LSU EE 7700-1 Homework 2 Due: 29 March 2010

To complete this assignment follow the setup instructions from the course Web page (if not already followed). The setup instructions bring you to the point where you can compile the cpu-only examples but for this assignment that won't be necessary. Then follow the instructions in the first problem to complete and test the setup.

Problem 1: Check out the ball project code into a directory for use in this assignment, and make sure the code works. The transcript below shows typical commands to do this, along with comments (preceded by #). The comments near the top of file balls.cc describe keyboard commands. Examine these and do the following:

- Turn ball "dripping" on and off.
- Turn ball "shower" on and off.
- Move eye location.
- Move light 0 (the only one that can be moved) location.
- Change gravitational acceleration to about 20.
- Turn shadows on and off.
- Switch between existing shadow volume code and solution code ('Q').

```
# Transcript of commands to check out and run code for
# this assignment.

    [orion.ece.lsu.edu] % cd ~
    /home/faculty/koppel

# Check out a copy of the balls code into a directory named hw2.
    [orion.ece.lsu.edu] % svn co https://svn.ece.lsu.edu/svn/gp/proj-base/balls hw2
A    hw2/balls-shdr.cc
    A    hw2/balls.png
# ...
    Checked out revision 213.

# Check out the include directory.
# If the step below has already been performed for an earlier
# assignment it can be skipped, though it does not hurt to do it multiple
# times.
    [orion.ece.lsu.edu] % svn co https://svn.ece.lsu.edu/svn/gp/include
    A    include/gl-buffer.h
    A    include/misc.h
    A    include/texture-util.h
    A    include/util.h
    A    include/gp
    A    include/glextfuncs.h
    A    include/coord.h
    A    include/pstring.h
```

```
    A    include/shader.h
    A    include/cuda-util.h
    Checked out revision 213.


# Go to the balls directory (named hw2), compile, and run the code.
    [orion.ece.lsu.edu] % cd hw2
    /home/faculty/koppel/example/hw2
    [orion.ece.lsu.edu] % make -j 4
    /usr/local/cuda/bin/nvcc  -Xcompiler -Wall --ptxas-options=-v -I/usr/X11R6/include/
-I/opt/local/include -I../include -I../../include  -g -Xcompiler -Wno-strict-aliasing
-Xcompiler -Wno-parentheses -c balls-kernel.cu
# ...

    [orion.ece.lsu.edu] % balls
    S GL_VENDOR: "NVIDIA Corporation"
    S GL_RENDERER: "Quadro FX 3800/PCI/SSE2"
    S GL_VERSION: "3.2.0 NVIDIA 190.53"
```

Problem 2: The method used by the code to render the shadow volume of a sphere is inefficient. Write a more efficient one that sends over shadow volume coordinates at initialization time and at render time changes the modelview transformation matrix and renders the coordinates computed in the initialization step. This more efficient code would avoid (except for initialization) both the time needed to compute shadow volume coordinates and the time needed to send them to the GPU.

The code should be placed in routine `Sphere::render_shadow_volume2` (don't touch `Sphere::render_shadow`) and in Sphere::init. You may add other member functions to Sphere, as needed.

Solve this problem WITHOUT using the `pBuffer_Object` class. (But do feel free to look at the source for this class.) Don't confuse the `pBuffer_Object` class, something written for this course, with OpenGL buffer object commands, such as glBindBuffer. The solution should use OpenGL buffer object commands.

The `Sphere` code already pre-computes sphere coordinates at init time and changes a transformation matrix at render time. Look at that code for examples. Also look at `render_shadow_volume` to see how to find the coordinates of the shadow volume.

Problem 3: By running experiments on the code (with any modifications needed for this problem) estimate the fraction of time needed by the `render_shadow_volume` code to:

- Compute shadow volume coordinates (including trig functions).
- Compute shadow volume coordinates (not including trig functions).
- Send shadow volume coordinates to GPU.

Also estimate the timing of your code, `render_shadow_volume2`.
Briefly comment on whether the timings seem reasonable.