COSC 4370 – Homework 2

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1 Objective

In this assignment we are to use OpenGL's transformation mechanisms to recreate the three images provided in the assignment document. The fourth image is open ended with the requirement of having at least one instance of a nested matrix (i.e glPushMatrix within another glPushMatrix), and at least one triangle with direct coordinates.

2 Methods

There are four problem functions specified in the provided code to create four images. For *problem1()* and *problem3()* I used *glutSolidTeapot()* to produce the scene of rotating teapots and the scene of inverted pyramid of teapots. For *problem3()*, I utilized *glutSolidCube()* to recreate the scene of the stepping pyramid. In *problem4()*, as per the requirements of a nested *glPushMatrix()* and triangle with direct coordination, I first created the tree trunk then nested the matrix for the tree layers using *glVertex3f()* to create a complete Christmas Tree.

3 Implementation

Problem 1: To recreate the scene of sort of rotating teapots, I noticed that in the image provided there are eight teapots present rotating counterclockwise with every other teapot about $3/4^{th}$ x and y distance to the ones present on the xy-axis. Initially, it appeared ½ the distance but when tested it was not thus ¾ was used to make it look like a diamond shape rotation. Using this information, I first divided 360 by 8 to get an angle of 45 in-between each teapot then did if-else to determine the position of every even and odd numbered teapot and translate them accordingly.

Problem 2: In order to create the scene of a stepping pyramid, I declare arbitrary number of steps, height, base step size, and a decreasing size variable since I was constructing the pyramid bottom-up. I loop through the number of steps by decreasing the size of the step as I go through my loop and translate and scale accordingly.

Problem 3: For this problem, as the number of rows in the image provide in assignment was 6, I defined my rows as 6. To recreate the inverted pyramid of teapots that have even spacing between them both horizontally and vertically. I defined two for-loops, the outer loops through each row and sets the number of teapots in that row. The inner loop iterates each teapot and positions them relative to other teapots in that row as defined *glTranslatef(xStart + j * horSpace, -0.5 + i * vertSpace, 0)*.

Problem 4: In this problem, apart from the requirements of having at least one instance of a nested matrix (i.e glPushMatrix within another glPushMatrix), and also at least one triangle with direct coordinates, it was open to our imagination. So I chose to construct a Christmas Tree. To create a 3D Christmas Tree, I utilized *glVertex3f()* and *glColor3f()* to add color to my tree. I first construct my tree trunk using *gl_quads*. I construct the front view, back view, left and right views. Similarly, I declare a nested *glPushMatrix* and construct three layers of tree leaves. All the tree layers have code specifying the vertices to construct the front, back, left and right views. Additionally, I also construct a much smaller triangle pyramid as a star positioned at to of the Christmas Tree.

4 Results