CS 4620 Homework 5 (v.2): Pipeline and Mesh Data Structure

out: Friday 9 October 2008
due: Friday 17 October 2008

Problem 1: Rasterization. A particular triangle, when rasterized, produces the following fragments, each with pixel coordinates (x_s, y_s) and screen-space depth z_s.

x_s	y_s	z_s
13	22	19.2000
14	22	19.4000
10	23	18.9000
11	23	19.1000
12	23	19.3000
13	23	19.5000
10	24	19.2000
11	24	19.4000
12	24	19.6000
10	25	19.5000
11	25	19.7000
12	25	19.9000
11	26	20.0000

Table 1: The fragments table

What are the (x, y) coordinates and depths of the triangle's three vertices? *Hint*: The answer is not unique.

Problem 2: Mesh representations. The half-edge table in Table 2 represents a triangle mesh.

1. Express the same mesh as an indexed mesh.
2. What's the shape of the mesh? The answer is not unique, but different answers have the same topology.

Problem 3: Triangle Strips. Given a cube, by dividing each face into two triangles, we could create a mesh with 12 triangles. Figure 1 illustrates one possible way of dividing the faces. We can use 3 triangle strips to represent the mesh: $(3, 1, 4, 5, 8, 6, 7, 2, 3, 1)$, $(1, 2, 5, 6)$ and $(4, 8, 3, 7)$.

By changing how the cube is divided into triangles, you can get away with fewer strips. Find a triangulation and a set of triangle strips that represent the cube with as few strips as possible.

hedge	pair	next
0	1	8
1	0	22
2	3	10
3	2	17
4	5	12
5	4	19
6	7	14
7	6	21
8	9	15
9	8	2
10	11	9
11	10	4
12	13	11
13	12	6
14	15	13
15	14	0
16	17	1
17	16	18
18	19	3
19	18	20
20	21	5
21	20	23
22	23	16
23	22	7

Table 2: The half-edge table

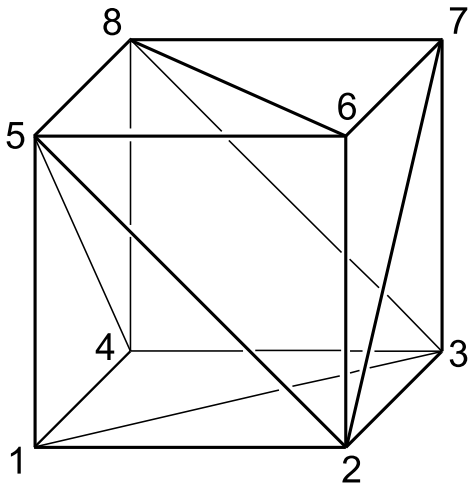

Figure 1: Triangle mesh of a cube