



Vidyavardhini's College of Engineering and Technology

Department of Artificial Intelligence & Data Science

Experiment No. 7
Implement Line Clipping Algorithm: Liang Barsky
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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:

$$x = x_1 + tdx$$

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

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

Algorithm

1. Read 2 endpoints of line as 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

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

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

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

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

4. if $p_i = 0$ then line is parallel to ith 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

$t1 = 0$ & $t2 = 1$



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 ($t1 < t2$)

{

$xx1 = x1 + t1dx$

$xx2 = x1 + t2dx$

$yy1 = y1 + t1dy$

$yy2 = y1 + t2dy$

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,"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)
{
```

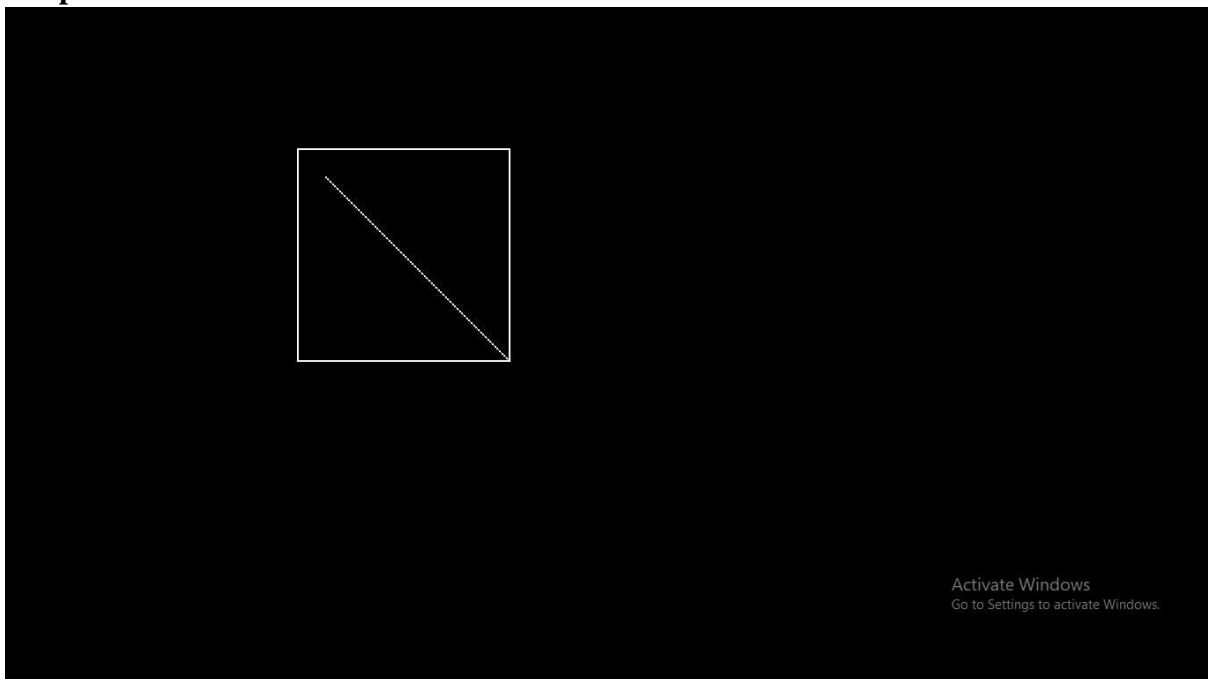


```
x2=xmax;
}
line(x1,y1,x2,y2);
}
}
}
}
t1=0;
t2=1;
for(i=0;i<4;i++)
{
temp=q[i]/p[i];
if(p[i]<0)
{
if(t1<=temp)
t1=temp;
}
else
{
if(t2>temp)
t2=temp;
}
}
if(t1<t2)
{
xx1 = x1 + t1 * p[2];
xx2 = x1 + t2 * p[2];
yy1 = y1 + t1 * p[3];
```



```
yy2 = y1 + t2 * p[3];  
line(xx1,yy1,xx2,yy2);  
}  
delay(5000);  
closegraph();  
return 0;  
}
```

Output:



Conclusion: The Liang-Barsky algorithm is a fundamental clipping technique in computer graphics and CAD, widely used to find the intersections of line segments with rectangular clipping windows. It efficiently discards line segments entirely outside the clipping region, saving computation time.

This algorithm employs parametric calculations, reducing the need for complex square root operations and division, making it computationally efficient. Its robustness ensures accurate results even when dealing with degenerate or near-parallel line segments



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In applications like real-time rendering and large dataset handling, the Liang-Barsky algorithm is highly favored due to its speed and precision. By eliminating unnecessary calculations, it optimizes the rendering process, contributing to smoother and more efficient graphic display. It's a valuable tool for creating visually appealing graphics and CAD designs.