COMP310/ECSE427 Lab1
Git

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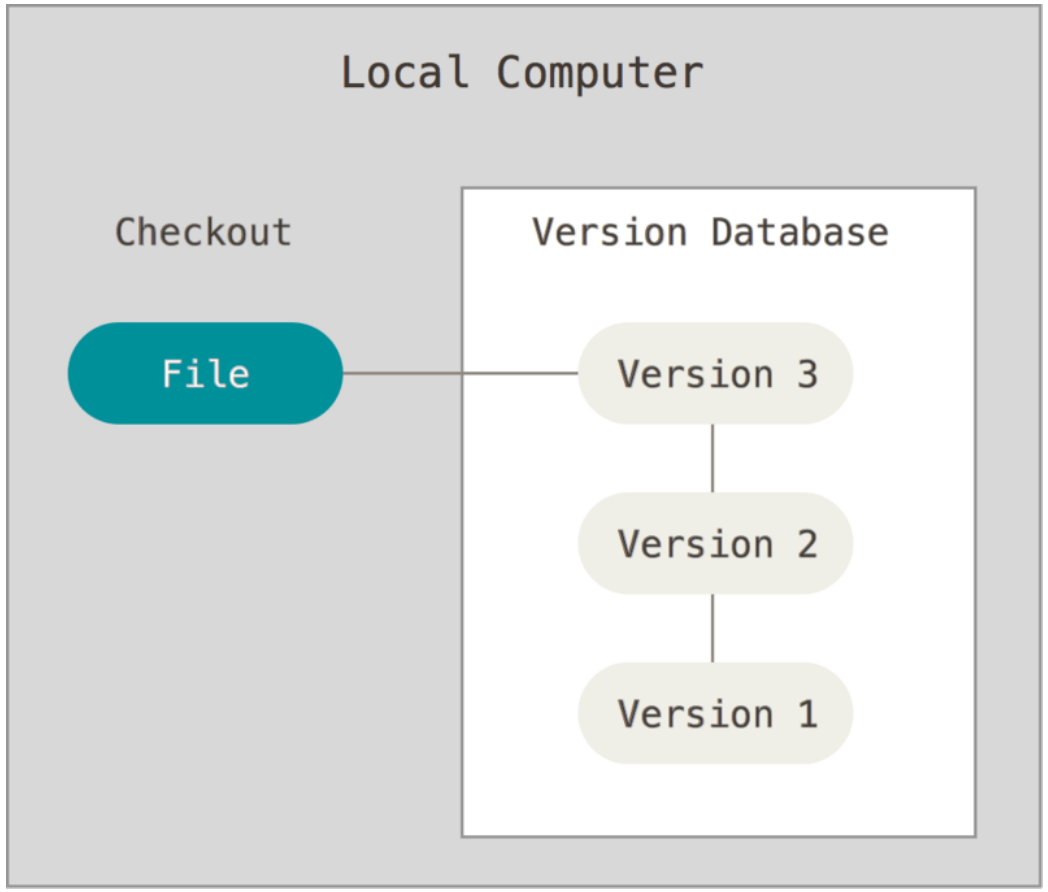
What is Version Control?

- **Definition**:
  - A system that records changes to a file or files over time so you can recall specific versions later.
- **Use Cases**:
  - Ideal for software source code and nearly any file type.
- **Benefits**:
  - Revert files or entire project to a previous state.
  - Track changes and identify who made specific changes.
  - Recover lost files with minimal overhead.

Local Version Control

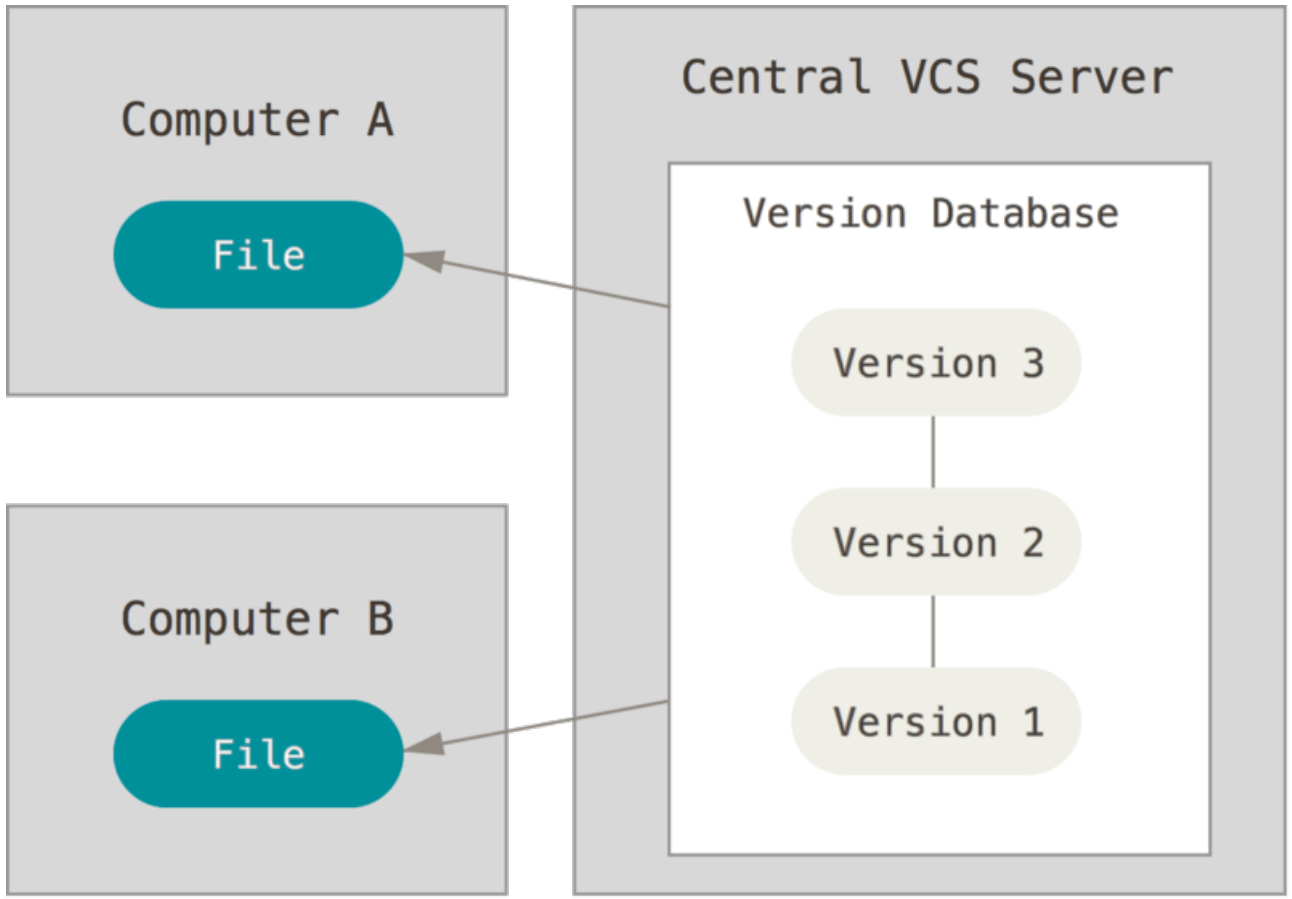
- **Early Methods**:
  - Copying files into time-stamped directories.
- **Problems**:
  - Error-prone and easy to lose track.
- **Local VCS**:
  - Uses a simple database to manage file revisions.
- **Example**:
  - RCS (Revision Control System).



https://git-scm.com/book/en/v2/Getting-Started-About-Version-Control

Centralized Version Control

- **Need**:
  - Collaboration among developers on different systems.
- **How It Works**:
  - A central server stores all versioned files, clients check out files from this server.
- **Advantages**:
  - Easier administration.
  - Enhanced visibility into project activities.
- **Risks**:
  - Single point of failure; total loss of history if the server fails without backups.



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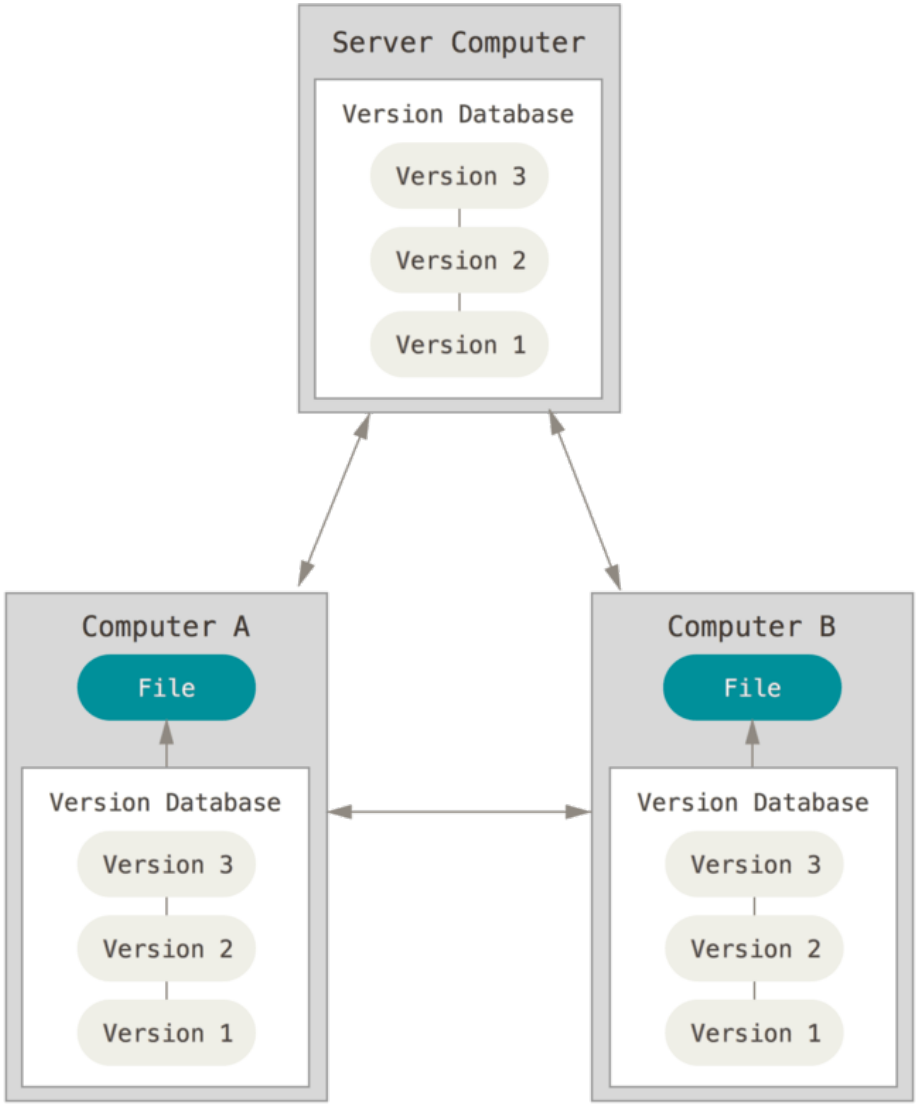
Distributed Version Control Systems

- **Introduction**:
  - Overcomes limitations of centralized systems.
- **Operation**:
  - Clients mirror the repository, including its full history.
- **Benefits**:
  - Each clone is a full backup.
  - Robust against server failures.
  - Supports multiple remote repositories and diverse collaborative workflows.



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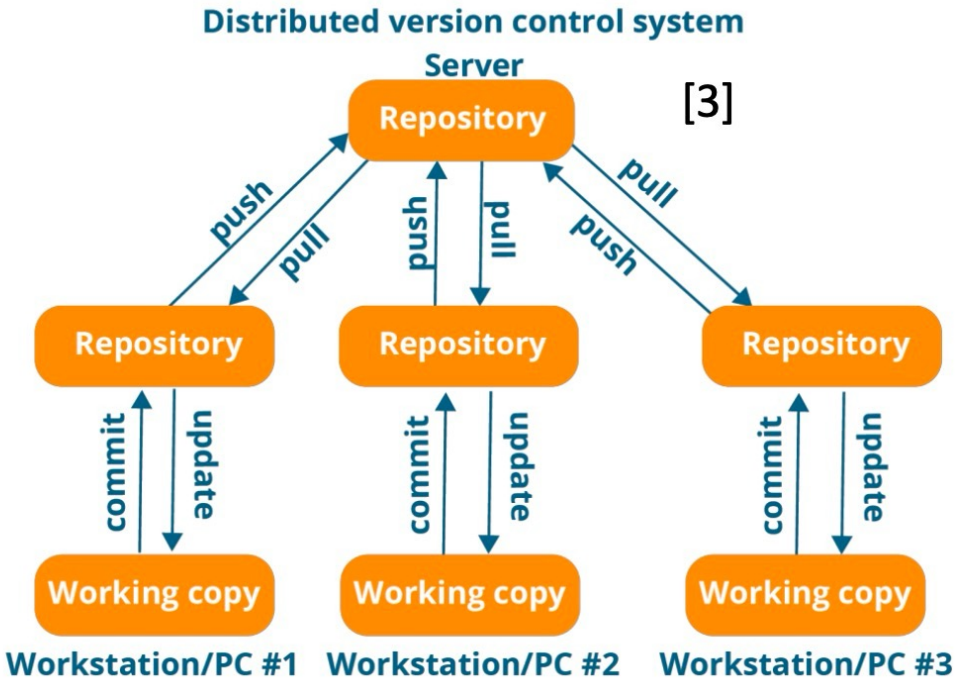
Git

- Distributed Version Control system
- Created in a month in 2005 by Linus Torvalds of Linux fame
- Each developer has an independent copy of the whole history
- If server dies, there are many backups of the history



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Git Terminology

- **Repository**: A "folder" containing all the code files and the entire history of the code
- **Remote repository**: Your repository, but stored in a server where it is always accessible, safe, and your teammates can access it too
- **Staging area**: After you modify the code, the area in your computer where Git keeps track of which changes you want to save
- **Commit**: "Save" or register your changes into the history of the repository
- **Push**: Upload the saves to the remote repository
- **Pull**: Get the latest saves that people have uploaded to the remote repo
- **Clone**: Download the repository for the first time

Add Commit Push

Branch

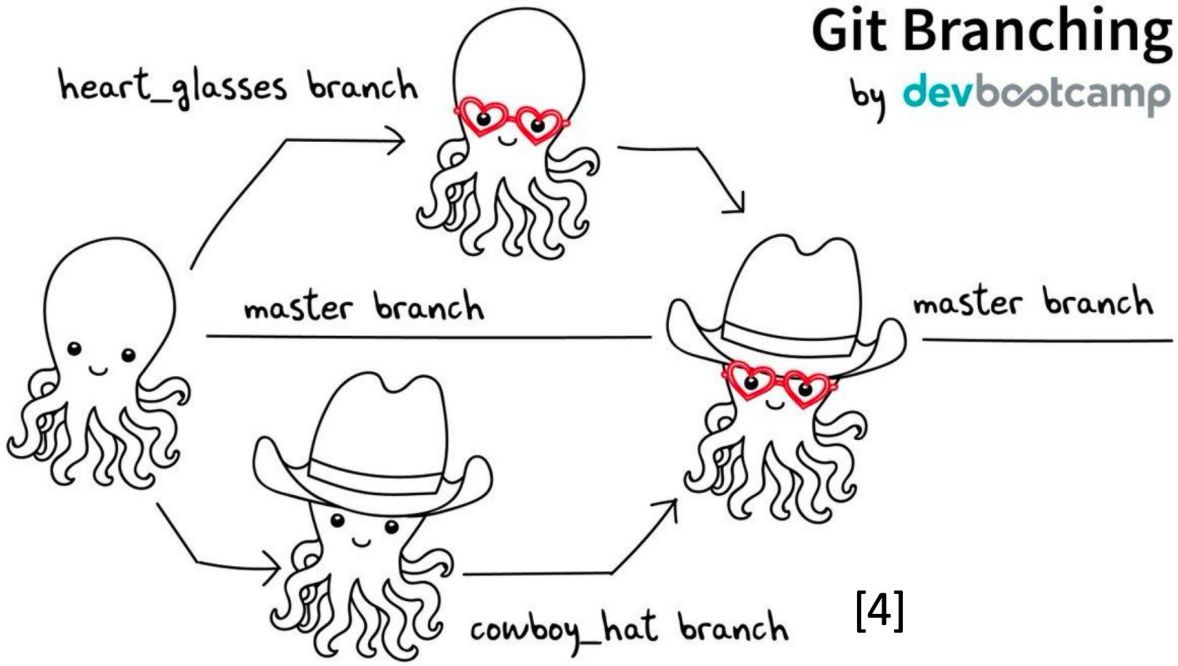
Git allows you to have “parallel universe" versions of your code

They are called Branches

Branches are part of your repository

Why have this?

- Work on multiple ideas in parallel without risking the history of the code
- Work on a feature until it‘s ready to be used without disturbing the main code



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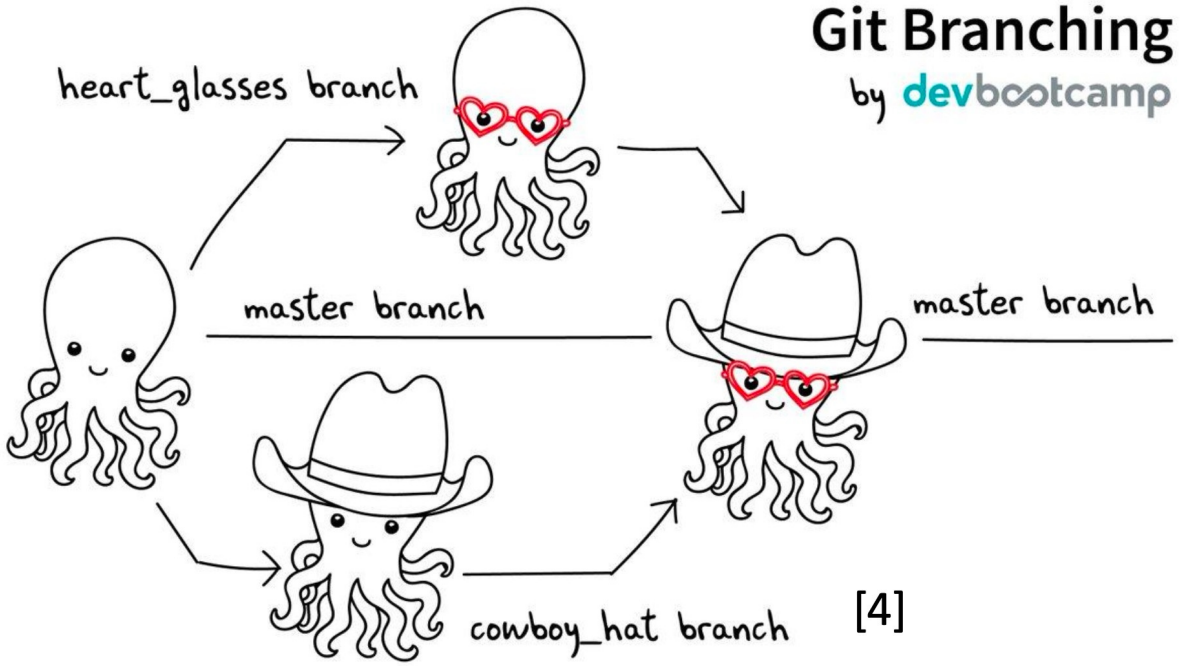
Merge

- Merging two branches is combining their changes
- One of the branches ends up with all the changes

What if two branches have different changes in the same place?

- This is called a merge conflict
- You will have to manually go through the conflicts and decide what to keep
- Merging is automatic if there are no conflicts



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Fork

- **Definition**:

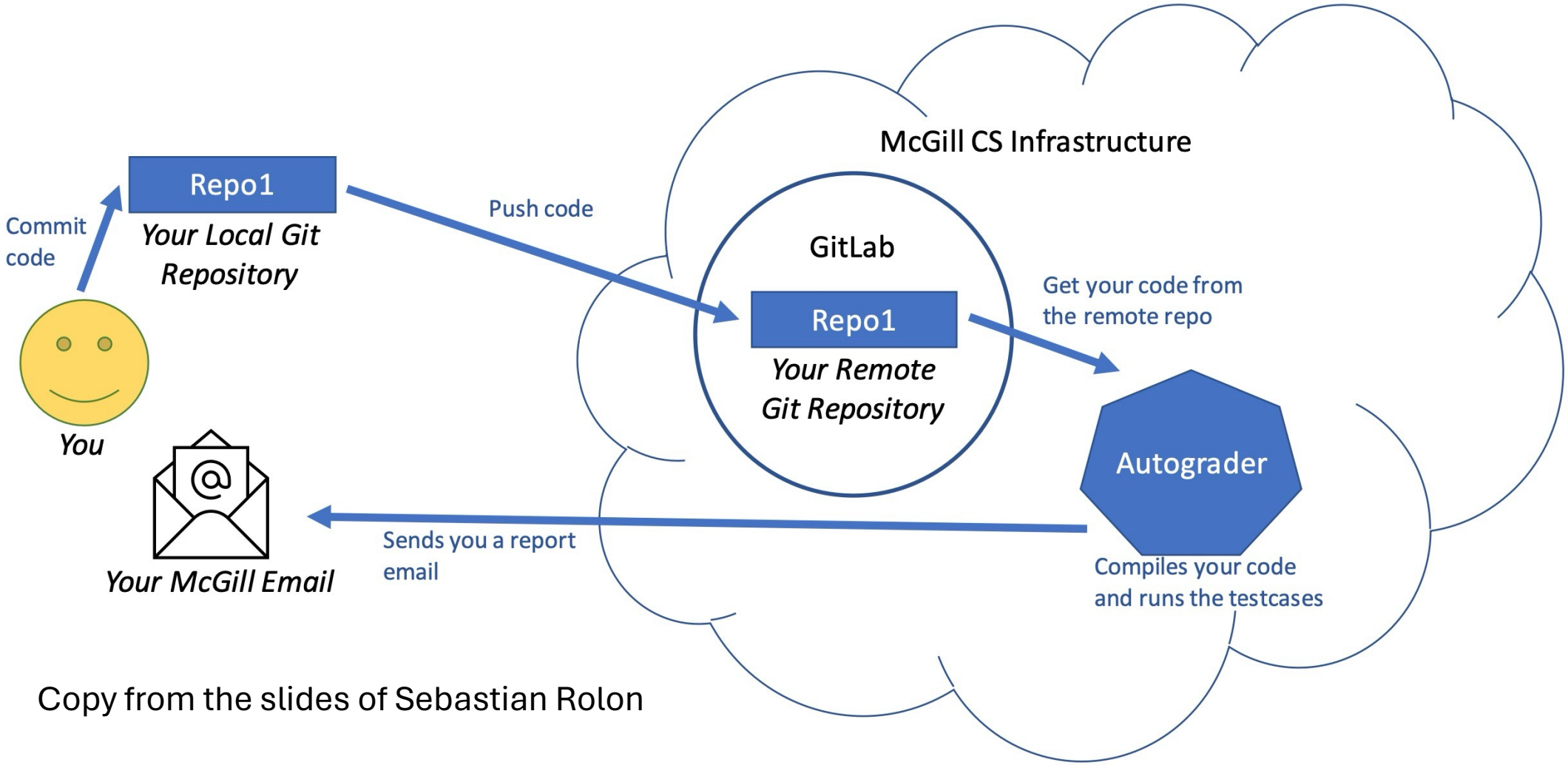
  A fork is a personal copy of another user's repository that's stored in your account. It allows you to experiment, make changes, and propose those changes back to the original repository.

- **Purpose**:
  - **Experimentation**: Test changes without affecting the original project.
  - **Contribution**: Submit patches or enhancements to the project.
  - **Independence**: Develop new features or take the project in a different direction without needing permissions from the original repository owners.

Workflow of Fork

1. **Fork the Repository**: Make your own copy of a repository.
2. **Clone the Fork**: Work locally on your machine.
3. **Make Changes**: Update, add, delete files.
4. **Commit Changes**: Save your work to your fork.
5. **Push Changes**: Upload the changes to your GitHub fork.
6. **Pull Request**: Send a request to the original owner to pull your changes(Unnecessary).

Autograder and git



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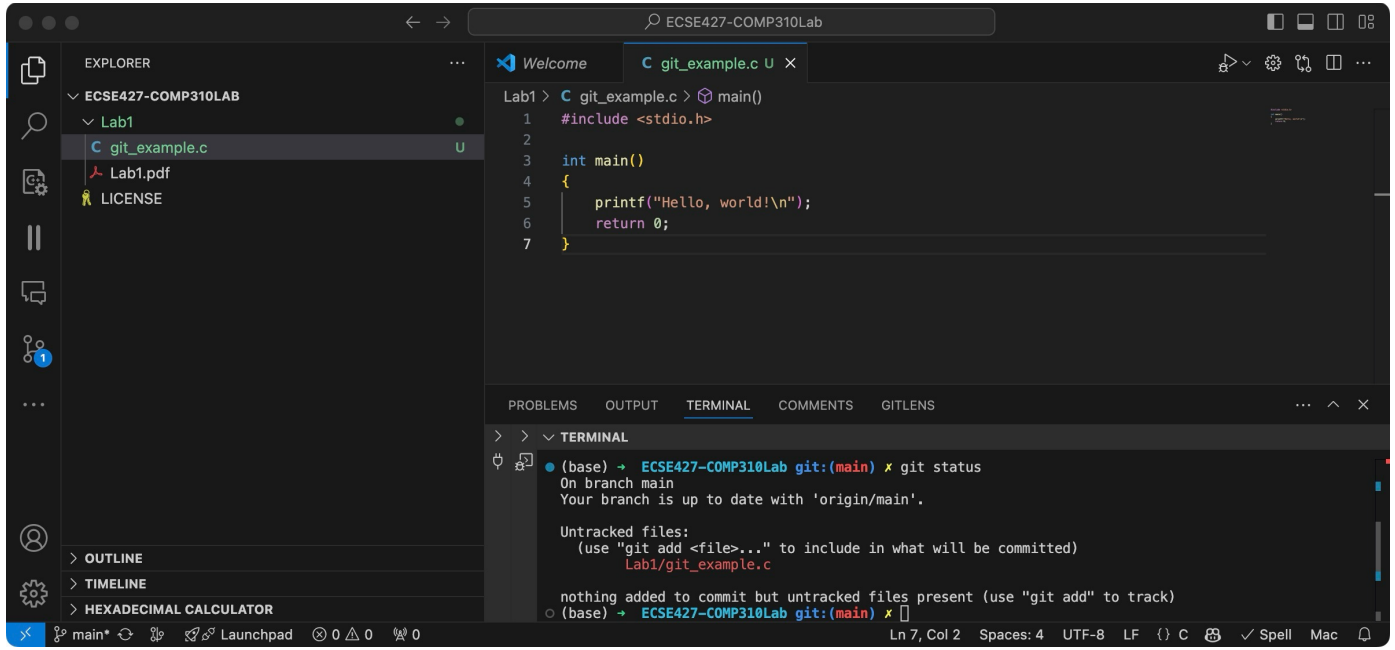
Hello World

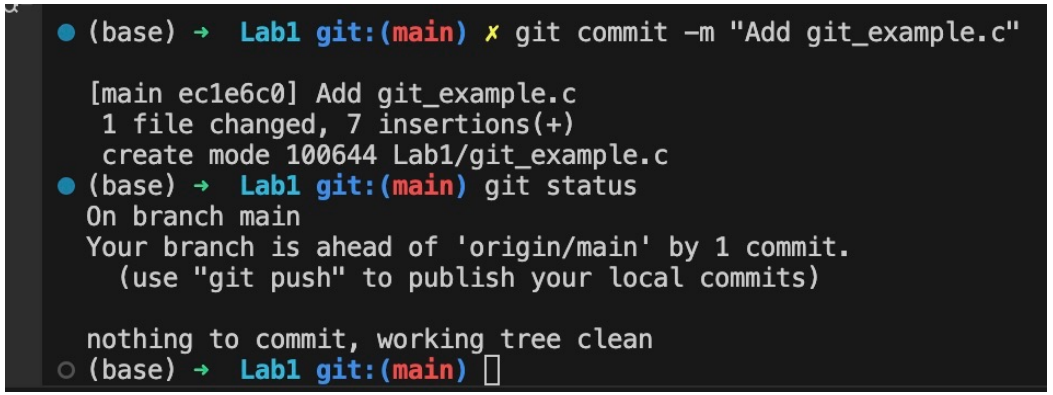
```c
#include <stdio.h>

int main()
{
printf("Hello, world!\n");
return 0;
}
```

Example-Work in Team

- Run git add git_example.c to stage the file for committing.
- Run git commit -m "Add git_example.c" to commit the file to the repository.



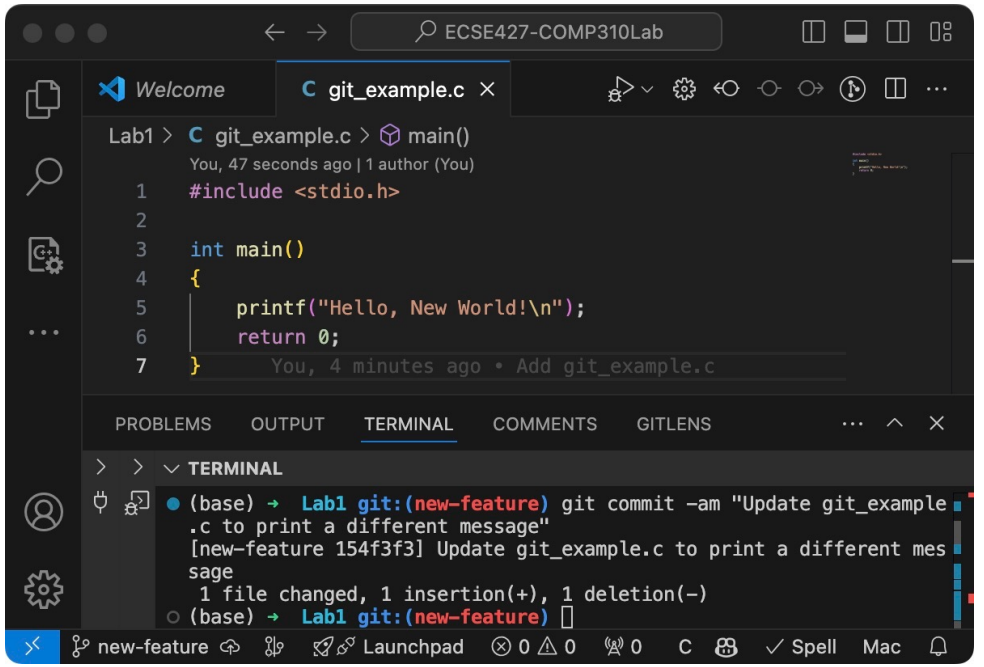


Example

- Run git branch new-feature to create a new branch.
- Run git checkout new-feature to switch to the new branch.
- Modify git_example.c, perhaps to print a different message.
- Commit the changes with git commit -am "Update git_example.c to print a different message".
- git push origin new-feature

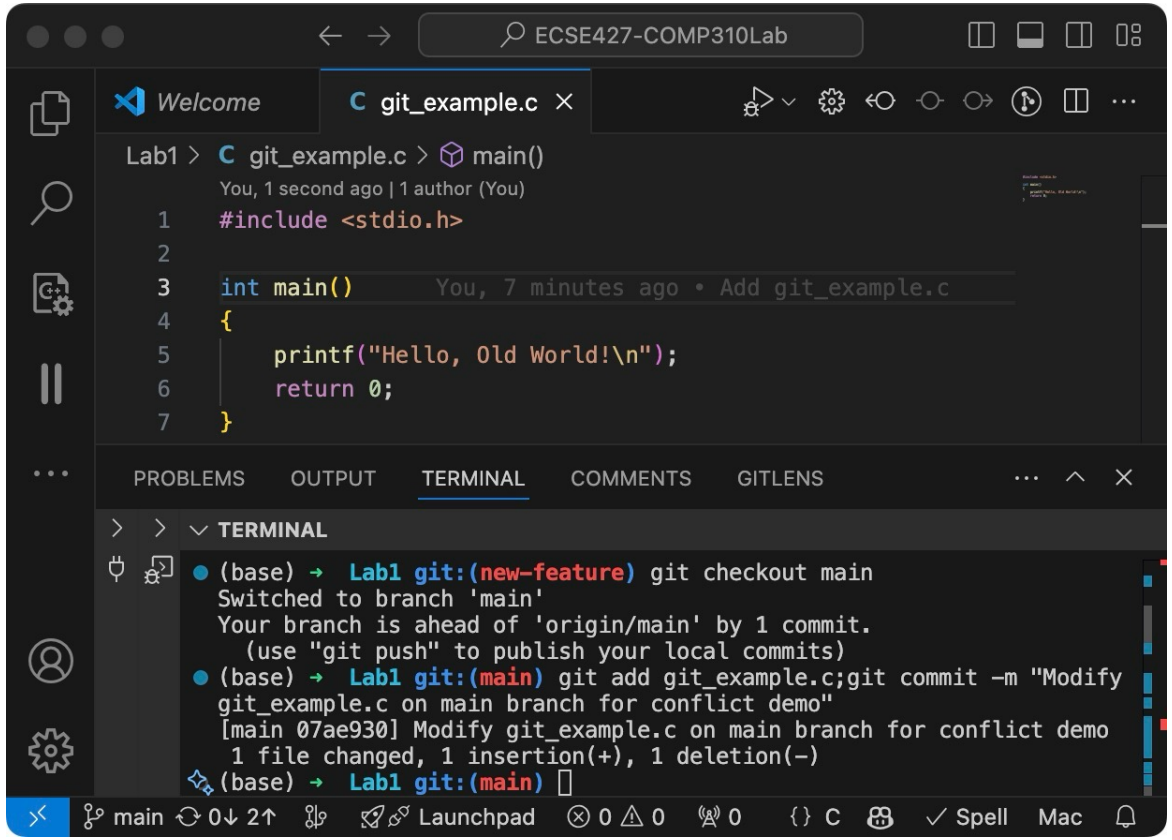
```
(base) ➜  Lab1 git:(main) git branch new-feature
(base) ➜  Lab1 git:(main) git branch -all
error: did you mean `--all` (with two dashes)?
(base) ➜  Lab1 git:(main) git branch --all
* main
  new-feature
  remotes/origin/HEAD -> origin/main
  remotes/origin/main
(END)
```

```
(base) ➜  Lab1 git:(main) git checkout new-feature
Switched to branch 'new-feature'
(base) ➜  Lab1 git:(new-feature) git status
On branch new-feature
nothing to commit, working tree clean
```



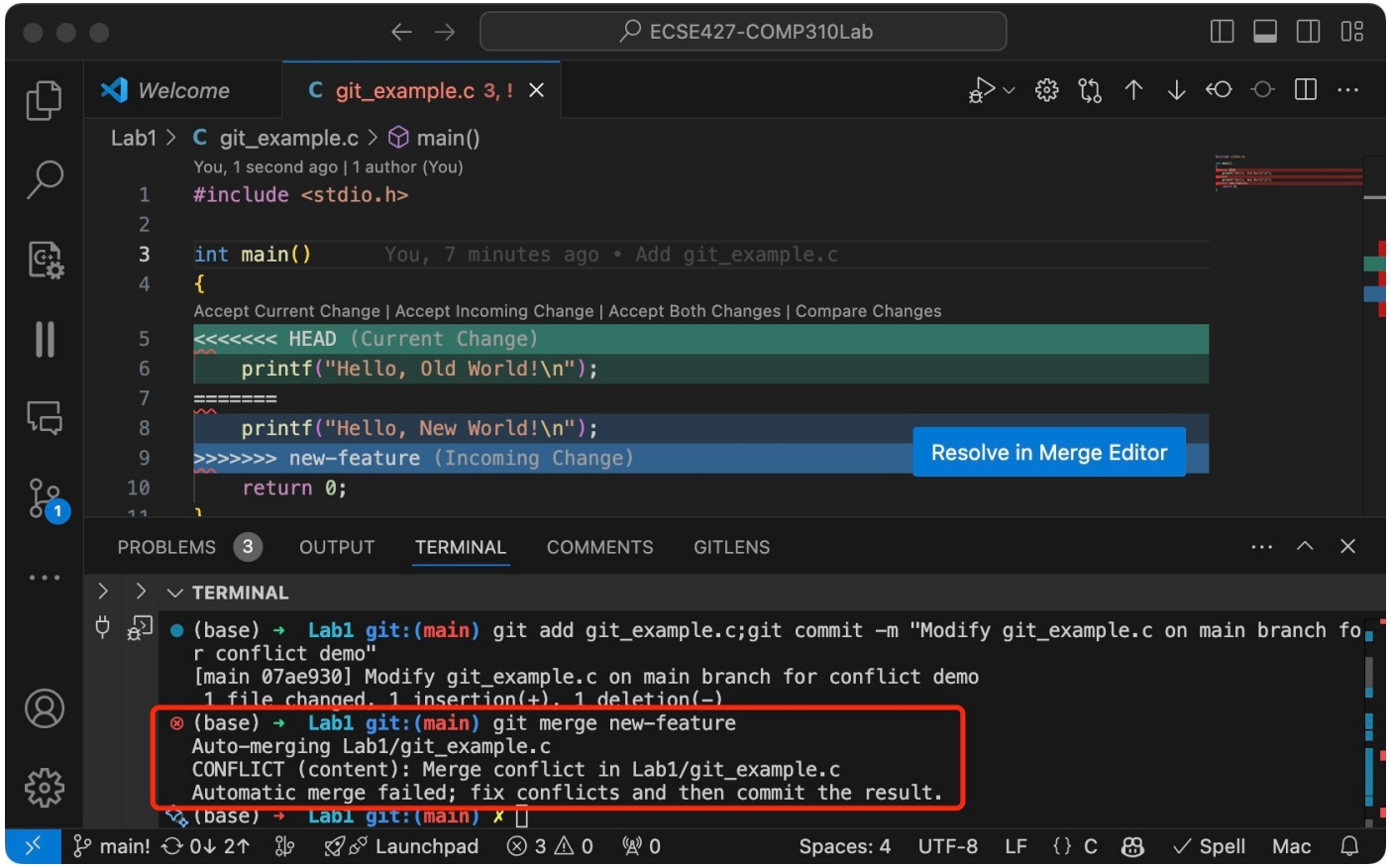
Example

- Run git checkout main to switch back to the main branch. Introduce a change in git_example.c on the main branch that conflicts with your branch change. Commit this change.



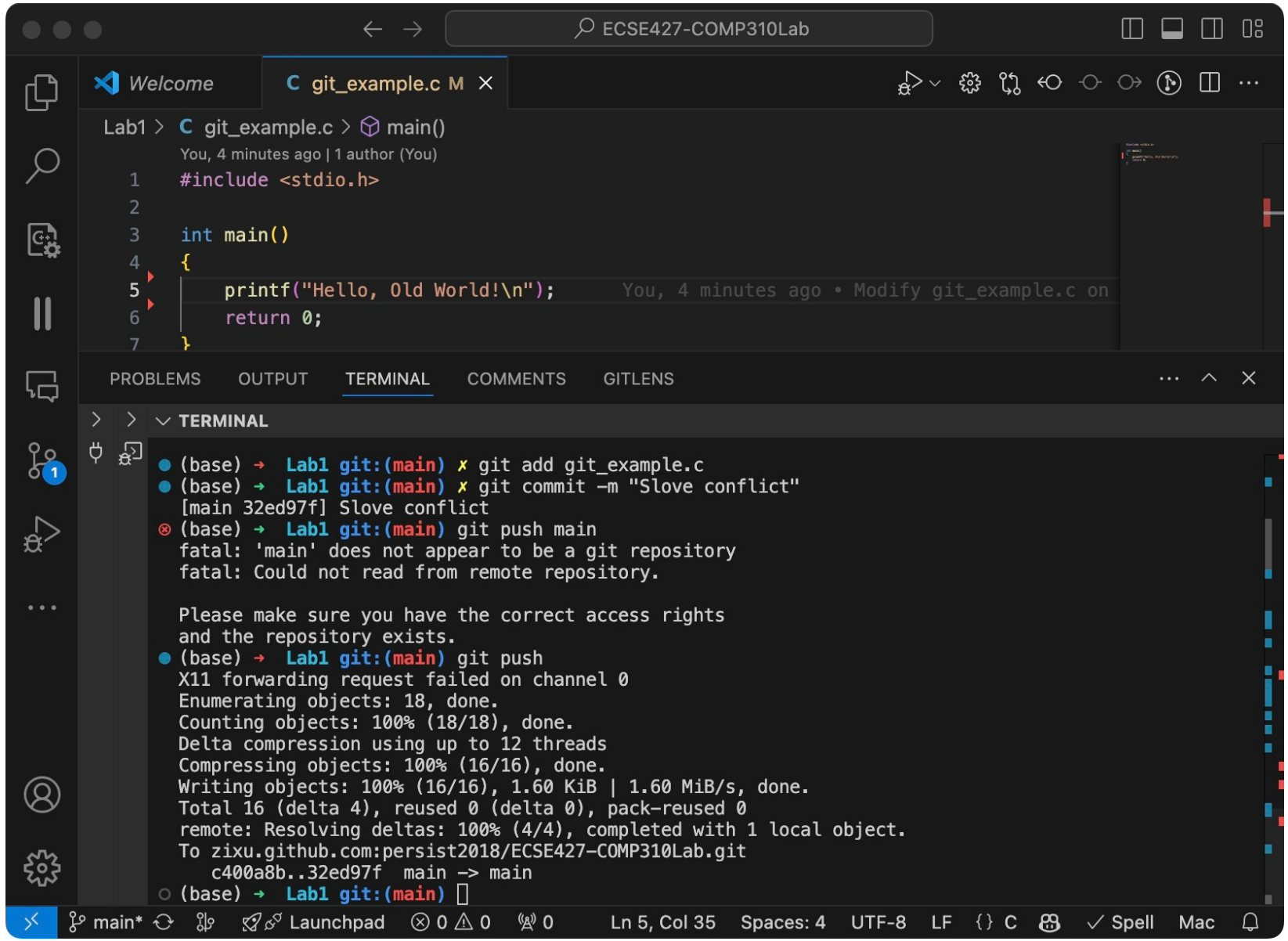
Example

- Run git merge new-feature to merge the changes from new-feature into main.



Example

- Resolve any conflicts that arise, then commit the resolved version.
- git push



Comparing GitHub and GitLab

- **Introduction to GitHub**:
  - Founded in 2008, GitHub is the largest host of source code in the world.
  - Offers cloud-based Git repository hosting.
  - Focuses on simplicity and community collaboration.
- **Introduction to GitLab**:
  - Founded in 2011, GitLab is a single application for the entire software development lifecycle.
  - Offers both cloud-based and self-hosted options.
  - Focuses on integrated CI/CD and comprehensive DevOps solutions.

Key Features and Differences

- **User Interface and Experience**:
  - GitHub: User-friendly, intuitive, preferred for project collaboration.
  - GitLab: Comprehensive, feature-rich, can be overwhelming but **highly customizable**.
- **CI/CD Integration**:
  - GitHub: Offers GitHub Actions for automation but relies heavily on third-party apps.
  - GitLab: Built-in CI/CD features, providing a more seamless and integrated experience.
- **Deployment Options**:
  - GitHub: Primarily cloud-hosted, with GitHub Enterprise for self-hosting.
  - GitLab: Flexible with both cloud and self-hosted options from the start.
- **Open Source vs. Proprietary**:
  - GitHub: Primarily proprietary but supports a vast array of open-source projects.
  - GitLab: Core is open-source, offering greater transparency and customization.

Ref

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3. What Is Git ? – Explore A Distributed Version Control Tool. Reshma
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