Liang-Barsky's Line Clipping Algorithm

The parametric eqn of line between (x1,y1) and (x2,y2) is:

$$X = x1 + \Delta x \cdot u$$
$$Y = y1 + \Delta y \cdot u \quad \text{----------(1)}$$

Where, $\Delta x = x2 - x1$, $\Delta y = y2 - y1$, $0 <= u <= 1$

For a point (x,y) inside the clipping window

$$Xmin <= x1 + \Delta x \cdot u <= Xmax$$
$$Ymin <= y1 + \Delta y \cdot u <= Ymax \quad \text{----------(2)}$$

Rewriting the four inequalities of eqn (2)

$$P_k u <= q_k, \quad k = 1,2,3,4$$

Where ,

p1= -Δx,	q1=x1-Xmin	(left)
p2= Δx,	q2=Xmax- X1	(right)
p3= -Δy,	q3=y1-Ymin	(bottom)
p4= Δy,	q4=Ymax- Y1	(Top)

Case 1: If Pk =0 for all i=> both ends points are same=> it is a point.

Case 2: If **Pk =0** for any two i=> Line is parallel to the window boundary

And if **qk <0** => the line is completely outside the window boundary

Else if **qk>=0**=> line is inside the window boundaries

Case 3: Pk <0 => Line is potentially Entering (PE)

Case4: Pk>0 => Line is potentially Leaving (PL)

When Pk != 0, the intersection points can be calculated using the values of u that can further be calculated using the formula rk=qk/pk

Algorithm

Step1:

If Pk=0 and qk <0 for some i (invisible, ignore)

Step2:

If Pk=0 and qk >0 (Completely visible, save)

Step3:

$\forall$ k s.t. Pk <0, rk=qk/pk

U1=max(0, rk)

Step4:

$\forall$ k s.t. Pk >0, rk=qk/pk

U2=min(1, rk)

Step 5:

If u1 >= u2 => invisible else use u1 and u2 and eqn 1 for calculating the end points.

Q1. Use Liang-Barsky's line Clipping algorithm to Clip the line P1P2 given by the coordinates P1 (0, 2) and P2 (5, 7) w.r.t the clipping window whose Principal diagonal coordinates are (1, 1) and (4, 4) respectively.

Q2. Use Liang-Barsky's line Clipping algorithm to Clip the line P1P2 given by the coordinates P1 (0, 5) and P2 (15, 5) against the clipping window whose principal diagonal coordinates are (2, 3) and (10, 9) respectively.

Q2. Use Liang-Barsky's line Clipping algorithm to Clip the following lines against the clipping window whose principal diagonal coordinates are (2, 2) and (6, 6) respectively.

i. P1 (3, 5) and P2 (3, 9)

ii. P1 (1, 8) and P2 (1, 10)

iii. P1(1,2) and p2(7,7)