



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:

$$x = x_1 + tdx$$

$$y = y_1 + tdy, 0 \leq t \leq 1$$

Where $dx = x_2 - x_1$ & $dy = y_2 - y_1$

Algorithm:

1. Read 2 endpoints of line as $p_1 (x_1, y_1)$ & $p_2 (x_2, y_2)$.
2. Read 2 corners (left-top & right-bottom) of the clipping window as $(x_{wmin}, y_{wmin}, x_{wmax}, y_{wmax})$.
3. Calculate values of parameters p_i and q_i for $i = 1, 2, 3, 4$ such that

$$p_1 = -dx, q_1 = x_1 - x_{wmin}$$

$$p_2 = dx, q_2 = x_{wmax} - x_1$$

$$p_3 = -dy, q_3 = y_1 - y_{wmin}$$

$$p_4 = dy, q_4 = y_{wmax} - y_1$$

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



Vidyavardhini's College of Engineering & Technology

Department of Artificial Intelligence and Data Science

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 t_1 & t_2 as

$t_1 = 0$ & $t_2 = 1$

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 t_1 .

8. Select values of q_i/p_i where $p_i > 0$ and assign minimum out of them as t_2 .

9. if ($t_1 < t_2$)

{

$xx_1 = x_1 + t_1 dx$

$xx_2 = x_1 + t_2 dx$

$yy_1 = y_1 + t_1 dy$

$yy_2 = y_1 + t_2 dy$

line (xx_1, yy_1, xx_2, yy_2)

}

10. Stop.

Program:

```
#include<stdio.h>
#include<graphics.h>
#include<math.h>
#include<dos.h>
int main()
```



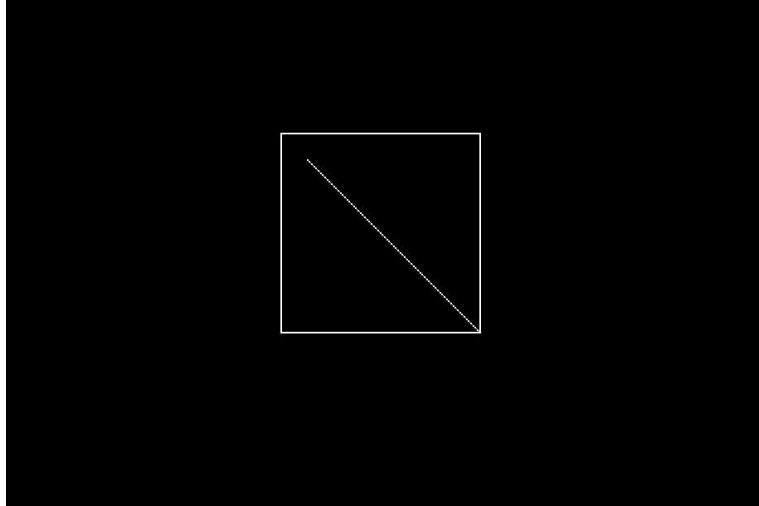
```
{
int i,gd=DETECT,gm;
int x1,y1,x2,y2,xmin,xmax,ymin,ymax,xx1,xx2,yy1,yy2,dx,dy;
float t1,t2,p[4],q[4],temp;
x1=120;
y1=120;
x2=300;
y2=300;
xmin=100;
ymin=100;
xmax=250;
ymax=250;
initgraph(&gd,&gm,"C:\\TurboC3\\BGI ");
rectangle(xmin,ymin,xmax,ymax);
dx=x2-x1;
dy=y2-y1;
p[0]=-dx;
p[1]=dx;
p[2]=-dy;
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[2];
xx2 = x1 + t2 * p[2];
yy1 = y1 + t1 * p[3];
yy2 = y1 + t2 * p[3];
line(xx1,yy1,xx2,yy2);
}
delay(5000);
closegraph();
return 0; }
```



Output:



Conclusion:

In conclusion, the Liang-Barsky algorithm is a powerful and efficient method for line clipping in computer graphics. It provides a systematic way to determine which portion of a line lies within a specified clipping window, helping optimize rendering and improve the visual representation of objects on the screen.

By efficiently discarding portions of lines that are outside the viewing area, it reduces unnecessary computational overhead, making it a valuable tool for real-time graphics applications.