1 Triangle normals 5%

Given a triangle with vertices $\vec{A}$, $\vec{B}$, and $\vec{C}$, and normals at the vertices $\vec{n}_A$, $\vec{n}_B$, and $\vec{n}_C$. Given the barycentric coordinates $\alpha$, $\beta$, and $\gamma$ show the equation used to compute an interpolated normal.

2 Triangle texturing 20%

Given a triangle with vertices $\vec{A}$, $\vec{B}$, and $\vec{C}$, and texture coordinates $(u_A, v_A)$, $(u_B, v_B)$, and $(u_C, v_C)$. For a given position $\vec{X}$ within the triangle show the equations necessary to compute the texture coordinates $(u, v)$ at $\vec{X}$. 
3 Object transformation 20%

Given a sphere with radius 1 at the origin. The sphere is transformed by the following matrix

\[ T = \begin{bmatrix} 4 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \]

Compute the intersection of this transformed sphere and a ray with origin (1,1,1) and direction (-1,-1,-1)
4 Surface area heuristic 5%

What is computed using the surface area heuristic?

5 Refraction 5%

What is the name of the equations that can be used to compute the direction of a refracted ray entering a dielectric material?

6 Box intersection 15%

Given a box with corners \((-2, -2, -2)\) and \((2, 2, 2)\). Compute the entry and exit point of this box for a ray that has origin \((-3, 4, 5)\) and direction \((1, -1, -2)\).
7 Cost functions

Given a box $B_2$ that contains 3 triangles and a box $B_3$ that contains 2 triangles. Both boxes are contained within a box $B_1$. If a ray hits box $B_1$ what is the probability that it will hit $B_2$, and what is the probability that it will hit $B_3$?

8 BSP traversal

A BSP node has a splitting plane $x = 2$. A ray with origin $(1,1,1)$ and direction $(\sqrt{\frac{T}{3}}, \sqrt{\frac{T}{3}}, \sqrt{\frac{T}{3}})$ intersects the surrounding node at distances $\frac{1}{2}$ and 1. Which child node(s) should be checked for objects that might be intersected by the ray?

9 Triangle voxel test

A triangle has vertices $(0,0,0)$, $(3,3,3)$ and $(10,0,0)$. Is the triangle within a voxel that has corners $(-1,-1,-1)$ and $(1,1,1)$?