CSCI 441 - Lab 03
Friday, September 15, 2017

LAB IS DUE BY **FRIDAY SEPTEMBER 22 11:59 PM**!!

Today, we'll add some new features to our OpenGL Toolbox and display some nifty looking curves.

Step 1 – Getting Our Code To Compile

THIS IS AN INDIVIDUAL TASK.

Included in this bundle are the header and library files for GLUI that are built for the lab Windows machines. If you want to use them on your own machine, you will need to follow the instructions online. These files are already installed on the lab machines, but if you are running Windows – they may work out of the box for you.

If you want to make sure you set everything up correctly, switch into the gluiTest folder and type `make` to build this example program.

Ok, back to our lab. Type `make` again. Bah another error! Can't find Point.h? What's that? Well it's our first task.

Step 2 – Loading Our Control Points

We are going to eventually be drawing a Bezier curve. As discussed, Bezier curves are defined by a series of control points. We will read the control points in from a file to allow greater flexibility in our Bezier Curve Viewer (the BCV for you folk in the know). `TODO #01` will get us in the right place. Make sure that a single command line argument has been provided by the user. Perhaps provide a helpful usage message if the user does not run your program as expected.

Test this step and make sure the program starts as desired.

Now we need to actually read in our data, `TODO #02` will accomplish this for us. Hopefully you figured out already that you need to pass the command line argument to `loadControlPoints( char* )`. This function will read through the file and create a `glm::vec3` for each line in our file. The control file has the following structure

```
n-points
x1, y1, z1
x2, y2, z2
…
xn, yn, zn
```

The first line is the number of points in the file and then there are n lines that follow with one point per line. Read in each point and store it in our `controlPoints` vector. You may assume that the control file will be properly formed, meaning it will contain the proper number of points to draw a complete Bezier Curve (4, 7, 10, etc.)

There are two control files included with this lab, controlPoints4.csv and controlPoints7.csv. Compile, run, and test running/loading with each file.

Step 3 – Draw our Control Point Cage

We want to be able to visualize where our control points are in relation to the final curve. For this step we'll fill in `TODO #03` and `TODO #04`. First for `TODO #03`, draw a green sphere at the location of each control point. Make the sphere an appropriate size relative to our grid size.

Compile and run. Run with the controlPoints4.csv file. How many spheres do you see?

Now for `TODO #04`, connect each pair of control points with a yellow line. Refer to how the grid gets drawn as a reminder of how to work with 2D OpenGL Primitives. You'll probably want to make the control cage lines a thickness of 3.0f so they are easier to see.

Compile and run. Run with the controlPoints4.csv file. How many yellow lines do you see?

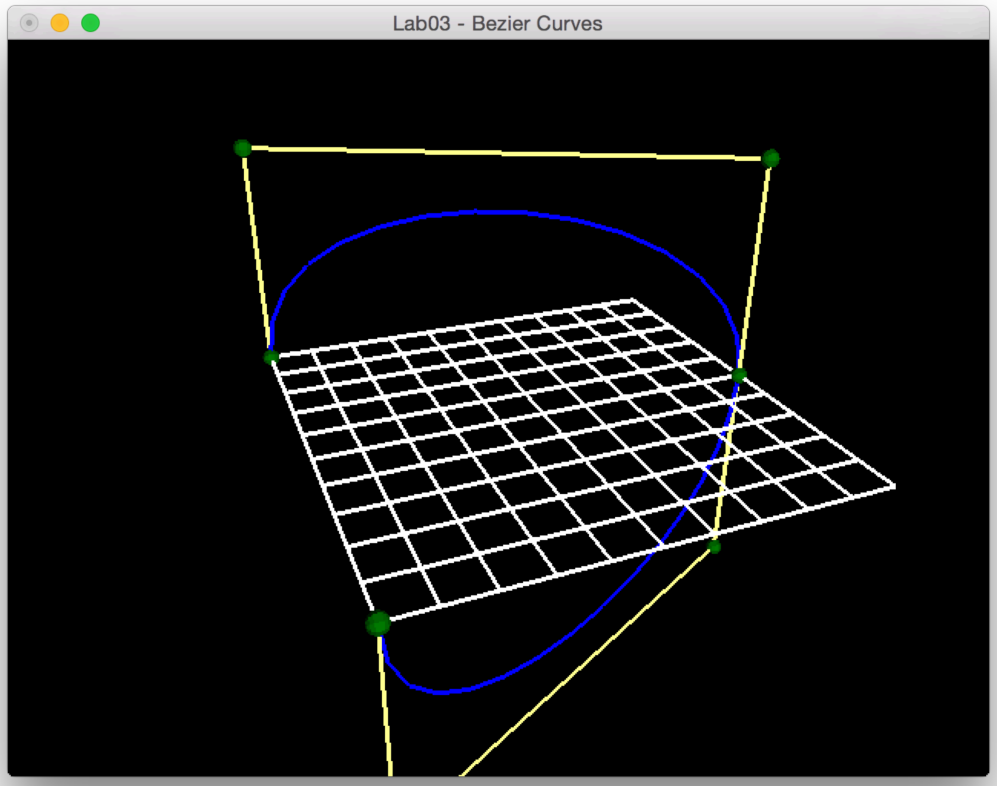
You should have not connected the last point back to the first point, so now we should see our full control point cage. Let's draw the curve!!

Step 4 – Drawing the Bezier Curve

Now we are ready to draw the curve. Use a blue line with thickness of 3.0f to draw the curve. You will need to fill in `TODO #05` and `TODO #06` to complete this task. `TODO #05` is responsible for segmenting our curve into lines and connecting the dots. `TODO #06` is responsible for evaluating the Bezier Curve at a single point.

When testing, start with controlPoints4.csv. Once you have a single curve drawn, then test with controlPoints7.csv. Your program should be able to handle any number of Bezier Curves as specified from a file.

Once your view for controlPoints7.csv looks like below….you did it! Hooray!



EXTRA EXTRA! Extra Credit Achievement 

The following section is not required for the lab. If you want to earn an extra credit achievement, then continue. Otherwise, skip to the end to zip up your submission. ☺

If you are feeling extra ambitious and want to earn an Extra Credit Achievement, then complete the Picking Made Easy tutorial included with this lab (the tutorial was originally put together by Oregon State University. Thank you to them for doing such a great job. I converted their write up from GLUT to GLFW.). We want to be able to click on a control point and move its location. To earn the extra credit achievement, you must allow the user to Shift + Left Click on a control point. If the user clicked a control point, then highlight that control point red. Once the control point is selected, the user can move the control point's location along the X-, Y-, and Z-axis through keyboard presses. If the user Shift + Left Click's and does not select a control point, then deactivate any previously selected control points. Only one control point can be active at a time.

Q1: Was this lab fun? 1-10 (1 least fun, 10 most fun)
Q2: How was the write-up for the lab? Too much hand holding? Too thorough? Too vague? Just right?
Q3: How long did this lab take you?
Q4: Any other comments?

To submit this lab, zip together your main.cpp, Makefile, screenshot, and README.txt with questions. Name the zip file <HeroName>_L03.zip. Upload this on to Canvas under the L03 section.

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