



Experiment No. 7
Topic : : To implement Line Clipping Algorithm: Liang Barsky
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Date of Performance:
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Experiment No. 7

Aim: To implement Line Clipping Algorithm: Liang Barsky

Objective:

To understand the concept of Liang Barsky algorithm to efficiently determine the portion of a line segment that lies within a specified clipping window. This method is particularly effective for lines predominantly inside or outside the window.

Theory:

This Algorithm was developed by Liang and Barsky. It is used for line clipping as it is more efficient because it uses more efficient parametric equations to clip the given line.

These parametric equations are given as:

$$x = x1 + tdx$$

$$y = y1 + tdy, 0 \leq t \leq 1$$

Where $dx = x2 - x1$ & $dy = y2 - y1$

Algorithm

1. Read 2 endpoints of line as p1 (x1, y1) & p2 (x2, y2).
2. Read 2 corners (left-top & right-bottom) of the clipping window as (xwmin, ywmin, xwmax, ywmax).
3. Calculate values of parameters pi and qi for i = 1, 2, 3, 4 such that

$$p1 = -dx, q1 = x1 - xwmin$$

$$p2 = dx, q2 = xwmax - x1$$



$$p3 = -dy, q3 = y1 - y_{wmin}$$

$$p4 = dy, q4 = y_{wmax} - y1$$

4. if $p_i = 0$ then line is parallel to i th boundary

if $q_i < 0$ then line is completely outside boundary so discard line

else, check whether line is horizontal or vertical and then check the line endpoints with the corresponding boundaries.

5. Initialize $t1$ & $t2$ as

$$t1 = 0 \text{ \& } t2 = 1$$



6. Calculate values for q_i/p_i for $i = 1, 2, 3, 4$.

7. Select values of q_i/p_i where $p_i < 0$ and assign maximum out of them as $t1$.

8. Select values of q_i/p_i where $p_i > 0$ and assign minimum out of them as $t2$.

9. if ($t1 < t2$)

{

$$xx1 = x1 + t1dx$$

$$xx2 = x1 + t2dx$$

$$yy1 = y1 + t1dy$$

$$yy2 = y1 + t2dy$$

$$\text{line}(xx1, yy1, xx2, yy2)$$

}

10. Stop.

Program:



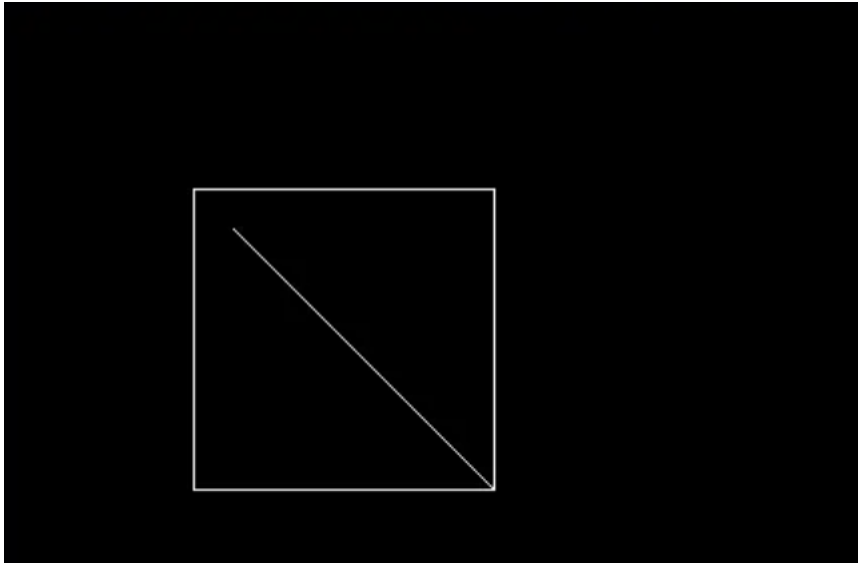
```
#include<stdio.h>
#include<graphics.h>
#include<math.h>
#include<dos.h>

int main()
{
int i,gd=DETECT,gm;
int x1,y1,x2,y2,xmin,xmax,ymin,ymax,xx1,xx2,yy1,yy2,dx,dy;
float t1,t2,p[4],q[4],temp;
x1=120;
y1=120;
x2=300;
y2=300;
xmin=100;
ymin=100;
xmax=250;
ymax=250;
initgraph(&gd,&gm," ");
rectangle(xmin,ymin,xmax,ymax);
dx=x2-x1;
dy=y2-y1;
p[0]=-dx;
p[1]=dx;
p[2]=-dy;
p[3]=dy;
q[0]=x1-xmin;
q[1]=xmax-x1;
q[2]=y1-ymin;
q[3]=ymax-y1;
for(i=0;i<4;i++)
{
if(p[i]==0)
{
printf("line is parallel to one of the clipping boundary");
if(q[i]>=0)
{
if(i<2)
{
if(y1<ymin)
{
y1=ymin;
}
if(y2>ymax)
{
y2=ymax;
}
}
line(x1,y1,x2,y2);
}
```



```
}  
if(i>1)  
{  
if(x1<xmin)  
{  
x1=xmin;  
}  
if(x2>xmax)  
{  
x2=xmax;  
}  
line(x1,y1,x2,y2);  
}  
}  
}  
}  
t1=0;  
t2=1;  
for(i=0;i<4;i++)  
{  
temp=q[i]/p[i];  
if(p[i]<0)  
{  
if(t1<=temp)  
t1=temp;  
}  
else  
{  
if(t2>temp)  
t2=temp;  
}  
}  
if(t1<t2)  
{  
xx1 = x1 + t1 * p[1];  
xx2 = x1 + t2 * p[1];  
yy1 = y1 + t1 * p[3];  
yy2 = y1 + t2 * p[3];  
line(xx1,yy1,xx2,yy2);  
}  
delay(5000);  
closegraph();  
}
```

Output:



Conclusion:

The Liang Barsky algorithm is a computational method used for line clipping, which efficiently determines the intersections between a given line and a rectangular clipping window. It operates by calculating parameter values to define the points where the line enters and exits the window. This algorithm effectively reduces unnecessary calculations by utilizing the parametric representation of lines. By incorporating this approach, the Liang Barsky algorithm significantly enhances the efficiency of line clipping operations, making it a valuable tool for computer graphics and related applications.