Western University, Computer Science Department

CS3388B, Computer Graphics

Assignment 1 **Due: Thursday, January 19, 2022**

General Instructions: This assignment consists of 4 pages, 1 exercise, and is marked out of 100. For any question involving calculations you must provide your workings. *Correct final answers without workings will be marked as incorrect.* Each assignment submission and the answers within are to be solely your individual work and completed independently. Any plagiarism found will be taken seriously and may result in a mark of 0 on this assignment, removal from the course, or more serious consequences.

Submission Instructions: The answers to this assignment (code, workings, written answers) are to be submitted electronically to OWL. Ideally, any workings or written answers are to be typed. At the very least, clearly *scanned* copies (no photographs) of hand-written work. If the person correcting your assignment is unable to easily read or interpret your written answers then it may be marked as incorrect without the possibility of remarking. Include a **README** with any code.

Exercise 1. The goal of this assignment, and this exercise, it to setup your OpenGL environment. This is highly dependent on your operating system and its version. You may wish to use a *virtual machine* to run Linux (e.g. Ubuntu 22.04) and then develop your OpenGL code within that virtual machine.

The two key components are **OpenGL**, **glfw**, and **glut**.

Part I. Install OpenGL on your machine

Here the goal is to install the required headers, libraries, and utilities libraries for OpenGL. In particular, OpenGL, glut, and glfw. You may use Python or C++.

For Python, get started at these links: PyOpenGL, glfw for Python. Use your normal package management system and development environment. Anaconda? pip? PyCharm? Your choice. You will also need *numpy*. Note that glut comes with PyOpenGL. **Warning:** glfw for Python and Wayland don't like each other. If you use Wayland (e.g. Ubuntu 22.04), maybe use C++ instead of Python. If you're developing on Windows, try this. Or, you might want to try some "easy" installers; see this blog post. If following that blog post, you'll need an additional command to install glfw: pacman -S mingw-w64-x86_64-glfw. Another option is to use something like Cygwin. Dr. Davis likes to use Windows Subsystem for Linux (WSL2) but does most of his graphics work on his macbook. WSL2 instructions however are here

For C++ and, in particular, Ubuntu, here are some easy to following instructions. For non-Debian operating systems, the key components are a C++ compiler, OpenGL headers and libraries, glfw headers and libraries.

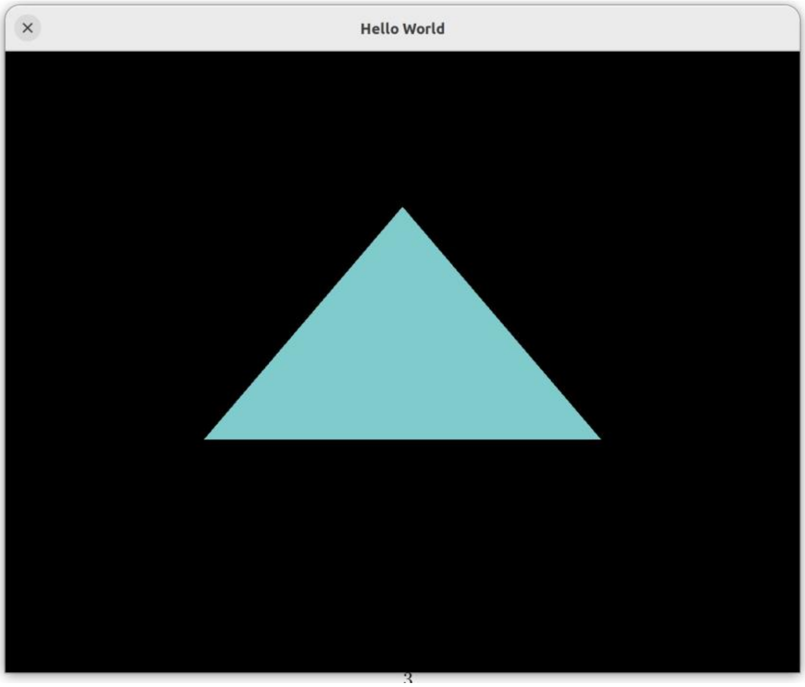
0. (Optional) If you want, go ahead and install a Linux virtual machine. I personally like Virtual Box. You can get a Ubuntu image here.
1. Install gcc/g++: sudo apt install gcc g++
2. Install OpenGL: sudo apt install libopengl-dev
3. Install glfw: sudo apt install libglfw3-dev
4. Install glut: sudo apt install freeglut3-dev

Part II: Your first OpenGL program.

Using the programming language of your choice, write a program which does the following. Notice some template source files are provided on OWL.

1. Creates a window with dimensions 1280px by 1000px and title "Hello World".
2. Find your favourite color in the RGB color model and make it the active color. See here.
3. Draw a triangle with vertices (0,0.5),(0.5,−0.25),(−0.5,−0.25). **Use immediate mode!**; see here.

Run your program! It should look like this, but probably with a different color triangle.



Part III: Submit your work.

Submit the following to OWL:

1. Your source code. A single .cpp or .py file.
2. A screenshot of your **entire desktop** with your opengl program running, showing your triangle. Yes, your entire desktop, not just the OpenGL window. This is so we can make sure you got in running in your particular development environment.
3. A README explaining your source code and additional submitted files. (This will be very basic for this assignment, but a good practice to start).