Visible surface Detection

Scan-Line method

→ Scan line method is an image space method for visible surface detection.

→ This method computes and compares depth values to create an image one scan line at a time.

→ This algorithm is similar to scan line algorithm for polygon filling but it deals with multiple surfaces.

→ In Scan-line method, three important tables are maintained:

ⓐ The Edge Table (ET)
ⓑ The polygon Table (PT)
ⓒ Active Edge Table (AEL)

Edge Table (ET)

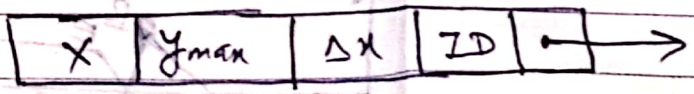
→ Create an edge table for all non-horizontal edges of all polygons projected on the viewplane.

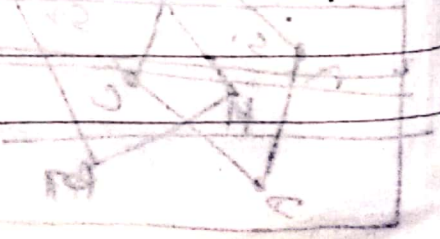
→ Edge table process:

- Entries in the ET are stored into buckets based on each edge's smaller y-coordinates and within bucket are ordered by increasing x-coordinate.

→ Edge table fields:

- The x-coordinate of the end with the smaller y coordinate.
- The y-coordinate of the edge's other end.
- The x increment, Δx used in stepping from one scanline to the next
- polygon identification number, indicating the polygon to which the edge belongs.
- pointers into the surface facet table to connect edges to surfaces





Polygon Table

→ Polygon table fields:

- PolygonID
- The coefficients of the plane equation
- Shading or Color information for the polygon
- An "in-out" Boolean flag, initiated to false and used during scan-line processing

ID	Plane Equation	Shading Information	In-out

Active Edge Table (AEL)

Fields:

- ScanLine
- Edge
- surface.

Scan Line	Edge	Surface

→ The scan-line method works as follows:

(1) To facilitate the search for surfaces crossing a given scan-line an active list of edges is formed for each scan-line as it is processed.

(2) The active list stores only those edges that cross the scan-line in order of increasing X.

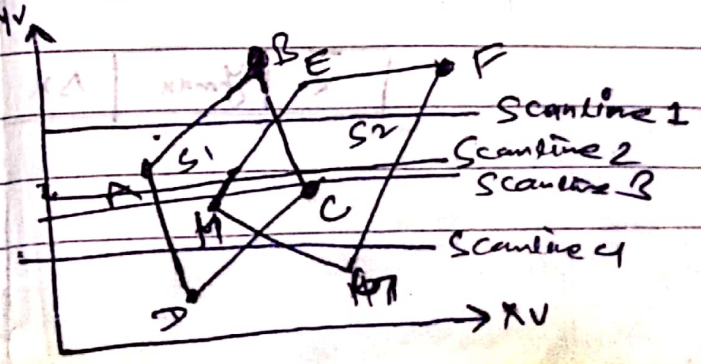
(3) Also a flag is set for each surface to indicate whether a position along a scan-line is either inside or outside the surface.

(4) Each scan-line are processed from left to right for pixel positions.

(5) The surface flag is turned on (true) when the scanline intersect left edge of the surface and the flag is turned off (false) when cross from right edge of the surface.

(6) When multiple surfaces flags are turned on for a scanline position, then need to perform depth calculations.

Scan-Line Method: Example



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- Sorted edges are: AD, DC, GH, FG, BC, HE, AB and EF.
- polygon table has entries for ABCD & EFGH.
- prepare an Active Edge Table (AET):

Active Edge Table (AET)		Surface
Scan Line	Entries	← Sorting from left to right.
1	AB, BC, HE, FG	
2	AD, HE, BC, FG	
3	AD, HE, BC, FG	
4	AD, DC, GH, FG	

Advantages

→ Any number of overlapping polygon Surfaces are processed.
→ Takes advantage of coherence principle. (if there are any regularities in the scene)
→ Can be applied to non-polygonal objects → Deals with any Surface (transparent, translucent & opaque).

Dis-advantage

→ It doesnot work for surfaces that cut through or cyclically overlap each-other.
→ Depth calculations needs to performed for overlapping polygons.
→ Additional memory buffer is required.
→ Complex