CS425/525 Computer Graphics

Programming Assignment #1
Drawing Lines/Curves with OpenGL

Computer Science Department
Bowling Green State University
Spring 2009

20 points
Due date: Friday, January 30, 2009
Time: Electronic submission of program files due by 10:00am on the due date
Printout (i.e., hardcopy) is due at the beginning of the class on the due date (must be stapled)

This program assignment is designed to help you learn about basic 2D graphics operations using OpenGL with GLUT. The program must be developed using the OpenGL graphics library with GLUT on our departmental Windows machines (i.e., test your program on the machines before submitting it).

Assignment: Plots of mathematical functions are often used to understand the behaviors of different types of functions. In this assignment, you will develop a program that uses 2D OpenGL constructs to generate a sine waveform (i.e., plot/draw a sine wave) on the screen. (You need to use only 2D OpenGL constructs in this program).

The assignment will help acquaint you with OpenGL's operations for generating and using simple 2D primitives. Your program should be well-constructed. Be sure to document the major variables and data structures. Using accurate, descriptive variables and function/method names can help reduce your need to explicitly document the non-major variables.

Details:

- The screen is to be 401 pixels in height by 401 pixels in width. The screen is to have a light background color (e.g., white).
- The program will use the screen axes as the actual axes for plotting the function *y=A+B sine(x)*, where *A* and *B* are scaling factors. In the program, *x* is a pixel *x-coordinate* (i.e., the pixel's column number on the screen), but the function is to take *x* as if it were expressed in degrees (remember, *sine(360) = sine(0) = 0*). Your program will plot the function for all valid values of x (i.e., *0* to *400*).
- The scaling factors *A* and *B* (i.e., in *y=A+B sine(x)*) are ones that you choose. *A* and *B* must be chosen such that the lowest "trough" of the sine wave is at the lower horizontal boundary of the screen and such that the highest "peak" of the sine wave is at the upper horizontal boundary of the screen. Be sure to document your choice of *A* and *B* in the first comment box of the program. Your documentation should describe why you chose the values of *A* and *B* that you did.
- The sine wave (only one cycle) will be displayed by the program until the user terminates the program by pressing "q" keyboard key.
    - "q" key exits the program.
    - You must query the keyboard using OpenGL functions to determine if a key has been struck (i.e., do not use scanf, cin, or any other related C/C++ function).
- The sine wave should be displayed as a color piecewise collection of line segments that might look like very much like a series of lines if viewed carefully. Be sure you choose line lengths of 3 pixels so that the user perceives your program to be generating a reasonable smooth curve. You are free to select the color of your line segments, but all segments must be the same color and the color must have a high degree of contrast from the background.

- Draw the *x*- and *y*-axes for the sine wave where the origin is at the center of screen. Use a different color of axes than the sine wave.

CS525 Students: Graduate students must add a plot of a cosine function atop the sine function. Be sure to choose scaling factors so that it is called in a manner equivalent to the sine function. Also, to avoid confusion with the sine function, color the cosine function in a substantially different way from the sine function.

Extra point: If you want to add extra features to the program, a small number of extra credit points may be awarded. An example extra feature would be plotting the functions with dashed line segments when right mouse button is pressed (when pressing the button again, it should go back to the original plot with the solid line segments).

Structure and Documentation Note: The program should have a modular design and a reasonable amount of documentation. This means that major/important features, functions/methods, and data structures should be very clearly documented. Remember, you can reduce some documentation work that might otherwise be needed by careful choice of variable and function/method names. Object-oriented approaches must be very clearly described; careful choice of object names is not sufficient for other readers of your program to understand its structure. Programs are also expected to be reasonably efficient.

The initial comment section of the program should include a concise description of the architecture of your program. Your goal in the initial comment section should include providing a concise description of the program's methodology (including any critical functions and data structures) to the grader. Anyone reading the initial comment section should be able to very quickly understand the structure of the program.

Building and submitting the OpenGL program: Your program must include and use the *cs_425_525_setup.h* header file that is on the BlackBoard. Unless you are doing animation, you should use that file exactly as it is. If you want to use an object-based approach, you are free to minimally modify the *cs_425_525_setup.h* to work with your object-based framework. Please, no use of STL for C++ program.

You need to hand-deliver a print-out of your program's complete source code. *(Please have a separate cover page.)* In addition, you need to put your complete source code in the directory specified below on the CS server. In particular, create a Visual Studio Project under a work directory named **cs425_prog1_yourlastname** (for undergraduate students) or **cs525_prog1_yourlastname** (for graduate students) (e.g., if you name is Tiger Woods, the directory should be named as **cs425_prog1_woods**.) and then submit the entire folder. You are restricted to NO MORE THAN **TWO** header files (including *cs_425_525_setup.h*) and **ONE** C/C++ file.

Please check that your program works on the departmental Windows machine.

- Turn-in your softcopy of program for grading:
  1. Go to **Start → CS Classes** and login as **bgsulabs** for both username and password.
  2. Click on **lee\cs425_turn_in** (for undergraduate students) or **lee\cs525_turn_in** (for graduate students)
  3. Drag your **cs425_prog1_yourlastname** (or **cs525_prog1_yourlastname**)folder and drop it into the **"cs425_turn_in"** (or **"cs525_turn_in"**) folder**.**

  (For more details to access the CS Classes, see http://www.bgsu.edu/departments/compsci/docs/cs-classes.html)