

# ECE 4122/6122 Lab 3: OpenGL with OBJ files and Multiple Objects

(100 pts)

*Category:* 3D Graphics

*Due:* Tuesday October 24<sup>th</sup>, 2023 by 11:59 PM



## Objective:

To create a **dynamic 3D graphics application** using lighting, shading, model transformations, and keyboard inputs.

## Description:

Using the code from **tutorial09\_Assimp** create an application that loads in the **suzanne.obj file** and creates **4 instances of the head object**. Place (rotate) each of the heads so that it faces away from the origin along the +x-axis, -x-axis, +y-axis, and -y-axis. Translate the heads so that the **ears** of each head **just barely touch** and the **chin** of all the heads just touches the  $z = 0$  plane. Place a **green rectangle** on the  $z = 0$  plane that is sized to **just extend past the front of all the heads**.

Modify the keyboard inputs so that (5 points each)

- |  |                                   |                   |
|--|-----------------------------------|-------------------|
| 1) 'w' key moves the camera radially <b>closer</b> to the <b>origin</b> .  | 近原点                               | 四个头               |
| 2) 's' key moves the camera radially <b>farther</b> from the <b>origin</b> .   | 远原点                               | 分别看向四个轴           |
| 3) 'a' key rotates the camera to the left <b>maintaining the radial distance from the origin</b> .                             |                                   | 耳朵刚好互相碰到          |
| 4) 'd' key rotates to camera to the <b>right</b> maintaining the radial distance from the origin.                              |                                   | 下巴碰到 $z=0$        |
| 5) The up arrow key radially rotates the camera up.  |                                   | 在 $z=0$ 画一个绿色长方形。 |
| 6) The down arrow radially rotates the camera down.  |                                   | 修改keyboard input  |
| 7) The 'L' key toggles the specular and diffuse components of the light on and off but leaves the ambient component unchanged. | "L"键可打开和关闭光的镜面反射和漫反射分量，但保持环境分量不变。 |                   |
| 8) Pressing the escape key closes the window and exits the program   |                                   |                   |

## Points grading:

- 30 Points – loading obj file and displaying the fours heads and the green  $z = 0$  rectangle
- 30 Points – rotating and placing the heads in the correct location and orientation
- 40 Points – keyboard control
- 5 pts extra credit – place a texture (of your choice) on the  $z=0$  plane rectangle. Make sure to include the bmp file in your submission.

- 5 pts extra credit make a short, narrated video of your program in action. (include it in the zip file)

## **Turn-In Instructions**

Make your required changes to the file tutorial09\_several\_objects.cpp and controls.cpp.

Zip up the folders **tutorial09\_vbo\_indexing** and **common** into **Lab3.zip** and upload this zip file on the assignment section of Canvas. When the TAs replace the existing folders with yours and the code should compile and run correctly. If needed you can also include an update CMakeLists.txt. You can also include a short, narrated video of your program in action.

### **Grading Rubric:**

If a student's program runs correctly and produces the desired output, the student has the potential to get a 100 on his or her homework; however, TA's will look through your code for other elements needed to meet the lab requirements. The table below shows typical deductions that could occur.

#### **AUTOMATIC GRADING POINT DEDUCTIONS PER PROBLEM:**

Element	Percentage Deduction	Details
Does Not Compile	40%	Code does not compile on PACE-ICE!
Does Not Match Output	Up to 90%	The code compiles but does not produce correct outputs.
Clear Self-Documenting Coding Styles	Up to 25%	This can include incorrect indentation, using unclear variable names, unclear/missing comments, or compiling with warnings. (See Appendix A)

#### **LATE POLICY**

Element	Percentage Deduction	Details
Late Deduction Function	score – 0.5 * H	H = number of hours (ceiling function) passed deadline

## **Appendix A: Coding Standards**

### **Indentation:**

When using *if/for/while* statements, make sure you indent 4 spaces for the content inside those. Also make sure that you use spaces to make the code more readable.

For example:

```
for (int i; i < 10; i++)
{
    j = j + i;
}
```

If you have nested statements, you should use multiple indentations. Each { should be on its own line (like the *for* loop) If you have *else* or *else if* statements after your *if* statement, they should be on their own line.

```
for (int i; i < 10; i++)
{
    if (i < 5)
    {
        counter++;
        k -= i;
    }
    else
    {
        k +=1;
    }
    j += i;
}
```

### **Camel Case:**

This naming convention has the first letter of the variable be lower case, and the first letter in each new word be capitalized (e.g. firstSecondThird).

This applies for functions and member functions as well!

The main exception to this is class names, where the first letter should also be capitalized.

### **Variable and Function Names:**

Your variable and function names should be clear about what that variable or function represents. Do not use one letter variables, but use abbreviations when it is appropriate (for example: “imag” instead of “imaginary”). The more descriptive your variable and function names are, the more readable your code will be. This is the idea behind self-documenting code.

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### **File Headers:**

Every file should have the following header at the top

/\*

Author: your name

Class: ECE4122 or ECE6122 (section)

Last Date Modified: date

Description:

What is the purpose of this file?

\*/

### **Code Comments:**

1. Every function must have a comment section describing the purpose of the function, the input and output parameters, the return value (if any).
2. Every class must have a comment section to describe the purpose of the class.
3. Comments need to be placed inside of functions/loops to assist in the understanding of the flow of the code.