CS545 Introduction to Computer Graphics

Programming Assignment 5
Play Ball II

Computer Science Department
University of Alabama-Huntsville
Spring 2006

Due Date: April 11, 2006
Time: Listing due by **3:55 pm** on due date. Electronic submission due by **3:50 pm** on due date.
Value: 30 points

This assignment will help you gain more practical knowledge and experience relating to the role of 3D transformations and 3D viewing in graphics. The program must be developed for OpenGL (with GLUT).

Assignment: For this assignment, you will enhance the pitching simulation recently developed. Essentially, you'll add a perspective viewing option and a new animation feature. You can use all OpenGL transformations and viewing options as long as you satisfy all program requirements.

The particular details are listed below.

Program Particulars:

- The on-screen canvas must be 475 pixels in width and 400 pixels in height. This canvas can be viewed to be the viewport on the projection plane.
- On the canvas, there is a 455 pixel wide and 380 pixel high box. The box's center is the canvas center. The box is axis-aligned. The box outline is to be drawn in blue.
- The key 'P' toggles between parallel and perspective viewing. Parallel is the default, and its parameters are exactly the same as in the last assignment. For perspective, the eyepoint is 200 units above the center of the field.
- The backstop is at the other end of the screen from the pitcher's mound. It should be drawn as a yellow line that is at the $x = 465$ position.
- For this assignment, increase the size of the ball to size 20.
- There will be a rotating shape in the center of the field. Its center is exactly the center of the viewport. The shape is a parallelogram (square) with side lengths of 375. The shape will constantly spin while the program is operating. It spins by two degrees per step, with 20 steps per second. I recommend you use the glutIdleFunc to achieve the animation of the diamond, but you are free to use other mechanisms, such as a glutTimerFunc, to achieve its animation. You'll probably want to keep a data structure that encodes the current state of the ball and spinning shape. The spinning shape must be clipped against the blue box using a line-clipping algorithm that we have discussed in the class.
- If you choose to use OpenGL projections (i.e., if you choose not to implement perspective projection by hand), you must complete a worksheet that shows the arithmetic to project point (150,175,50) using perspective projection, according to the projection parameters of this programming assignment. The worksheet should show all work to do this projection. Attach the worksheet to your printout.

All other conditions specified in the previous programming assignment still apply to this assignment.

The program should be well-structured, well-documented and easy to use (to allow for future changes). You should strive for modularity and generality in the program.

Extra credit: Any extra features must be noted in the first comment box which will be at the top of the listing (before any executable statements or functions). A total of up to 2 extra credit points may be earned on this program. A primary extra credit feature desired this time is a picture-in-a-picture feature that shows the ball moving from a side view. Of course, the inset picture shows the same scene as in the main window! The picture-in-a-picture should be about 100 units high and 150 units long and should be placed in a corner of the drawing area. The view in the picture-in-a-picture should be the same class of projection as the view in the main window.

Submitting the Program: You need to email me the very final version of your program. Don't submit until you're sure it's ready.

Also, hand-deliver a print-out of your program's complete source code. That print-out is due at the time class would start on the due date. Since we probably won't have class that day, you can submit the program to the department office and ask them to time stamp it and get it to me. If you can conclusively demonstrate that you won't be in Huntsville that day, you can either submit it early or contact me for details about faxing in your listing and arithmetic work.

The email submission must include all needed header files and source files. Email to `tnewman@cs.uah.edu`. Be sure to put a subject line "CS 545 Prog 5" on your email. You are restricted to no more than 2 header files and 1 C/C++ file. The files must be well-constructed attachmentsto the message. The attachments must be in the standard format for attachments. Please note that some Microsoft mailers fail to conform to the industry standard for attachments. I reserve the right to either return any program that is submitted as an improperly-formatted attachment or to assign a 10% additional penalty to such a program.

Before submitting your files, please make certain that they will compile correctly using the same command I will use:

```
gcc -o pgm5 *.c -lglut -lGLU -lGL -lm
```

I will execute your program on my linux box. Please check that your program works on the departmental linux boxes. The program MUST be electronically submitted by the due time

Structure and Documentation Note: The program should be modular in its design and have 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 the 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.