

COSC 4370 - Homework 2

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1 Problem

The assignment requires the creation of 4 separate images using OpenGL. The first image is a circle of teapots surrounding the origin. The second image is a staircase of cubes. The third image is a triangle made of teapots. The fourth image is a creative piece that requires a nested `glPushMatrix` and the creation of a triangle. For this piece i decided to attempt to make a hand grabbing a triangle.

2 Method

The method for the first image is to first place a teapot a distance away to the right of the origin then rotate the matrix while pasting more teapots. Doing so will create a circle of rotated teapots.

The method for the second image is to create a row of solid squares that scale in proportion to the first square in line. The first square will keep its base scale while the squares after the first will have their y scale be gradually increased as each square is created. The result will be a staircase of squares.

For the third image, to create a triangle there will be two loops, one for the amount of levels in the triangle and one for the amount of teapots on each level. The first level will have one teapot while the next level will have two teapots and so on. Afterwards, some transformation will take place to make sure each level is aligned to make a triangle.

For the creative image, the hand is composed of one modified square to act as the palm and 5 smaller stretched squares to act as the fingers. The fingers are transformed from being nested in the palm matrix. After the hand is constructed, a triangle is drawn in front of the hand to make it look as if it is trying to grab it.

3 Implementation

For the first image, all that is needed is one for loop that runs ten times. Inside the loop, a matrix is pushed and rotated x degrees and translated 1 unit to the right on the x-axis. From here the teapot is created and x is incremented by 36. Pop the matrix after fulfilling the previous steps and the initial teapot is done. Doing so 9 more times will cover 360 degrees and output a circle of rotated teapots.

For the second image, a for loop is used to create multiple squares that are placed next to each other and modified slightly. Before the loop starts, a variable called x is initialized with a value of 1. X will determine the scaling of the cubes later on. The loop is going to run for 15 times and in the loop a matrix is pushed, the cube is translated i units on the x-axis, $x*0.50$ on the y axis, then the matrix is popped at the end. The i will make sure the cubes are not placed in the same place while the $x*0.50$ makes sure all the cubes are leveled. From here the cubed is scaled on the y-axis to the value of x . X is then incremented by 0.15 to increase the scaling of the cubes to ensure a stair case like structure. There is also a transformation before the for loop to center the stair case as well as some scaling to ensure the finished render fits within the camera.

The third image uses a nested for loop to get a triangle like structure. Before starting the loops, a variable called current will be initialized with a value of 1 and another variable called countofteapots is initialized with the value of 1. Current will represent the level the teapots will be outputted while countofteapots will represent how many teapots are outputted. The first loop will run to the amount of levels needed while the second loop will output the amount of teapots on each level. Before starting the second for loop we push another matrix and translate it $-0.5*(countofteapots-1)$ on the x-axis and

also set an offset variable to 0. The translation will move the teapots to center. For the second for loop, it will run to the amount the variable countofteapots is set to. In this loop, push another matrix and translate the x-axis to the offset and the y-axis to current. From here create the teapot, pop the matrix, and add one to the offset to complete the nested loop. After leaving the nested loop, pop the matrix, increase the amountofteapots by one, and subtract current by 0.5 to complete the first loop. The results should be a triangle of teapots.

The fourth image uses no loops and will be constructed one piece at a time. The first step to constructing the hand is to make the palm. The palm is made of a stretched cube that is scaled down on the z-axis and translated back on the z-axis. From making the palm, the fingers are nested in the matrix that the palm was created in. They are scaled down on the x-axis to make them slimmer and are translated on the y-axis and x-axis to position them on top or the side of the palm object. The fingers are also slightly rotated on the z-axis to look as if they are leaning forward. After creating the hand, a triangle is drawn in front of it to look as if the hand is trying to grab it. The triangle was drawn using immediate mode.

4 Results

The results are 4 images using the methods and implementation mentioned above.





