

# C Programming Lab

BME554L - Spring 2026 - Palmeri

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## Prelab

- Complete [Nordic DevAcademy: Lesson 3 – Elements of an nRF Connect SDK application](#)
- Complete [Nordic DevAcademy: Lesson 4 – Printing messages to console and logging](#)
- Review [Debugging](#) resource.

## Objectives

- Introduction to C Programming
- Building Zephyr application
- Flashing Zephyr application
- Viewing serial output from Zephyr application running on your `nrf52833DK`
- Debugging Zephyr applications in VS Code

## Zephyr Application Git Repository Overview

- `src/main.c` - main application code
- `.gitignore` - ignore files that are not needed in the git repository
- `CMakeLists.txt` - build system configuration file
- `prj.conf` - Zephyr configuration file
- `README.md` - this file
- `CMakePresets.json` - CMake presets file (build configuration)
- `.gitlab-ci.yml` - GitLab CI configuration file

## Things To Do

### Git Best Practices

- Use best practices for version control (branching, commit messages, etc.).
- Do all development on a dedicated branch that is merged into `main` once it is functional.
- Commits should be very specific to the changes/additions you are making to your code. This will help you and others understand what you did and why you did it.
- On a given development branch, try to implement one small piece of functionality at a time, commit it, and then move on to the next piece of functionality.

#### ! Important

You do not want one, monolithic git commit right before you submit your project.

## Fork / Clone / Build / Flash / View Serial Output

- Fork the C Programming lab repository on Duke's GitLab server: <https://gitlab.oit.duke.edu/mlp6/c-programming-lab>
- Add Dr. Palmeri (`mlp6`) as a Maintainer in your forked repository.
- Clone your forked repository to your local machine.
- Build the Zephyr application "as is" (review [DevAcademy: Lesson 1](#)).
- Flash the Zephyr application to your development kit.
  - Connect the VCOM port on the `nrf52833DK` to your computer (using **Connected Devices** and the plug icon)
  - Look at the serial output in the VS Code **Terminal**

## Update the GitLab CI Pipeline Badge

- Update the URLs in `README.md` for the GitLab CI pipeline badge to point to your forked repository.

### Note

This badge represents the status of the CI pipeline for your repository, and will only showed **Passed** once you have completed all of the tasks in this lab.

- Commit this specific change to your `main` branch as its own commit.

## Modify the Zephyr Application (DataTypes / Typecasting / Formatted Printing)

- Inspect the code to see how variables `a`, `b` and `c` are declared and initialized. 0 Flash the existing code and note the terminal output:

```
a = 2 (uint8_t)
b = 3 (uint8_t)
c = 0.000000 (float)
YOU LOSE!!
```

- On a development branch called `fix_division`, without changing the declared datatypes of `a`, `b`, or `c`, correct the code so that `c` is output in the terminal:

```
a = 2 (uint8_t)
b = 3 (uint8_t)
c = 0.666667 (float)
YOU WIN!!
```

- Push the `fix_division` branch to your GitLab repository.
- Create a **Merge Request** to merge the `fix_division` branch into your `main` branch.
- Make sure the GitLab CI pipeline for `test_division` is successful before merging the `fix_division` branch into `main`.

### 💡 Tip

You can view the pipeline status in the Merge Request page on GitLab, or under the **Build -> Pipelines** section of your repository. The entire pipeline will not pass until *all* of the tests pass, but you are just checking the test specific to fixing the division error here.

If it isn't passing, fix the problem locally on the same branch and push the changes to GitLab.

- Pull your updated `main` branch to your local machine.
- Create an annotated tag for the merged commit on main with the fixed division named `v1.0.0`.
- Push this annotated tag to your GitLab repository.

### 💡 Tip

Note that the CI pipelines running on the GitLab server can take a while to complete. Do not rely on them for immediate development feedback, but rather as a final check before merging code into `main`.

## Library Refactor

- On another development branch on your local machine called `refactor_library`, refactor the code to put the `divide_numbers()` function into a library called `my_math_functions.h`.
- Once you have your code working with this library, **locally merge** the `refactor_library` branch into `main`.
- Create an annotated tag for the merged commit on main with the refactored library named `v1.1.0`.
- Push the new commit(s) and annotated tag to your GitLab repository. Remember, this will need to be done with two commands, `git push` and `git push --tags`.

## Push Everything to GitLab & Create an Issue to Notify Dr. Palmeri

- Make sure all of your commits are pushed to your `main` branch, along with both annotated tags.
- Confirm that the GitLab CI pipeline is successful.
- Create an Issue titled `C Programming Lab Complete` and assign it to Dr. Palmeri (`mlp6`).

## Gradescope

Complete the Gradescope assignment for this lab that is a few simple tasks:

1. Confirm that you created the Issue above
2. Confirm that you completed both of the Nordic DevAcademy lessons
3. Upload a screenshot of your CI pipeline jobs passing

## How to Ask for Help

1. If you have a general / non-coding question, you should ask your TAs / Dr. Palmeri on Ed to allow any of them to respond in a timely manner.
2. Push your code to your GitLab repository, ideally with your active development on a non-main branch.
3. Create an [Issue](#) in your repository.
  - Add as much detail as possible as to your problem, and add links to specific lines / section of code when possible.
  - Assign the label “Bug” or “Question”, as appropriate.
  - Be sure to specify what branch you are working on.
  - Assign the Issue to one of the TAs.
  - If your TA cannot solve your Issue, they can escalate the Issue to Dr. Palmeri.
4. You will get a response to your Issue, and maybe a new branch of code will be pushed to help you with some example syntax that you can use `git diff` to visualize.