(1) CGM Assignment

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→ Bresenham's Line Drawing Algorithm

Initial Coordinates $= (x_k, y_k)$
Next coordinates $= (x_{k+1}, y_{k+1})$
Intersection point b/w y_k & y_{k+1} - y
Assume that the distance b/w y & $y_k = d_1$
The distance b/w y & $y_{k+1} = d_2$

$y = mx + b$
$y = m(x_k + 1) + b \rightarrow (1)$
$d_1 = y - y_k$
$y = m(x_k + 1) + b - y_k$
$d_2 = y_{k+1} - y$
$= y_{k+1} - m(x_k + 1) - b$

Now we calculate $d_1 - d_2$

$(d_1 - d_2) = m(x_k + 1) + b - y_k - y_k - 1 + m(x_k + 1) + b$

We simplify the above equation & replace m with $\Delta y / \Delta x$

$(d_1 - d_2) = 2m(x_k + 1) - 2y_k + 2b - 1$

Multiplying by Δx on both sides

$\Delta x (d_1 - d_2) = \Delta x (2m(x_k + 1) + 2y_k + 2b - 1)$

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We consider $\Delta x(d_1 - d_2)$ as decision parameter P_k

$P_k = \Delta x(d_1 - d_2)$

$P_k = 2\Delta y x_{k+1} + 2\Delta y - 2\Delta x y_{k+1} + \Delta x(2b-1)$

Difference b/w $P_{k+1} - P_k$

$P_{k+1} - P_k = 2\Delta y(x_{k+1} - x_k) - 2\Delta x(y_{k+1} - y_k)$

$P_{k+1} = P_k + 2\Delta y(x_{k+1} - x_k) - 2\Delta x(y_{k+1} - y_k)$

Replacing the value of x_{k+1} when $m>1$ we get

$$P_{k+1} = P_k + 2\Delta y - 2\Delta x(x_{k+1} - x_2)$$

if $P_k >= 0$ (for y coordinate)
then

$y_{k+1} = y_k + 1$

next co-ordinate will be (x_{k+1}, y_{k+1})

if $P_k < 0$
then
$y_{k+1} = y_k$

next coordinate will be (x_{k+1}, y_k)

similarly if $P_k >= 0$

then next coordinate will be (x_{k+1}, y_{k+1})

if $P_k < 0$
then (x_k, y_{k+1})

- Algorithm

1) Start
2) Starting point = B(x_1, y_1) Ending point = (x_2, y_2)
3) Calculate Δx & Δy

$$\Delta x = x_2 - x_1$$

$$\Delta y = y_2 - y_1$$

$$m = \Delta y / \Delta x$$

4) Calculate decision parameter P_K as $P_K = 2\Delta y - \Delta x$
5) Initial coordinate are (x_R, y_R) & next coordinates are (x_{R+1}, y_{R+1})

case 1 if $P_R < 0$

then

$$P_{R+1} = P_R + 2\Delta y$$

$$x_{R+1} = x_{R+1}$$

$$y_{R+1} = y_R$$

case 2 if $P_R >= 0$

then $P_{R+1} = P_R + 2\Delta y - 2\Delta x$

$$x_{R+1} = x_R + 1$$

$$y_{R+1} = y_R + 1$$

6) Repeat 5) until found ending point & total no of interation = $\Delta x - 1$
7) stop.

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