CIS277

Assignment 8

due 4/23/2010 @ noon

Group project (3 people). All: create on-screen help, do write-up.

"Mini-Maya"

Assume all polygons in mesh are quads or triangles. If a polygon with more than 4 vertices is created, at the minimum require the user to split into quads and triangles before any other geometric operations are allowed. Also, any non-planar or concave quad should be split into two triangles automatically.

Person 1 ***The Geometer***

1) Polygon mesh load and write. You are not required to include textures, but you should include materials. Information about the format can be found here and elsewhere on the web:
   http://www.eg-models.de/formats/Format_Obj.html
   http://www.fileformat.info/format/wavefrontobj/egff.htm
2) User interface to create and modify polygon mesh models.
3) User interface widgets to select faces (at least), edges, vertices via cursor [use tools from homework 7].
4) Implement this set of valid operations (at least):
   a. Insert vertex in edge (midpoint OK) [done in homework 6].
   b. Delete vertex (recursively delete incident dangling edges and faces if necessary) [done in homework 6].
   c. Modify XYZ of vertex (modifying incident faces to maintain planarity and convexity (perhaps via user) as necessary)
   d. Insert edge between two faces that share a vertex [done in homework 6]; move vertices apart to create a non-zero length edge; adjust incident faces to maintain planarity, splitting faces as needed to create quads and triangles.
   e. Insert edge joining two vertices of the same face to create (split into) two faces [done in homework 6 as long as you restrict mesh to quads].
   f. At least one other geometry editing operation of your choosing NOT already done in homework 6, e.g.:
      i. Replace vertex with a face incident to each face surrounding that vertex; the new vertices are at the midpoint (or make a better choice) between the replaced vertex and the adjacent vertices on each edge; add edges to each of the incident faces; adjust number of edges, planarity and convexity of all incident faces as well as the new one.

ii. Delete a face by replacing each of its vertices with a single vertex at its centroid; adjust planarity and convexity of all incident faces; delete faces now having only 2 edges.

Person 2 ***The Visualizer***

1) Camera view controls. You should now use gluLookAt to allow display lists to work. Check out how gluLookAt works. It will simplify your camera work once you get the hang of it.
    a. Make sure that you can move the center (focal or reference point).
    b. Use the mouse to operate the camera. (You can use any convenient input system, but you might try the quaternion arcball method, or just map the mouse motions to polar coordinates around the view center, etc.)
    c. Snap view (center and zoom) to a vertex or edge or face center.
    d. Automatically center the entire scene including moving the center and adjusting zoom. (There should be a widget to toggle this on and off.)
    e. Create named views: perspective, overhead, left, right, front, back, user-named
2) Use display lists. If you move your camera around use gluLookAt, display lists will significantly speed up the rendering (for large meshes). However, if you modify the mesh, you will need to recompile the display list. So while the camera moves around your mesh, you will be able to use your display list (because you'll be using gluLookAt). When the user changes the mesh, update your display list, and start again.
3) Set/modify object data: material, colors.
4) Set/modify lights.

Person 3 ***The Deformer***

1) Implement Catmull-Clark subdivision on quads and triangles.
2) Implement at least 4x4x4 Free Form Deformation with suitable XYZ position controls in the 64 control points. It is OK to align the deformation control mesh with the polygon mesh's axis-aligned bounding box.
3) Allow i x j x k control meshes, $2 \leq i,j,k \leq 4$
4) Test subdivision on cube to see if it converges toward a sphere.
5) Create at least 3 polygon mesh models and deform them into more "interesting" shapes.

Schedule:

Rushes: April 19th

Submission: April 23rd @ noon

Demos: April 23rd and April 26th

Grading: Show your work to us during reading days (schedule to be posted soon).

Grading:

Total: 200 points per person

75% for working features

15% for usability, look and feel

10% for documentation

Additional 50 points for presentation

Submit CIS277HW8_groupname.zip/rar via blackboard which includes a working project