

ICS 186A: Computer Graphics
Spring 2002
Gopi Meenakshisundaram

Written Assignment 1

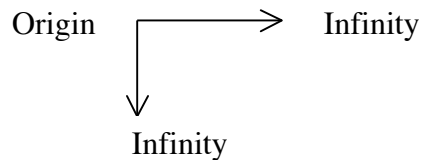
Assigned : Monday, April 1, 2002

Due: Friday, April 5, 2002

Estimated Time: 2 hrs

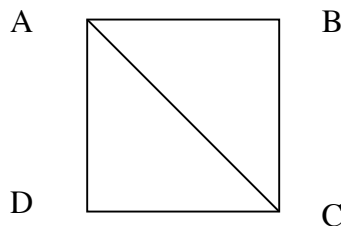
Rendering Pipeline

1. Draw the rendering pipeline and explain, in your own words, each stage of the pipeline.
2. Define (a) Pixel, (b) Rendering, (c) Rasterization
3. Many image files have linear structure. If the size of the image is 1000×1000 (WxH), then the element at position 3500 in the file would refer to the element in the fourth row and 500th column of the image. If the size of the image is infinite in both width and height, but has an origin (refer to the figure), then how would you organize your file into a linear structure? In other words, come up with a scheme of organizing the data in the file such that given the position of the element in the file, you can locate the corresponding position in the image.



Polygonal Representation

1. What is the dimension of a *point*, *line*, and a *triangle* in a 3D space?
2. Two important properties the triangle with respect to other polygons having more than three sides are *planarity* and *consistency in the interpolation*. Prove them.
3. Define manifold, manifold with boundary, and pseudo-manifolds. Give (draw) examples for each of them.
4. Euler Characteristic $e = V - E + F$, where V , E , and F are number of vertices, edges and faces respectively of a manifold and is usually an *even integer*. Consider the following triangles. Compute its e and justify your answer with respect to the above statement.



5. The genus g of a sphere is zero. Euler characteristic is related to the genus by the formula $e=2-2g$. What is the Euler characteristic of a sphere? What is the genus of a cube?
6. A cube is an approximation of a sphere using faces having four edges each (quadrilaterals). In a cube, all vertices have degree three. My claim is that you can construct an approximation of a sphere using quadrilaterals such that the degree of every vertex is four. Prove or disprove this claim.