CS 2110 Timed Lab 5: C Programming, GBA, DMA

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Contents

1 Before You Begin

Please take the time to read the entire document before starting the assignment. We have made some important updates, and it is your responsibility to follow the instructions and rules.

2 Timed Lab Rules - Please Read

2.1 General Rules

1. You must take the timed lab in your assigned recitation classroom. Not doing so will be considered an honor code violation.
2. You are allowed to submit this timed lab starting at the moment the assignment is released, until you are checked off by your TA as you leave the recitation classroom. Gradescope submissions will remain open until 6 pm - but you are not allowed to submit after you leave the recitation classroom under any circumstances. **Submitting or resubmitting the assignment after you leave the classroom is a violation of the honor code - doing so will automatically incur a zero on the assignment and might be referred to the Office of Student Integrity.**
3. Make sure to give your TA your Buzzcard before beginning the Timed Lab, and to pick it up and get checked off before you leave. **Students who leave the recitation classroom without getting checked off will receive a zero.**
4. Although you may ask TAs for clarification, you are ultimately responsible for what you submit. **The information provided in this Timed Lab document takes precedence.** If in doubt, please make sure to indicate any conflicting information to your TAs.
5. Resources you are allowed to use during the timed lab:
    - Assignment files
    - Previous homework and lab submissions
    - Your mind
    - Blank paper for scratch work (please ask for permission from your TAs if you want to take paper from your bag during the Timed Lab)
6. Resources you are **NOT** allowed to use:
    - The Internet (except for submissions)
    - Any resources that are not given in the assignment
    - Textbook or notes on paper or saved on your computer
    - Email/messaging
    - Contact in any form with any other person besides TAs
7. **Before you start, make sure to close every application on your computer.** Banned resources, if found to be open during the Timed Lab period, will be considered a violation of the Timed Lab rules.
8. We reserve the right to monitor the classroom during the Timed Lab period using cameras, packet capture software, and other means.

2.2 Submission Rules

1. Follow the guidelines under the Deliverables section.
2. You are also responsible for ensuring that what you turned in is what you meant to turn in. After submitting you should be sure to download your submission into a brand new folder and test if it works. No excuses if you submit the wrong files, what you turn in is what we grade. In addition, your assignment must be turned in via Canvas/Gradescope. Under no circumstances whatsoever we will accept any email submission of an assignment. Note: if you were granted an extension you will still turn in the assignment over Canvas/Gradescope.
3. Do not submit links to files. We will not grade assignments submitted this way as it is easy to change the files after the submission period ends.

2.3 Is collaboration allowed?

Absolutely NOT. No collaboration is allowed for timed labs.

3 Overview

For this assignment, you will be drawing a collage onto the GBA screen. To create the collage, you will be implementing five functions in `TL05.c`:

1. `drawFullBackgroundImage`
2. `drawImageRotated180`
3. `redFilter`
4. `greenFilter`
5. `blueFilter`

Please note that for the `drawFullBackgroundImage` function, you **must** use DMA. This function should be written without any for loops.

We have also provided `myLib.h`, which contains relevant macros for the GBA, `Makefile`, which will be used to compile your code, and all of the image files needed. The **only** file you need to edit is `TL05.c`

PLEASE DOUBLE CHECK YOUR SUBMISSION BEFORE YOU LEAVE THE TIMED LAB.

4 Instructions

4.1 drawFullBackgroundImage

`drawFullBackgroundImage` takes in an image that is 240 x 160 pixels. It draws this image onto the GBA screen. You can assume that only valid, full-screen images will be passed in. **You must use DMA to draw the image, and you cannot use a for loop**.

4.2 drawImageRotated180

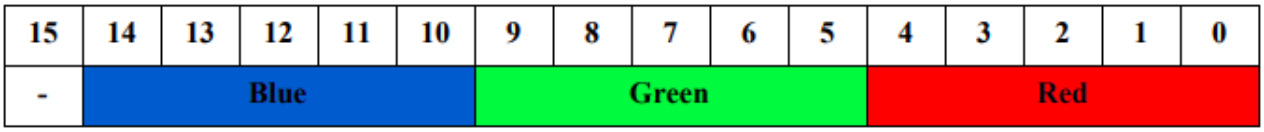
`drawImageRotated180` has the following parameters:

1. `image`
2. `row`: row on the GBA screen
3. `col`: column on the GBA screen
4. `width`: width of the image
5. `height`: height of the image
6. `colorFilter`: color filter to apply to all pixels of the image

`drawImageRotated180` draws an image starting at the specified row and column on the GBA screen. The image should be drawn so that it is rotated 180 degrees. In addition, the `colorFilter` should be applied to all pixels of the image.
Using DMA for this function is optional.

4.3 Color Filters

Pixels in the GBA are stored in 16-bit BGR format:



You will be writing `redFilter`, `greenFilter`, and `blueFilter`.Each of the filters takes in a pixel and returns that pixel with all of the other color channels zeroed out. For example, `redFilter` should zero out the blue and green channels and return a pixel with only the red channel.

4.4 Main Function

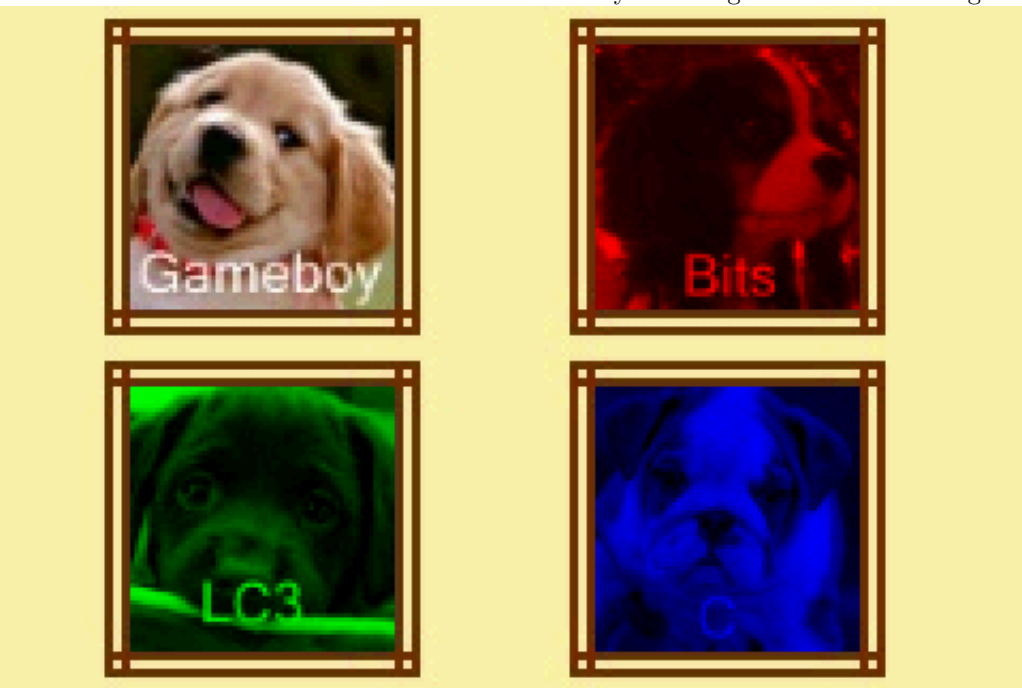
After implementing the functions, you will need to call them in the `main` function. Follow the instructions in the comments of the `main` function.

4.5 Restrictions

For the `drawFullBackgroundImage` function, you must use DMA, and you cannot use any for loops. In addition, you should not edit any other files in the directory except for `TL05.c`.

5 Testing Your Work

Run `make vba` to run the GBA emulator and view your collage. The correct collage looks like this:



Please note that we will be testing your submission Ubuntu 16.04. Your submission **MUST** work on Ubuntu 16.04.

6 Rubric

The output is an approximation of your score on this timed lab. It is a tool provided to students so that you can evaluate how much of the assignment expectations your submission fulfills. However, **we reserve the right to run additional tests, fewer tests, different tests, or change individual tests** - your final score will be determined by your instructors and no guarantee of tester output correlation is given.

7 Deliverables

Please upload the following files to Canvas:

1. `TL05.c`

Do NOT upload an archive, upload the files individually.

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