**Liang-Barsky Line Clipping Algorithm:**

The algorithm was introduced by **“You-Dong Liang”** and **“Brian A. Barsky.”** It is used for line clipping. It is a more powerful algorithm than the Cohen-Sutherland algorithm.

**We use the following concepts in this algorithm-**

* We can use the parametric equation of line and inequalities.
* These are used to describe the range of windows to find out the intersection points between the line and the clipping window.
* The parametric line is also known as **“Cyrus-Beck.”**

In this algorithm, we have to find the intersection point based on a time interval.

**Time interval** (**t**) can be defined as travelling time between initial position (0) to final position (1). Then we have,

**0 < t < 1**(Here, t lies between 0 and 1)

We have the formula to find x and y points of the line-

**x= x1+ t. ▲x** (For point x)

**y= y1+ t. ▲y** (For point y)

To check that the point lies between the window or outside the equation is-

**Xwmin<= x1+ t. ▲x <= Xwmax**

**Ywmin<= y1+ t. ▲y <= Ywmax**

These two conditions can be written as-

**x1+ t. ▲x >= Xwmin**

**x1+ t. ▲x <= Xwmax**

**y1+ t. ▲y >= Ywmin**

**y1+ t. ▲y <= Ywmax**

We can take a common expression for above four conditions. It will be-

**t.pk<= qk**(Here the value of k is multiple)

**t = qk/ pk**

**p1=**–**▲x**

**q1= x1– xwmin**(For left boundary)

**p2= ▲x**

**q2= xwmax– x1**(For right boundary)

**p3=**–**▲y**

**q3= y1– ywmin**(For bottom boundary)

**p4= ▲y**

**q4= ywmax– y1**(For top Boundary)

**Algorithm of Liang-Barsky Line Clipping:**

**Step 1:**Set the endpoints of the line **(x1, y1)** and **(x2, y2).**

**Step 2:**Calculate the value of **p1, p2,p3, p4**­and **q1, q2, q3,q4.**

**Step 3:** Now we calculate the value of **t**

**t1= 0 (For initial point)**

**t2= 1 (For final point)**

**Step 4:**Now, we have to calculate the value of **pk**and **qk**

If

**pk**=**0**

then

                    {The line is parallel to the window}

If

**Qk< 0**

then

                       {The line is completely outside the window}

**Step 5:**If we have non zero value of **pk**–

If

**pk< 0**

           then

**t1= max (0, qk/ pk)**

            If

**pk> 0**

then

**t2= min (1, qk/ pk)**

Now, if **t1< t2{**If**t1**value is changed

Then the first point is outside the window.

If **t2**value is changed

                          Then the second point is outside the window**}**

        else

**t1> t2**

        then

                 {Line is completely outside the window}

**Step 6:** Stop.

**Example:**

Let a rectangular window size with (5, 9). The points of the line are (4, 12) and (8, 8). Use the Liang- Barsky algorithm to clip the line and find the intersection point.

**Solution:**

We have,

The initial point of the line (p1) = (4, 12)

The ending point of the line (p2) = (8, 8)

 x1= 4, x2= 8

 y1= 12, y2= 8

xw­min= 5, xw­max= 9

yw­min= 5, yw­max= 9

**Step 1:**We have to calculate the value of **▲x**and**▲y-**

**▲x =**x2– x1= 8-4 = 4

**▲y =**y2– y1= 8-12 = -4

**Step 2:** Now, we will calculate-

                p1= -4              q1= 4-5 = -1

                p2= 4                q2= 9-4 = 5

                p3= 4                q3= 12-5 = 7

                p4= -4               q4= 9-12 = -3

**Step 3:**Now we will calculate t1value**–**

          If p1, p4< 0

          Then t1=max (0, qk/pk)

=max (0, q1/p1, q4/p4)

              =max (0, 1/4, 3/4)

           t1 = 3/4

If p2, p3> 0

Then t2= min (1, qk/pk)

            = min (1, q2/p2, q3/p3)

            = min (1, 5/4, 7/4)

         t2 = 1

**Step 4:**Now, we have to calculate the intersection point.

           x = x1+ t1.▲x= 4+ 3/4 \* 4 = 7

y = y1+ t1.▲y= 12+ 3/4 \*(-4) = 9

**The coordinates intersection point = (7, 9)**

