

COSC 4370

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1 Problem

The assignment requires the recreation of four 3D images using OpenGL skills. The first image should display a circular series of teapots rotated and translated around the origin. The second image should display a series of cubes scaled and translated next to one another on the x-axis. The third image should display a triangular series of teapots stacked apart in a pyramid shape on the origin. The fourth image highlights our creative capacity using both OpenGL directives as well as our own artistic expression.

2 Method

The functions used to create the first three images were provided by the OpenGL extension: `pushMatrix()`, `popMatrix()`, `glutSolidTeapot(double size)`, `glutSolidCube(double size)`, `glTranslatef(float x, float y, float z)`, `glRotatef(float x, float y, float z)`, and `glScalef(float x, float y, float z)`. Some familiarity with geometry and linear algebra was also required.

To create the fourth image, the functions `glBegin(glenum mode)`, `glPushMatrix()`, `glPopMatrix()`, `glVertex2f(float x, float y, float z)`, `glVertex3f(float x, float y, float z)`, and `glEnd()` were used.

3 Implementation

The first image was recreated mostly by a guess-and-test method once the first teapot was displayed. The other teapots were first rotated then translated onto the already existing plane where the first teapot was created. There were challenges encountered during the whole process of properly placing each teapot next to the previous one. Upon further investigation, the method may have been significantly easier had the teapot first been translated, then rotated in the existing plane.

The second image was recreated using knowledge of the `glScale()` and `glTranslatef()` functions to line up a series of cubes, with each individual cube taller than the previous one. The first cube was made to half its original scale (size 0.5) and then placed on the negative x-axis ($x = -4.0$) to accommodate the other cubes soon to follow. The cubes that followed were then resized 20% higher than its previous replica by adding 0.2 units to its y-value on the `glScale()` function. The cubes were then translated adjacent to the right of the previous ones in half-unit intervals. The process was repeated until all fifteen cubes were displayed. The only challenge with recreating

this image was the manipulation of the y-axis after translating each cube to its proper placement. Originally, the cubes rose incrementally from its previous iteration, perhaps due to the rescaling of the y-value on each cube. Every cube except the first had to be adjusted on its y-axis through translation in order to match the given image on the assignment. Initially, the y-values were calculated to set the bottom of each cube to match the placement of the first cube. Once the appropriate measurements were taken and implemented, the y-values of each cube were again adjusted in ± 0.1 -0.001 increments to further approximate the bottom placement of each cube.

The third image was recreated using mostly mathematical calculations for input values on the `glTranslatef()` function. The first teapot was first placed one unit higher than the origin, then using the knowledge of recreating the vertices of a triangle, the second and third teapots were placed accordingly. The process of recreating this image mostly involved a manipulation of the x and y values for each teapot's translation. From being evenly spaced apart to its individual placement in collectively representing a pyramid shape, each teapot's translation involved mathematical approximation.

The fourth image was inspired by both the sample image given in the homework prompt as well as the well-known "Go Coogs!" hand symbol that represents the spirit and pride of the University of Houston. Using the `GL_LINES()` and `glVertex3f()` functions, I first created a 2D polygon to represent the back of the hand. From there, ballpark approximations as well as creative intuition were used in making the size and shape of each finger and the hand gesture. The challenges encountered involved the 3D aspect in making the hand. It was initially a 2D image that progressed further into a 3D replica of the hand gesture. The image consists mostly of polygons connected by their vertices with a few triangles that represent the thumb and inner palm areas. The red background was added to represent the university's colors.

4 Results

The output of the program consists of a series of each of the four images in png format. The fourth image is depicted in three different angles.





