C Programming Lab

BME554L - Spring 2026 - Palmeri

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Table of contents

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
- `.gitingore` - 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 Programing 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

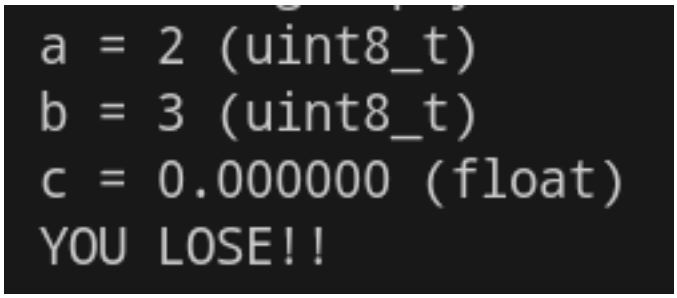
- Update the URLs in `README.md` for the GitLab CI pipeline badge to point to your forked repository.

> **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.

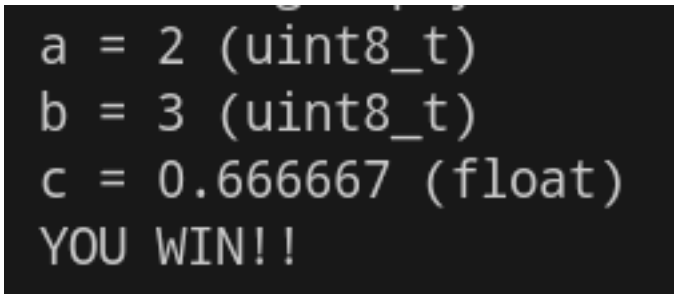
- Commit this specific change to your `main` branch as its own commit.

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:



- 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:



- 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 you 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.