

# C Programming Lab

BME554L - Spring 2026 - Palmeri

Dr. Mark Palmeri, M.D., Ph.D.

2026-01-04

## Table of contents

Prelab . . . . .	1
Objectives . . . . .	1
Zephyr Application Git Repository Overview . . . . .	2
Things To Do . . . . .	2
Git Best Practices . . . . .	2
Fork / Clone / Build / Flash / View Serial Output . . . . .	2
Modify the Zephyr Application (DataTypes / Typecasting / Formatted Printing) . . . . .	3
Library Refactor . . . . .	4
Push Everything to GitLab & Create an Issue to Notify Dr. Palmeri . . . . .	4
Gradescope . . . . .	4
How to Ask for Help . . . . .	4

## 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/kits/BME-554L-001-F25/c-programming-lab>
- Add Dr. Palmeri (`m1p6`) 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

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

- Inspect the code to see how variables `a`, `b` and `c` are declared and initialized.
- 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 is successful before merging the `fix_division` branch into `main`. 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.