

Assignment 1

CSCI-4965: Three-Dimensional Computer Graphics

Due: Monday, October 2, 2000, 10:00am

1 Overview

This assignment is intended to familiarize you with OpenGL and its modeling and viewing transformations. You are to write a program to display an image of the “Utah teapot” on a table created from cubes. You will use both OpenGL and GLUT functions such as `glTranslatef()` and `glutWireTeapot()`, and use mouse and keyboard input events.

You can use the Sun Ultra10 machines in the Sparc Lab in Amos Eaton 217. (You should already have your login ID and password for these machines.) Make sure that your submitted program can be compiled and run on these machines. For an example piece of OpenGL code and a sample Makefile, and any further updates and information on the assignment, please see the assignment web page at www.cs.rpi.edu/courses/fall00/graphics/assign1.html.

2 Assignment Task

You are to write an OpenGL program to draw a teapot on a table, where the table has four legs and is supported on a planar floor surface. The table consists of five cuboids, with one serving as the tabletop and the other four serving as table legs. You can use `glutWireTeapot()` to draw the teapot, and `glutWireCube()` to draw a cube.

1. Draw the teapot with its center at the origin $(0, 0, 0)$, and its height being 0.8 units. (Note that when you call `glutWireTeapot(1.0)`, the (empirically measured) height of the teapot is 1.6 units.) Select the initial camera location to be at $(0, 0, 5)$. Let the default projection mode be perspective projection.
2. Create a table with a cuboidal tabletop (2 units long along the X and Z directions and 0.2 units long along the Y direction) and four cuboids (0.2 units long along the X and Z directions and 1 unit long along the Y direction) serving as its four legs. Each leg should be flush with one of the corners of the tabletop.
3. Draw a rectangle with dimensions 6 units (in X) and 4 units (in Z) to serve as the supporting planar floor.

The centers of the teapot, the table, and the ground are on the Y axis. Use the `glColor3f()` function to display the teapot, table, and the ground plane in different colors.

4. To enable user interaction using both the mouse and keyboard, write functions to rotate the viewpoint around the objects, to translate away from and towards the objects, and to toggle between perspective and orthographic projection modes.

The main keyboard events and the corresponding desired behavior are:

- Left/right arrow keys: The objects (table, teapot, and floor) rotate 10 degrees clockwise/counterclockwise about the Y axis with each key press.
- Up/down arrow keys: The objects are rotated 10 degrees clockwise/counterclockwise about the X axis.
- z/Z keys: The viewpoint moves 1 unit closer/further to the objects.
- i key: The objects are returned to their initial positions.
- q key: The program quits.

The main mouse event is:

- A click of the left mouse button inside the display window should toggle the projection transformation mode between perspective projection and orthographic projection.

3 Handin

The code must be submitted no later than 10:00 am on October 2, 2000. **You are responsible for ensuring that your code can compile and run on the Sun Ultras in Amos Eaton 217.** Specific instructions for handing in your code will be provided on the assignment web page.

You must hand in your source code (source and header files) along with a Makefile to compile it. Also include a README file with the following information: your name, instructions on how to compile the code and run it, known bugs or limitations, any extra credit enhancements, and any other relevant information.

4 Grading

Your assignment will be graded as follows (100 points total):

1. Display of the image of the teapot, table, and floor. 45 points
2. Keyboard event functions (arrows, z/Z , i , and q keys). 30 points
3. Mouse function to toggle projection modes. 15 points
4. Code structure, clarity, and documentation. 10 points

Extra credit: You can earn up to 10 additional points for special features and creative enhancements to the assignment requirements.

Lateness policy: Late submissions will incur a penalty of 20% a day (24-hour period) after the submission deadline.