

## Exercise Sheet 5

Out: 16.11.2015

Due: 25.11.2015

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You should work in groups of two. Don't forget to put your names and student ID numbers on the solution you hand in!

**Exercise 5.1** (Garland & Heckbert, 4 Points). Consider a simplicial surface defined by a set of points  $p_1 = (0, 0, 0)$ ,  $p_2 = (1, 0, 0)$ ,  $p_3 = (0, 1, 0)$ ,  $p_4 = (0, 1, 1)$  with three triangles  $\{p_1, p_3, p_2\}$ ,  $\{p_1, p_4, p_3\}$ , and  $\{p_1, p_2, p_4\}$ .

Determine the error quadric  $Q_1$  at point  $p_1$  as defined in the Garland & Heckbert algorithm (Here the quadrics don't need to be normalized with the triangle area).

**Exercise 5.2** (Textured Globe, 2+2+2+2 Points). Construct a digital globe model in JavaView.

1. Generate a triangle mesh approximating a round sphere. You may start with a coarse mesh and use an appropriate subdivision scheme.
2. Pick a rectangular earth texture of your choice and map it (`Method->Texture->Make Element/Vertex Texture...`) to your globe by
  - a) ...using vertex-based texture coordinates.
  - b) ...using element-based texture coordinates.
3. Describe the problems that occur. Can you improve the mapping? How can you obtain a fairly good/realistic-looking textured model? What projection do you use?

**Hint:** A good place to start your search for earth textures is <http://visibleearth.nasa.gov/>. For instance you can find <http://visibleearth.nasa.gov/view.php?id=73580> or a night light map <http://visibleearth.nasa.gov/view.php?id=79765>. If you feel more affiliated to other planets you may also choose Mars textures etc. However your texture should contain a pretty rich structure in order to see distortion effects. For submission purpose, don't exaggerate with the resolution. Your submitted texture file should not exceed 2mb in size. Rescale your original texture if necessary, e.g. using *GIMP*, *ImageMagick* or any other pixel editor.

Save your textured globes (element and vertex-based textures) as .jvx-files (make sure the "Texture" checkbox is enabled in the save dialogue options). This will create the .jvx file as well as a texture file in your save folder. Sent all files (2 .jvx + 2 .gif) to your tutor following the usual naming convention `name1_name2_globe_vertex/element.jvx`.

**Exercise 5.3** (Simple Simplification, 8 Bonus Points, until 2.12.2015). Implement the simplification strategy proposed by deTurck, as presented in the lecture. The project control panel should contain a “subdivide” button together with a field variable to specify the number of subdivision steps to be performed whenever the button is clicked.

**Hint:** After removal of a vertex and its adjacent elements you can re-triangulate the geometry by using the static method `PgElementSet.triangulate(...)`. To obtain the vertex index with minimal distance to its averaging plane you may use the class `PuPriorityQueue`.

See also <http://javaview.de/doc/reference/jvx/util/PuPriorityQueue.html>