invite them as members:

The screenshot shows the GitHub interface for a project named 'Git-Example'. The 'Members' tab is selected in the left sidebar (1) and the 'Members' tab is active (2). The 'Invite a group' button is highlighted (3). The 'Invite members' modal is open, showing the 'Username, name or email address' field (4) with the value 'Verzijden, J.C. (Johan, Student B-EE)'. The 'Select a role' dropdown is set to 'Developer' (5). The 'Invite' button in the modal is highlighted (6).

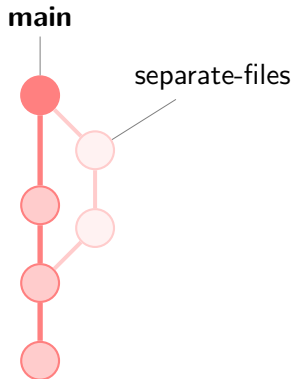
# Cloning

The remote is where people base their own local repositories on. If we are invited to someone's repository we can clone this repository onto our local machine. We can then edit code, do commits and eventually push back to the remote.

Clone someone else's repo (after being added as member) or simulate working together by cloning your own repository in a different folder:

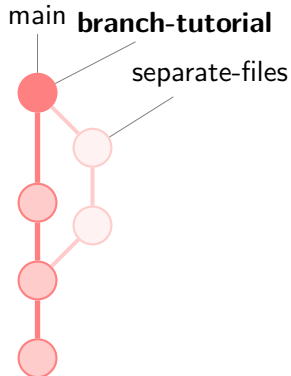
```
$ cd ../  
$ mkdir clone  
$ cd clone  
$ git clone https://gitlab.utwente.nl/<s-number>/<project-name>  
$ cd <project-name>
```

# Comitting on the clone



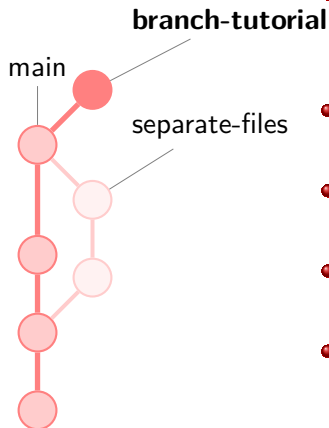
- We will do a commit on the new branch *branch-tutorial* on the clone:  
`$ git switch -c branch-tutorial`

# Comitting on the clone



- We will do a commit on the new branch *branch-tutorial* on the clone:  
`$ git switch -c branch-tutorial`
- Now add a summary to the *TUTORIAL.md* file of how to make a branch and switch to it.
- Once again commit your changes: `$ git commit -am 'Add branching tutorial'`

# Comitting on the clone



- We will do a commit on the new branch *branch-tutorial* on the clone:  
`$ git switch -c branch-tutorial`
- Now add a summary to the *TUTORIAL.md* file of how to make a branch and switch to it.
- Once again commit your changes: `$ git commit -am 'Add branching tutorial'`
- We now see a new commit on *branch-tutorial* in the clone repository.
- *Note: Although the separate-files history is embedded in the main after the merge commit the branch itself is not known as it was never pushed to or pulled from the remote.*

# Pushing from the clone

We commit our new branch from the clone to the remote repository:

```
$ git push origin branch-tutorial
```

After this we can see that on the website we can switch between the pushed branches:

The screenshot shows the GitHub web interface for a repository named 'Git-Example'. The left sidebar contains navigation links: Project, Pinned, Issues, Merge requests, Manage, Plan, Code, Build, Secure, Deploy, Operate, Monitor, Analyze, Settings, and Help. The main content area displays a notification about the Auto DevOps pipeline, a confirmation message 'You pushed to branch-tutorial at s2037335 / Git-Example just now', and a 'Create merge request' button. Below this, the repository name 'Git-Example' is shown with a search icon. A dropdown menu for 'Select Git revision' is open, showing a search bar and a list of branches: 'main' (selected), 'branch-tutorial', and 'TUTORIAL.md'. The 'main' branch is marked as 'default' and 'protected'. To the right of the dropdown, there are buttons for 'History', 'Find file', 'Edit', and 'Code'. Below the dropdown, a table lists the 'Last commit' and 'Last update' for the selected branch. The table has two columns: 'Last commit' and 'Last update'. The first row shows a commit 'Merge branch 'separate-files'' from 13 hours ago. The second row shows a commit 'Move "How to commit" to TUTORIAL....' from 14 hours ago. On the right side of the page, there is a 'Project information' section with statistics: 5 Commits, 2 Branches, 0 Tags, and 5 KiB Project Storage. Below this, there are links to 'README', 'Auto DevOps enabled', 'Add LICENSE', 'Add CHANGELOG', 'Add CONTRIBUTING', and 'Add Kubernetes cluster'.

# Merge request

Instead of merging on the command line we can create a merge request (often also called pull request). This is very useful for working together. Before actually bringing the *branch-tutorial* branch changes into the *main* version of our summary project we first create the request for this. This allows us to write some text explaining, discussing this with comments and also have other people review the changes you suggest.

*Note: On open source projects you are often not a member so you cannot push to these repositories straight away. You can however create a so-called fork of the project. This is your own copy where you have all the access rights. After pushing to your fork you can create a pull request to push the changes 'upstream' to the actual repository.*

Let's try it!

# Open merge request

The screenshot shows the GitLab web interface for a project named "My awesome project fork". The left sidebar contains navigation links: Project information, Repository, Issues, Merge requests, CI/CD, Security and Compliance, Deployments, Packages and registries, Infrastructure, Monitor, Analytics, Wiki, Snippets, and Settings. The main content area displays the merge request details. At the top, it shows the project name, ID (9407), and statistics (5 Commits, 1 Branch, 0 Tags, 10 KB Project Storage). Below this, a commit titled "Change the text colour to something amazing" by Johan Verzijden is shown. The merge request is currently "Unmerged" with a hash of 40fccf80. A red box highlights the "Create merge request" button. Below the merge request details, there are checkboxes for "Auto DevOps enabled", "Add README", "Add LICENSE", "Add CHANGELOG", "Add CONTRIBUTING", "Add Kubernetes cluster", and "Add Wiki". At the bottom, a table lists the files changed in the merge request.

| Name       | Last commit                                 | Last update  |
|------------|---------------------------------------------|--------------|
| index.html | Merge branch 'add-learning-gli-project'     | 1 week ago   |
| style.css  | Change the text colour to something amazing | 1 minute ago |

# Open merge request

My awesome project fork

Project information  
Repository  
Issues  
Merge requests  
CI/CD  
Security and Compliance  
Deployments  
Packages and registries  
Infrastructure  
Monitor  
Analytics  
Wiki  
Snippets  
Settings

My awesome project fork > Merge requests > New

## New merge request

From: /my-awesome-project-fork:main into: /my-awesome-project:main [Change branches](#)

**Title (required)**

Change the text colour to something amazing

☐ Mark as draft  
Drafts cannot be merged until marked ready.

**Description**

[Write](#) [Preview](#)

B I

Describe the goal of the changes and what reviewers should be aware of.

Supports [Markdown](#). For [quick actions](#), type [/](#).

Add [description templates](#) to help your contributors to communicate effectively!

**Assignees**

Unassigned [Assign to me](#)

**Reviewers**

Unassigned

Approvals are optional.  
[Approval rules](#)

**Milestone**

Select milestone

**Labels**

« Collapse sidebar

# Open merge request

The screenshot shows the GitHub web interface for a repository named "My awesome project fork". The left sidebar contains navigation links: Project information, Repository, Issues (1), Merge requests (1), CI/CD, Security and Compliance, Deployments, Packages and registries, Infrastructure, Monitor, Analytics, Wiki, Snippets, and Settings. The main content area is titled "Create merge request" and includes sections for "Approvals are optional", "Milestone" (with a "Select milestone" dropdown), "Labels" (with a "Labels" dropdown), "Merge request dependencies" (with a text input for "Enter merge request URLs or references"), "Merge options" (with a checkbox for "Squash commits when merge request is accepted"), and "Contribution" (with a checkbox for "Allow commits from members who can merge to the target branch"). At the bottom of this section, the "Create merge request" button is highlighted with a red box, next to a "Cancel" button. Below this, the "Commits" section shows a single commit from 20 Jun, 2023, titled "Change the text colour to something amazing" by Johan Verzijden. The commit hash "48fccf88" is visible in the bottom right corner of the commit list.

# Review and accept merge request

The screenshot displays the GitLab interface for a merge request titled "Change the text colour to something amazing". The left sidebar shows the project navigation menu with "Merge requests" selected. The main content area has tabs for Overview, Commits, Pipelines, and Changes (which is highlighted with a red box). The "Changes" tab shows the source branch is 2 commits behind the target branch. A "Merge" button is highlighted with a red box. The right sidebar shows the merge request details, including assignees, reviewers, labels, milestones, time tracking, lock merge request, notifications, and participants.

My awesome project

Change the text colour to something amazing

requested to merge /my-awesome-project into main 6 days ago

Overview Commits Pipelines **Changes**

Approval is optional

Ready to merge!

Squash commits Edit commit message

The source branch is 2 commits behind the target branch: 1 commit and 1 merge commit will be added to main.

Merge

Activity

Write Preview

Write a comment or drag your files here...

Supports Markdown. For quick actions, type `/`

Comment Close merge request

Mark as done

0 Assignees None - assign yourself

0 Reviewers None - assign yourself

Labels None

Milestone None

Time tracking No estimate or time spent

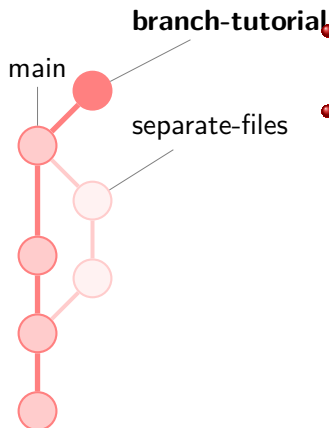
Lock merge request Unlocked

Notifications

1 Participant

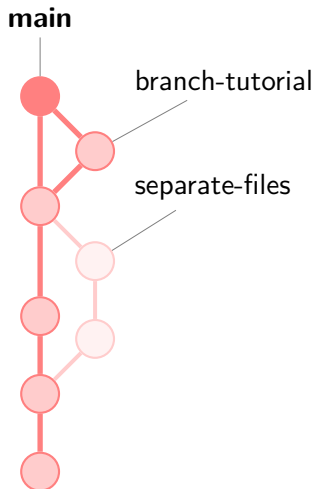
Reference: s2235854/my-awesom...  
Source branch: main

# Performing the merge



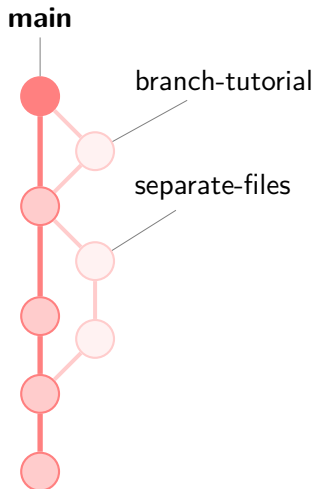
- On the website create a merge request. Merge *branch-tutorial* into *main*.
- Review and merge the request.

# Performing the merge



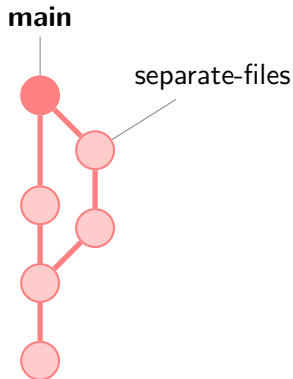
- On the website create a merge request. Merge *branch-tutorial* into *main*.
- Review and merge the request.
- Now again a merge commit is created on the *main* branch.
- If we know we don't need the *branch-tutorial* branch anymore we can click 'Delete source branch' on the Merge Request.

# Performing the merge



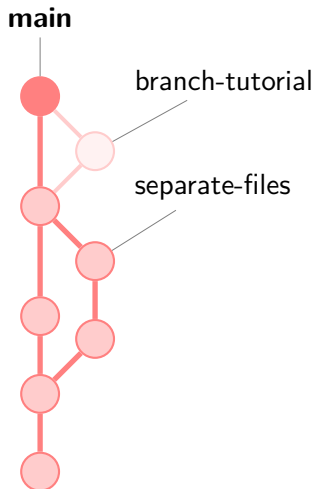
- On the website create a merge request. Merge *branch-tutorial* into *main*.
- Review and merge the request.
- Now again a merge commit is created on the *main* branch.
- If we know we don't need the *branch-tutorial* branch anymore we can click 'Delete source branch' on the Merge Request.
- We see the remote no longer holds the source branch but all changes and history are embedded from the merge.

# Pulling from the origin



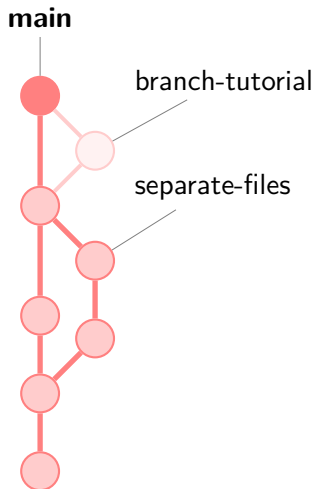
- Let's switch back to our first local repository:  
`$ cd ../../<project-name>`
- Now of course we don't know about the changes of the remote yet. Let's reel them in:  
`$ git pull origin main`

# Pulling from the origin



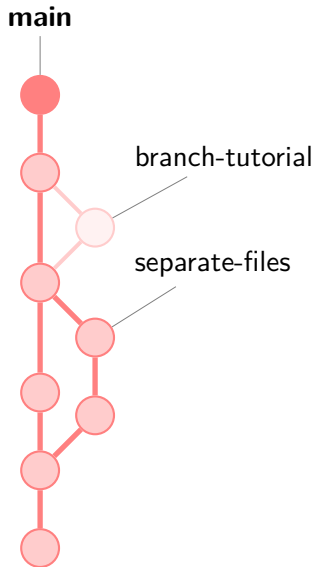
- Let's switch back to our first local repository:  
`$ cd ../../<project-name>`
- Now of course we don't know about the changes of the remote yet. Let's reel them in:  
`$ git pull origin main`
- Yes! Now our changes are also in the other local branch!
- *Note: In this repository we still of course have the separate-files branch as we never deleted it locally. We do not have the branch-tutorial branch as we have never pulled it from the remote.*

# Reverting a commit



- Imagine that the last change screwed up our program and we want to delete it. Git helps a lot by recording all changes so we can just revert the change.
- First find out the hash of the commit that introduced the mistake. You can do this on the website or perhaps with:  
`$ git log`
- In my case it seemed the 'Add branching tutorial' was wrong. Its hash starts with 'd7f775'. We can revert it using:  
`$ git revert d7f775`

# Reverting a commit



- Imagine that the last change screwed up our program and we want to delete it. Git helps a lot by recording all changes so we can just revert the change.
- First find out the hash of the commit that introduced the mistake. You can do this on the website or perhaps with:  
`$ git log`
- In my case it seemed the 'Add branching tutorial' was wrong. Its hash starts with 'd7f775'. We can revert it using:  
`$ git revert d7f775`
- This creates a new commit on *main* that does the opposite changes of the commit specified. It essentially negates it.

# Never forget

Reverting creates a new commit. History never gets deleted this way and we can even revert the revert. Of course to update to our other developers we have to push to the origin and then pull on the other machines again.

*Note: While it is not advised to muck about in the history of git commits, you can for instance use `git reset`. A use case might be that you accidentally committed a password to a shared repository and reverting the commit does not remove this from history. As these actions are more uncommon we will discuss them only in the intermediate course.*

# Done!

This concludes the practical for the basic git course. You have now used all important and most essential git commands and concepts, congratulations!

There is a lot more that Git can do. It can help you find bugs by doing a binary search on your code, there are commands to easily help you find changes in history (so you know who to blame). You can work together with multiple upstream branches, secure your code with signed GPG keys, etc. If you want to learn more about this search the web or come to our intermediate course! :-)