

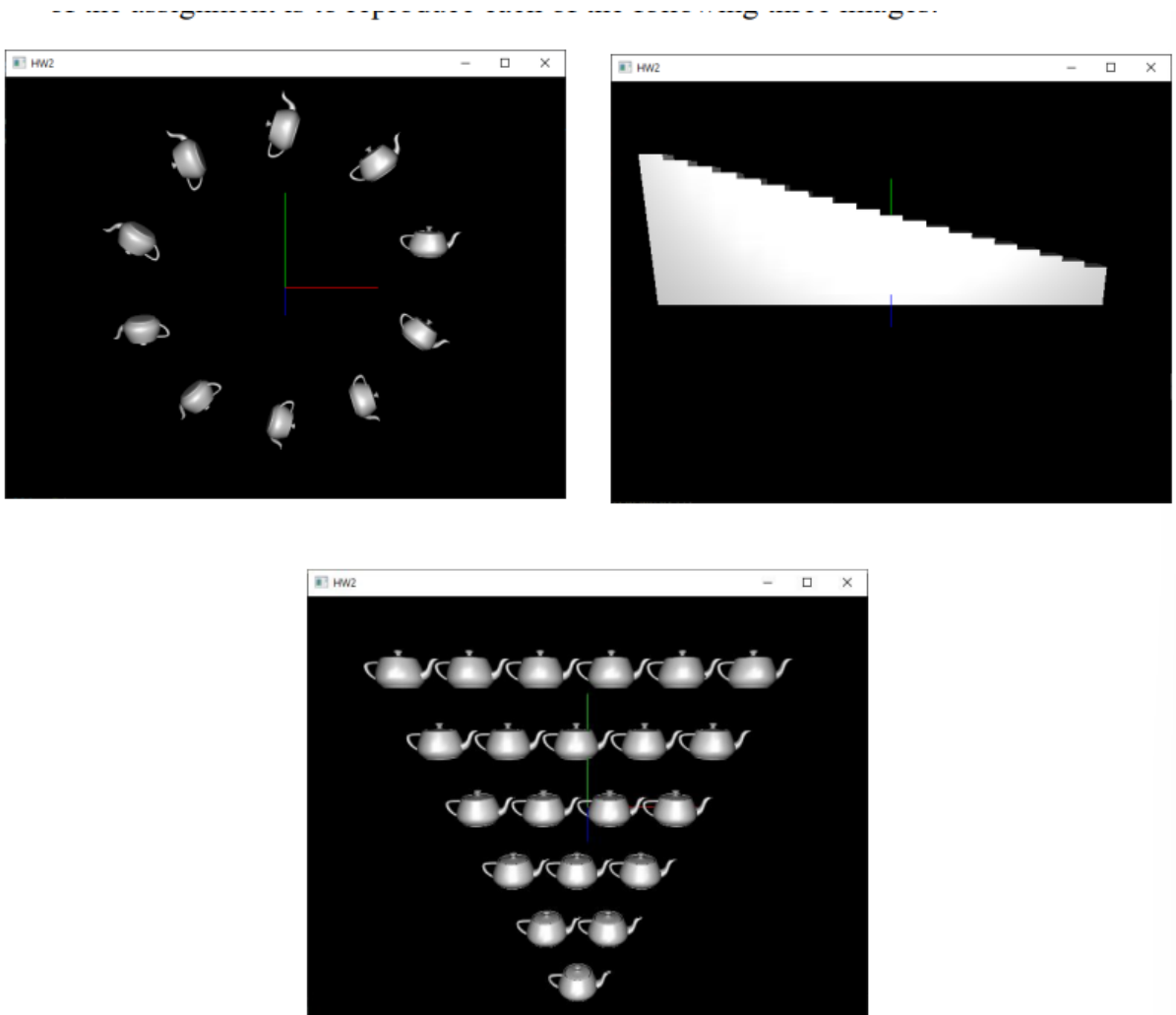
COSC 4370 - Homework 2

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1 Problem

The assignment consists of two parts. The first one requires us to recreate the following three pictures presented to us on the assignment:



The second part requires us to create a scene of our own imagination, requiring us to use at least one triangle.

2 Method

First of all, we had to prepare the environment. All we needed was given to us in a file attached with the assignment. After setting it up, all the functions needed in order to do this assignment are collected. We will be using mainly:

glPushMatrix(), *glPopMatrix()*, *GlTranslatef()*, *glRotatef()* and *glScalef()* for transformations only. On the other hand, to create the shapes we are going to need, we will use:

glutSolidTeapot() and *glutSolidCube()*

3.1 Implementation

For problem number 1, because we need 10 teapot to be on our screen, a for loop from 0 to less than 10 is used. First, we have to *glPushMatrix()* for us to start working on an empty matrix. The first thing I did was to rotate every loop by 36 degrees using *glRotatef*. Because we are doing a full circle around 0,0, I divided 360 by 10, getting 36 degrees per angle. so when rotating, I make sure to multiply 36 by the value of i (iterator), so through every iteration we get 0 degrees, 36 degrees, 72 degrees... and so on. After rotating, we need to translate every teapot to an estimated distance based on the given picture using *glTranslatef*. And finally, we call *glutSolidTeapot* of size .2 so it matches the picture, and right after that we pop the matrix using *glPopMatrix()*. By doing this all in the for loop, we get the desired recreation.

3.2 Implementation

For problem number 2, the first thing I notice is that 20 steps are required to recreate the image, so what I did was to create a for loop from 0 to less than 20. Inside the for loop, I use *glPushMatrix()* first to start working on it. Because I want the image to be centered, I first translate it left by 10 minus the iterator using *glTranslatef()*, and because the squares that we are going to use are not of size 1, I multiply that number by a small float number, such as .2, so it matches the distance needed between each step. Then, I also translate every single one by $x * 0.02$, due to the scaling done after that step. Because we need rectangles and not cubes to make the staircase, I must scale it on the y-axis. The scaling that I do was achieved after finding the right numbers based on the sizes required using *glScalef()*. After that, I just spawn the cube of size 0.2 using *glutSolidCube()* which is already scaled, so I can just pop the matrix right after.

3.3 Implementation

For problem number 3, I have to make an inverted pyramid of teapots. In order to do this, I do a for loop, which will go from 6 to 0, and that is because we need six rows, and also, because the first row is made of six teapots, so it will take care of making the right number of teapots. I then push a matrix with *glPushMatrix*. I first use *glTranslatef()* to translate it a bit to the left with (-i-1) to make it centered, and I multiply it by a small number so the gaps between each teapot decrease. I also translate them a bit up on the y axis for them to be centered too. After that, I make another for loop which will take care of placing them in the right place. I first translate them to the right, and then I move them up a little bit depending on the number of the first iterator using *glTranslatef()*. I then spawn the teapot with *glutSolidTeapot()* of size .2, and then I make another translation returning the y axis to its original place, but not the x axis. After that for loop ends, I pop the matrix with *glPopMatrix()* and I increase the rotation number by one each time. After the nested for loop is done executing, it will show the desired result.

3.4 Implementation

For problem number 4, we are required to make a free image based on our imagination, all that by using at least one triangle. I decided to create a hand that is bending its fingers a little bit. I first had to push a Matrix, and create an inverted triangle using *glBegin(GLTriangles)andglEnd()* which would then work as the palm of the hand. After that, I created a nested for loop which would take care of spawning the first four fingers, the ones at the top of the palm. Inside the second for loop, I first used *glPushMatrix()*, followed by *glTranslatef()* to move the first finger to the very left of the palm. I would then increase the x position by using a variable called position that would increase by 0.5 every time after each finger is done. I would also increase the y axis with the variable height for each section of the finger. I would then rotate it on the x axis. I would scale the y axis by 2, and finally I used *glutSolidCube(.2)* which would be elongated and rotated in the right position, for me then *glPopMatrix()* and increase the variable height by 0.4. The process will happen 3 times in total, creating a finger with 3 sections, each being rotated more and more. That process would occur 4 times in total, creating 4 fingers at the top. After that nested loop was over, I then created another for loop which would take care of creating the thumb. I used the same system but with different numbers. I first pushed the matrix, I then translated it to the right position, I rotated it by -45 degrees on the z axis so it would fit better what a thumb looks like, I would then rotate it again on the x axis to bend it as if it were closing, I would scale the y

axis by 2, and finally create the *glutSolidCube* , for me to finally pop the matrix. After that for loop, I just *glPopMatrix()* that created the triangle.

4 Output

The output of this assignment were the required recreation of images. I exported them as png. The first one is the 10 teapots rotating around a point for problem 1. The second one is problem 2, the staircase. The third one is the inverted pyramid of teapots. And finally, the fourth one for problem 4 is a hand.

