Bresenham Line Drawing Algorithm.

## Theory

Bresenham's line algorithm is an accurate and efficient line drawing algorithm. It uses only integer arithmetic to find the next position to be plotted. It avoids incremental error. The major concept of Bresenham's algorithm is to determine the nearest pixel position. Great advantage of this algorithm is that it can be used to display circles and other curves. In Bresenham's algorithm, we calculate the decision parameter which decides which pixel to select and which function is used for next decision parameter.

For positive slope |m|<1

Pixel positions are determined by sampling at unit x intervals. Starting from left end position (x0, y0) of a given line, we step to each successive column (x-position) and plot the pixel whose scan line y value is closed to the line path. Assuming the pixel at (x, y) to be displayed is determined, we next to decide which pixel to plot in column X+1, our choices are the pixels at positions.

(xk+1, yk) and (xk + 1, yk + 1)

At sampling position xk + 1. we label vertical pixel separations from the mathematical line path d1 and d2. The y-co-ordinate on the mathematical at pixel column position xk + 1 is calculation.

y=m(xk+1)+b

Then.

d₁=y-yk

d₁=m(xk+1)+b-yk

And,

d2 =(yk+1)-y

d2=(yk+1)-m(xk+1)-b

Now,

d1-d₂=m(xk+1)+b-ук-ук -1+m(xk+1)+b

=2m(xk+1)-2yk+2b-1

=2(x+1)-2yk+2b-1

Defining decision parameter pk = Δx(d₁-d2)

Pk =Δx(d1-d₂)=2Δy(xk+1)-2Δxyk+2Δxb - Δx

= 2Δухk +2Δу - 2Δхуk+Δx(2b-1)

= 2Δух-2Δхуk+2Δy+Δx(2b-1)

= 2Δухk-20хуk+c

Pk+1 =2Δухk+1-2Δхуk+!+c

Pk+1 - Pk =2Δу-2Δх(yk+1-yk)

For positive slope |m|>1

Pixel positions are determined by sampling at unit y intervals. Starting from left end position (x0, y0) of a given line, we step to each successive row (y-position) and plot the pixel whose scan line x value is closed to the line path.

Assuming the pixel at (x, y) to be displayed is determined, we next to decide which pixel to plot in rowy+1, our choices are the pixels at positions.

(Xk, yk+1) and (xk + 1, yk+1)

At sampling position yk + 1, we label horizontal pixel separations from the mathematical line path d1 and d₂

The x-co-ordinate on the mathematical at pixel row position yk + 1 is calculation.

As,

Yk+1 = mx +b

x=(yk+1-b)/m

Then,

d₁ = x-xk

And,

d₂=(xk+1)- x

Now,

d1-d2 =2x-2xk-1

x=(yk+1-b)/m

d1-d2=2(yk+1-b)/m-2xk-1

=2Δx (yk+1-b)/ Δy-2xk-1

Δy (d1-d₂)=2Ax yk+2Δx-2Δx b-2Δу хk- Δу

Defining decision parameter pk = Δy (d1-d₂)

Pk=Δy (d1-d₂) = 2Δx yk+2Δx-2Δx b-2Δy xk- Δy = 2Δх уk-2Δу хk+с

Pk+1-Pk=2Δx-2Δy(xk+1-xk)

## BLA Algorithm

Step 1. Start

Step 2. Declare variables x1,y1,x2,y2,1,ly, Δx, Δy,p0, pk,pk+1

Step 3. Read values of x1, y1,x2,y2

Step 4. Calculate Δx = absolute(x2-X1)

Δy = absolute(y2-y1)

Step 5. If (x2>x₁)

assign 1x= 1

else

assign 1x = -1

Step 6. if (y2>y1)

assign 1y = 1

else

assign 1y = -1

Step 7. Plot (x1, y1)

Step 8. if x>Δy (i.е., m<1)

compute p0 = 2Δy-Δx

starting at k = 0 to Δx times, repeat

if (pk<0)

Xk+1=X+1x

Уk+1=Ук

Pk+1=Pk+2Δy

else

Xk+1=Xk+1x

Уk+1=Ук+1y

Pk+1=Pk+2Δy-2Δx

plot(xk+1, Yk+1)

else

calculate p = 2Δх-Δу

starting at k = 0 to Δy times, repeat

if(p<0)

Xk+1=Xk

Уk+1=Ук+1y

Pk+1=Pk+2Δx

else

Xk+1=Xk

Yk+1=Yk+ly

PK+1=Pk+2Δx-2Δу

plot(Xk+1,Yy+1)

Step 9. Stop