Computer Graphics and Animation Lecture-10

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Liang Barsky Line Clipping Algorithm

- Parametric Equation of the line

Line (x_1, y_1) *to* (x_2, y_2)

Consider t: range from 0 to 1

At Start of the line (x_1, y_1) t=0

At End of the line (x_2, y_2) t=1

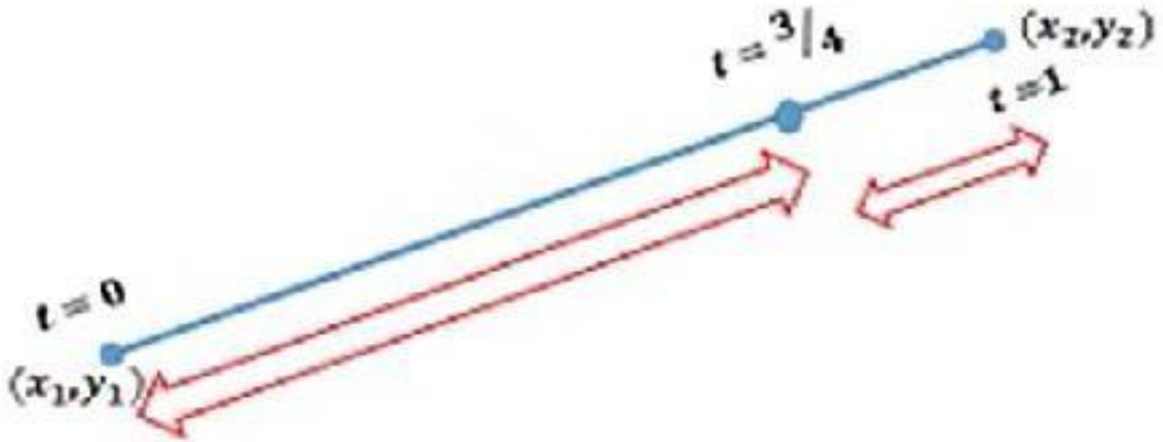
At ${}^3/_4{}^{th}$ of the line path

$t={}^3/_4$

The location is

$x={}^1/_4\, x_1 + {}^3/_4\, x_2$

$y={}^1/_4\, y_1 + {}^3/_4\, y_2$



At time t

x=(1-t). $x_1 + t.x_2$

y=(1-t). $y_1 + t.y_2$

x=$x_1 - x_1.t + t.x_2$

=x_1 + t($x_2 - x_1$)

$$x = x_1 + t\Delta x$$

y=$y_1 - y_1.t + t.y_2$

=y_1 + t($y_2 - y_1$)

$$y = y_1 + t\Delta y$$

Parametric Line Equation is

$$x = x_1 + t\Delta x$$
$$y = y_1 + t\Delta y$$

Liang Barsky Line Clipping Algorithm

Wkt

$x_w min \le x \le x_w max$

$y_w min \le y \le y_w max$

Sub x ,y value

$x_w min \le x_1 + t\Delta x \le x_w max$

$y_w min \le y_1 + t\Delta y \le y_w max$

$x_1 + t\Delta x \ge x_w min$

$x_1 + t\Delta x \le x_w max$

$y_1 + t\Delta y \ge y_w min$

$y_1 + t\Delta y \le y_w max$

$t\Delta x \ge x_w min - x_1$

$t\Delta x \le x_w max - x_1$

$t\Delta y \ge y_w min - y_1$

$t\Delta y \le y_w max - y_1$

$-t\Delta x \le x_1 - x_w min$

$t\Delta x \le x_w max - x_1$

$-t\Delta y \le y_1 - y_w min$

$t\Delta y \le y_w max - y_1$

$-t\Delta x \le x_1 - x_w min$

$t\Delta x \le x_w max - x_1$

$-t\Delta y \le y_1 - y_w min$

$t\Delta y \le y_w max - y_1$

$tp_k \le q_k [k = 1,2,3,4]$

$p_1 = -\Delta x \quad q_k = x_1 - x_w min$

$p_2 = \Delta x \quad q_2 = x_w max - x_1$

$p_3 = -\Delta y \quad q_3 = y_1 - y_w min$

$p_4 = \Delta y \quad q_4 = y_w max - y_1$

Liang Barsky Line Clipping Algorithm

- Step 1: Get the End Points of the Line (x1,y1) to (x2,y2).
- Step 2: find Δx, Δy,p1,p2,p3,p4,q1,q2,q3,q4
- Step 3: Assign t1=0, t2=1

1. If pk=0(k=1,2,3,4) the line is parallel to the window.

2. If qk<0(k=1,2,3,4) the line is outside the window.

3. For non-zero value of Pk

If pk<0 then find t1

t1=max(0,qk/pk)

Else

pk>0 the find t2

t2=min(1,qk/pk)

If t1>t2 the line is completely outside –reject

Or else find new set of (x, y) if t1 and t2 is changed

$$x=x1+ t*\Delta x$$

$$y=y1+t*\Delta y$$

Sutherland-Hodgeman algorithm polygon clipping.

Step1: Read the coordinates of all vertices of the polygon.

Step2: Read the coordinates of the window.

Step3: Read the left edge of the window.

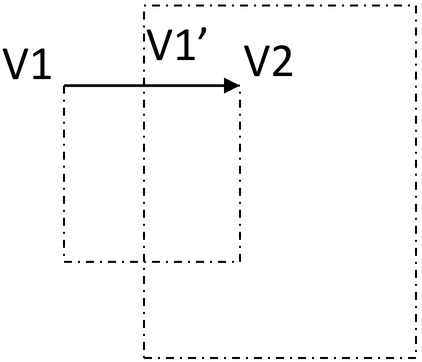
Step4: Compare the vertices of each edge of the polygon, individually with the clipping plane.

Step5: Save the resulting intersections and vertices in the new list of vertices according to four possible relationships between the edge and the clipping boundary as given as follows:

Sutherland-Hodgeman algorithm polygon clipping.

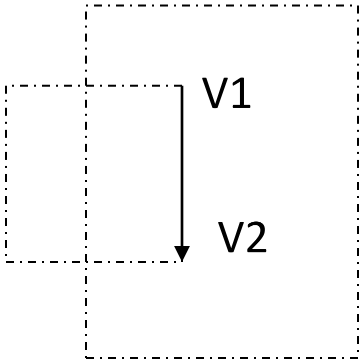
- Case 1:
- If previous vertex is outside and current vertex is inside the window boundary, then both the intersection point, and the current vertex are added to the new vertex list.
- Case 2:
  - If both vertex are inside, then only the current vertex will be added to the list.
- Case 3:
  - If the previous vertex is inside and the current vertex is outside, then only the intersection point is added to the list.
- Case 4:
  - If both the vertex are outside, then intersection point are tested for visibility and then added to the vertex list.
- **Step6:**Repeat the steps 4 and 6 for remaining edge of the clipping window. Each time the resultant list of vertices is successively passed to process the next edge of the clipping window.
- **Step7:** Stop.

Case : 1



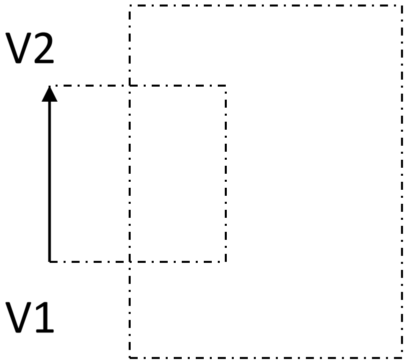
If V1 is Outside AND V2 is
Inside then Save V1’ and V2

Case : 2



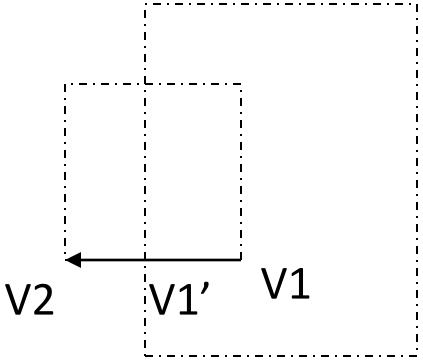
If V1 and V2 are inside then Save V2

Case : 4



If V1 V1 And V2 are Outside then Save nothing

Case : 3



If V1 is Inside AND V2 is
Outside then Save V1’

QUIZ

Thank You