Assignment #3

Due Date: November 23th, 11pm

CS 283: Advanced Computer Graphics
Fall 2009
Prof. James O'Brien

This assignment is purposefully described in an underdetermined fashion. I want to see what you do with it.

1. **This assignment has two main parts. The first one is fairly easy. The second is quite a bit harder, or at least it is harder to do well.**
   - Don't worry, grading on the second part will be mostly based on apparent effort.

2. **For the first part of the assignment, you should implement Catmull-Clark subdivision. The required features are:**
   - Operate on arbitrary input meshes.
   - Include tagging for the sharpness rules discussed in class.
   - Have the option of "pushing to the limit surface" after some number of subdivisions.
   - Be able to compute tangents, normals, and curvature (Gauss and Mean) at the verticies.

   How you implement this is largely up to you. The simplest method would be to read in an OBJ file along with some parameters and then output a new OBJ file. The normals can be included in the OBJ file. It is up to you how you'd like to output curvature.

3. **For the second part, you should write code that can move specified points of the control mesh so that the integral squared curvature or surface area of the limit surface is minimized.**
   - There are a lot of ways you could do this. Most of them will be slow.
   - You can use whatever optimization method you like. (Gradient descent is easy, but slow.)
   - You can make interesting surfaces by minimizing functions that combine surface area and curvature.
   - If you like, you can have your code operate recursively on each level of subdivision so that it converges to the true minimal surface.
   - Your optimization can make use of discrete approximations to the minimized function. But your visualizations (*i.e.* part 1) should be exact.

4. **You are free to use whatever libraries or code you find on the net as long as it does not trivialize the assignment.**

5. **Once you have things working, make a webpage that shows off what you did.**
   - Include a few example images showing subdivision with various parameters on a variety of objects.
   - Make sure you include some images that show off sharp features.
   - Include both shaded and wireframe images.
   - For each example make sure show the input control mesh for reference.
   - You optimization code is probably best demonstrated by a combination of still images and some animations.
