Tutorial No. 9: Visible Surface Etc

1. Define coherence wrt visible surface determination. In what was is it useful in the design and implementation of graphics algorithms? Give two examples.

2. One of the adcantages of the *z-buffer* algorithm is that primitives may be presented in any order. Does this mean that images created by sending primitives in different orders will have identical values in their z-buffers and in their frame buffers. Explain your answer.

3. Consider merging two images of identical size represented by their frame and z-buffer contents. Is it possible to merge the images properly? Is any additional information needed?

4. Explain the term visual realism, and, discuss its purpose in *computer graphics*. List several example applications together with graphics techniques that could be used to enhance visual realism in a relevant manner.

5. Consider a model of a sphere rotating on a graphics display. Discuss the minimal set of techniques needed to display it effectively.

6. The following outlines the *scan-line algorithm* applied to VSD, and is based upon the tutorial 2. Note that it assumes **non-penetrating** polygons.

   Edge Table (ET) Contains buckets, one for each scan-line. Edges are stored in the bucket corresponding to the edges smaller y-value. Each bucket contains a list of entries ordered by the x-value.

   An entry contains the following info:

   - x-value of the end with the smaller y-value,
   - y-value of the other end of the edge (y_{max}),
   - incremental x value Δx, and
   - polygon ID.

   Polygon Table (PT) Lists all polygons according to their ID, and contains the following information:

   - coefficients of the plane equation,
   - shading info, and
   - an in/out flag indicating whether the current position is inside/outside this polygon.

   Active Edge Table (AET) A list of active ET entries sorted by x-value.

   In Polygons Table (IPT) A list of all polygons which the current point is inside, ordered by z-value.

Algorithm As follows:

$AET = \emptyset, IP = \emptyset$

$\forall y \; from \; y_0 \rightarrow y_n$

Add ET entries for y to AET, maintaining order

$\forall entry \; e \in AET, in \; order$

If polygon(e) flag set to out

Set polygon(e) flag to in

Add polygon(e) to IPT, maintaining order

else

Set polygon(e) flag to out

Remove polygon(e) from IPT

end

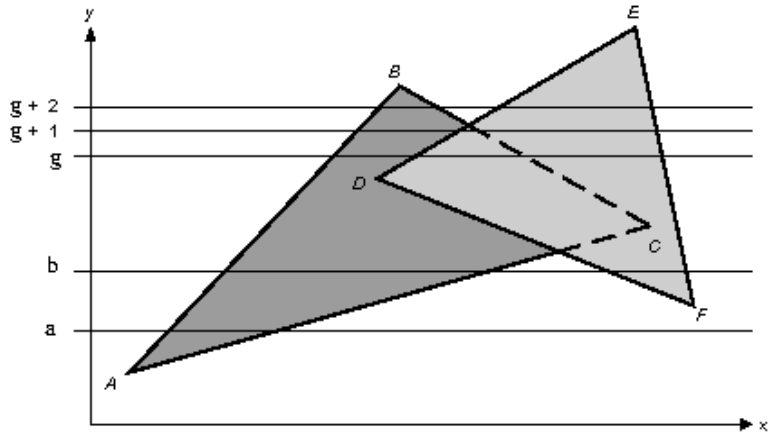
If $\mid IPT \mid \geq 1$ shade scan line up to next-edge(e) x-value

$\forall entry \; e \in AET$

If $y = y_{max}$ remove from AET

else update x-value

Draw diagrams showing the contents of the ET and PT for the scenario shown below.



7. For the same scenario, illustrate the contents of the transient data structures at the scan lines indicated on the diagram.

References: Computer Graphics, Section 13-1 through 13-10