CMSC 23700 Winter 2008	Introduction to Computer Graphics	Homework 4 Due February 28

1. An *axis-aligned bounding box* (AABB) in 2D is defined by four scalar values:

   $$\langle minX, maxX, minY, maxY \rangle$$

   We use $\langle 1, -1, 1, -1 \rangle$ to denote the empty AABB. Let

   $$bb_1 = \langle minX_1, maxX_1, minY_1, maxY_1 \rangle$$

   and

   $$bb_2 = \langle minX_2, maxX_2, minY_2, maxY_2 \rangle$$

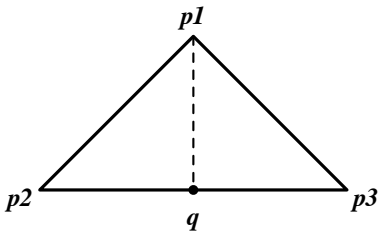
   be two *non-empty* AABBs.

   (a) What is the minimum AABB that contains the union of bb_1 and bb_2?

   (b) What is the minimum AABB that contains the intersection of bb_1 and bb_2?

   (c) What is the minimum AABB that contains the difference of bb_1 and bb_2 (*i.e.*, $bb_1 \setminus bb_2$).?

2. One way to make LOD transitions is to use an α *fade*, where you lerp the α channel to blend the two LODs. Assume that you have a triangle $\langle \mathbf{p}_1, \mathbf{p}_2, \mathbf{p}_3 \rangle$ and a vertex $\mathbf{q}$ that bisects the line $\mathbf{p}_2\mathbf{p}_3$, splitting the triangle into two triangles $\langle \mathbf{p}_1, \mathbf{p}_2, \mathbf{q} \rangle$ and $\langle \mathbf{p}_1, \mathbf{q}, \mathbf{p}_3 \rangle$.

   Assuming that triangles have the following representation:

   ```
   typedef struct {
       Vec3f_t  verts[3];
       Vec3f_t  normal;
       Vec3f_t  color;
   } Triangle_t;
   ```

   Define a function

   ```
   void alphaLerp (Triangle_t *tri, Vec3f_t q, float t);
   ```

   that takes as arguments the triangle `tri`, the point of bisection `q`, and a parameter $0 \leq \mathtt{t} \leq 1$ that controls the blending of the two images. When `t` is 0, just the single triangle should be drawn, and when `t` is 1, just the triangle pair should be drawn. You may use mathematical notation or C code to write your answer, but it should clearly specify the OpenGL state used in rendering.