COSC 4370 Homework 1

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Objective

The purpose of this assignment was to create several 3D objects assigned to us with the use of OpenGL. The first shape is a ring of teapots. The second shape is a staircase increasing from right to left, with 20 steps. The third image is a triangle/pyramid made of rows of teapots that decreases in number as the rows go down.

Method

Most of the program was pre-written for the assignment, incorporating OpenGL header files and commands to generate the images. The assignment requires the student to use existing OpenGL functions to generate the images. Some of the specified functions include glPushMatrix, glPopMatrix, and glTranslatef. Other useful functions I used for this assignment include gVertex2f, glBegin/glEnd, glutSolidTeapot, and glutSolidCube.

The method for Problem 1, the ring of teapots, was to create a for loop that plotted the teapot incrementally at each angle point relative to zero. There were 10 teapots and 360 degrees in a circle, so the for loop started at angle 0 and went until angle 360, increasing by 36 degrees each time.

The method for Problem 2 was another for loop, taking the number of cubes and rendering a vertically increasing stack of cubes based on an increasing variable. The loop lasts until there are 20 cubes, the number of steps in the staircase.

The method for Problem 3 was a loop that took the row number of the graphic and rendered an according number of teapots, decreasing with each row. An equation to measure the position of the position in between teapots (similar to how chairs in an auditorium are staggered), was used to determine the position of the teapots in the row below.

Problem 4 was my attempt to render a hand using triangles and teapots. The fingers are outstretched with each finger at a different angle. The palm was creating by rendering a square made out of teapots, and the fingers were made out of triangles created by a for loop starting at the position of the teapot squares.

Implementation

Problem 1:

A for loop was used to create the circle, starting at integer angle = 0, ending when angle reaches 360, and increasing by 36 degrees each time. At each increment of 36 degrees, a teapot would be created and rotated to the corresponding angle. The functions glPushMatrix and glutSolidTeapot initialized the teapot and the glTranslatef and glRotatef functions positioned and rotated the teapot respectively.

Problem 2:

Position variables were initialized for the x an y positions, which started at 10 and 0 respectively. This was done so that the first of 20 steps would start at x = 10 so the staircase would be centered. A for loop began starting with one cube and ending at 20, with 1 additional cube per loop. Just like Problem 1, the glPushMatrix function was used to initialize the cube and glTranslatef was used to position the cube(s). The glScalef command was used to create the shape of the cubes, which was set so that the y-value of the cube's shape equaled to half of the total cube count of the loop so far. This was done so that the steps were longer than they were tall, like a proper staircase. GlutSolidCube and glPopMatrix created the cubes. At the end of each loop, the x position decreased by 1 and they position decreased by 0.25 so that the height of the next cube stack would be more than the previous one and begin one position to the left of the current stack.

Problem 3:

This image is essentially a nested loop of teapot rows. It begins at row = 6 teapots and loops until there is only 1 left, ending the row once it hits 6 and decreases the number of teapots in each row every time the loop reaches the end of a row. To position them, a float variable called position was used to determine the position of the teapot relative to the ones in the row above and below it. This allowed the function to position the teapot relative to the gap in between the teapots above and below it, creating a staggered pattern similar to an auditorium or a brick wall. Similar functions to the ones mentioned above were used to initialize and position the teapots, with the position increasing by 1 each time, and resetting at the end of each row's loop.
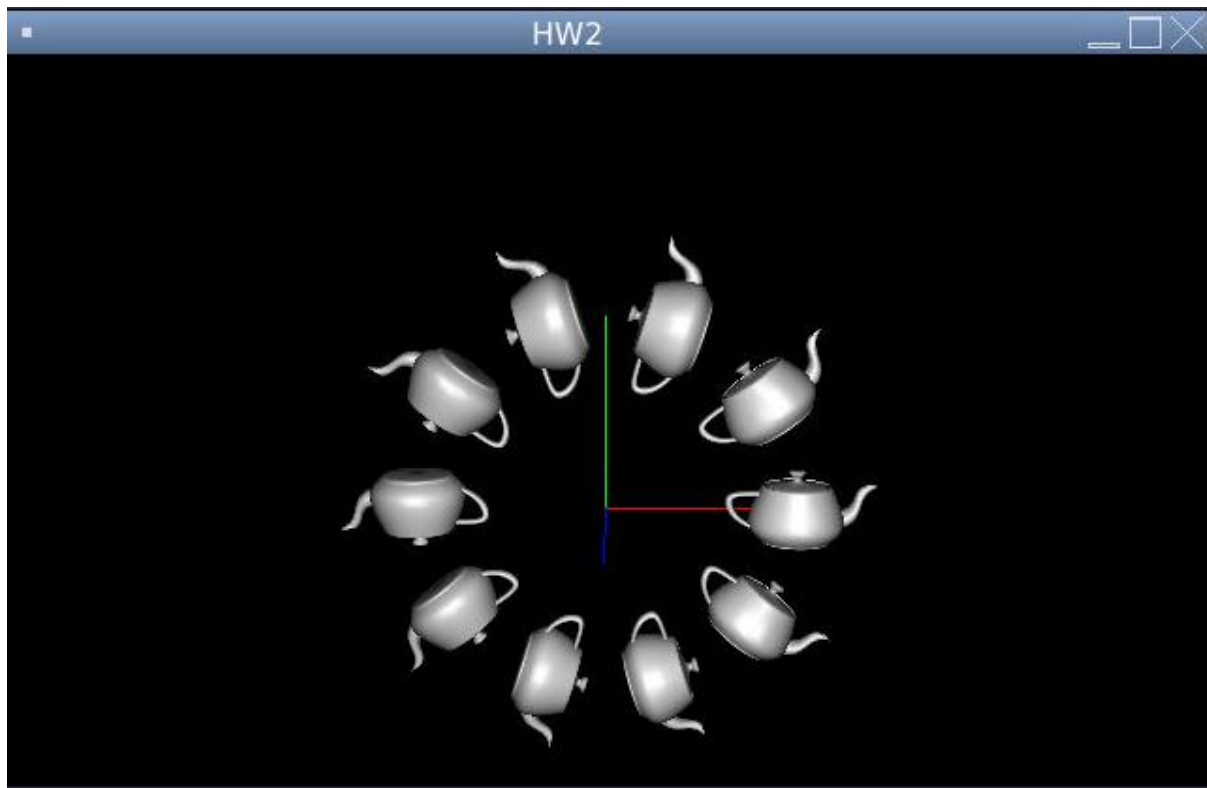
Problem 4:

I tried to create a waving hand using the triangles that were mandatory for this section, as well as the squares. The triangles formed the fingers, with a for loop increasing the x and y values of each triangle to form an angle for the fingers to align, and different starting x and y positions for each finger. The palm was formed by creating a square out of the cubes that touched the triangle patterns. It wasn't particularly creative or pretty but I like how it looked.
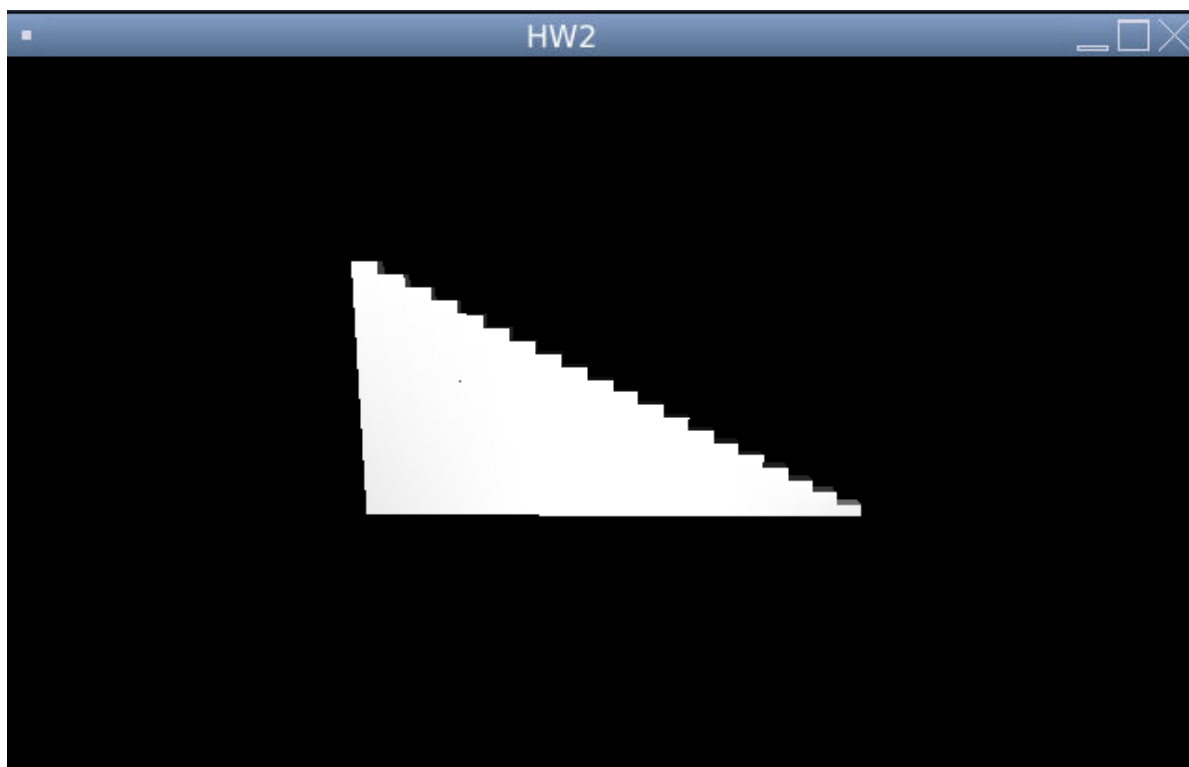
Results

The result of Problem 1 was a ring of teapots. The result of Problem 2 was a staircase that went from right to left ascending. The result of Problem 3 was a triangle composed of rows of teapots that decreased in number with each descending row. The result of Problem 4 was a hand made up of triangle fingers and cubes for a palm.
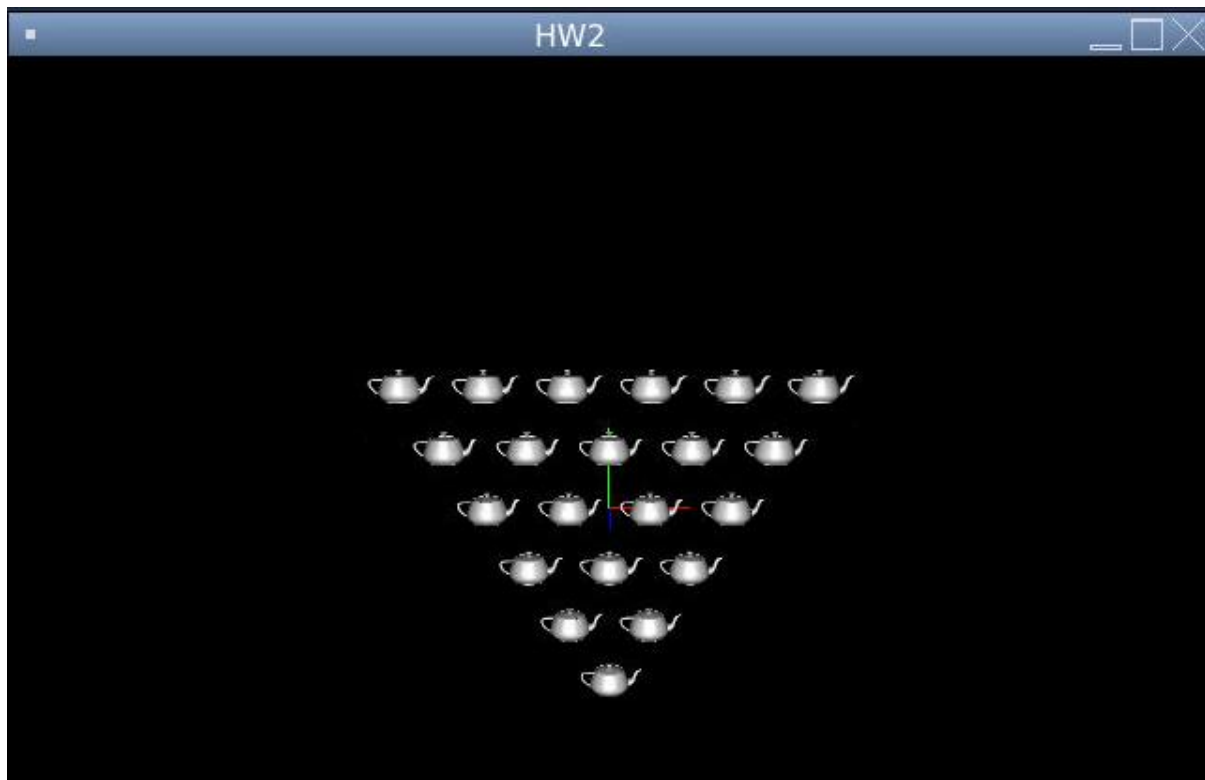

Images are shown below.

Problem 1

Problem 2

Problem 3

Problem 4