Sample Test 3: Surfaces, Textures, Pipeline

November 21, 2024

– State any simple, reasonable assumption used to arrive at your answer.
– A 'yes' or 'no' answer without reasoning is worth 0 points.
– Zero points if the writing is hard to decipher. Use a black pen if in doubt.
– Indicate with arrow if you use the back of the previous page (last page for page 1).

1 Surface Patches

A patch $\mathbf{p}$ in Bernstein-Bézier form has coefficients

$$\begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \quad \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \quad \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

1. What is the degree? (1/2 point)

2. evaluate $\mathbf{p}$ at $u = v = 0.5$ using DeCastejau's algorithm. (1 point)

3. compute the normal $\mathbf{p}$ at $u = v = 0.5$. (1 point)

4. A second patch in Bézier form has coefficients

$$\begin{bmatrix} -1 \\ 1 \\ b \end{bmatrix} \quad \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} -1 \\ 0 \\ c \end{bmatrix} \quad \begin{bmatrix} a \\ 0 \\ 0 \end{bmatrix}$$

   Determine a,b and c so that the two patches join smoothly. (1.5 points)

2   Texture Mapping

([3] points) Generalized subdivision algorithms, such as 'subd' in 'blender' work by repeatedly cutting off (sharp) edges and refining the polyhedron. How would you texture map a subdivision surface? That is, what is a good choice of texture coordinates?

3   Techniques and Concepts

[6] Describe, in a sentence or two, or using a sketch, the relationship of each of the following pairs of terms.

(A) Clipping and the viewing frustum.

(B) Painter's algorithm and z-buffering.

(C) Bump mapping and surface normals.

(D) Bresenham's algorithm and NURBS curves.

(E) Global Illumination and the OpenGL lighting model.

(F) Scan line processing and the flood fill algorithm.