DDA Algorithm

Digital Differential Analyzer (DDA) is a scan-conversion line algorithm based on calculation of either ΔY or ΔX using equation,

$$\Delta Y = m\,\Delta X \text{ ------- (1)}$$

$$\Delta X = \Delta Y / m \text{ ----- (2)}$$

We sample the line at unit interval in one co-ordinate and determine corresponding integer values nearest the line path for other co-ordinates.

Now, consider case with slope m <= 1 then we sample at unit X interval by considering ΔX = 1 & will compute each successive Y value as,

$$\Delta Y = m\,\Delta X$$

$$\Delta Y = m \text{ (B'se } \Delta X = 1)$$

$$Y_{K+1} - Y_k = m$$

(3)---------- $Y_{K+1} = Y_k + m$ And $X_{K+1} = X_k + 1$ ---------- (4)

Here k = 0, 1, 2…….n & m will be any real value between 0 and 1.The calculated value of y must be rounded to the nearest integer.

Now, consider case with slope m > 1 then we will reverse the case by considering ΔY = 1 and will compute successive value of X.

$$\Delta Y = m\,\Delta X$$

$$1 = m\,\Delta X \text{ (B'se } \Delta Y = 1)$$

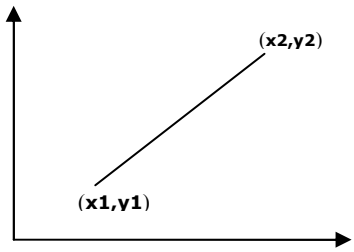
$$1 / m = \Delta X$$

$$X_{K+1} - X_k = 1 / m$$

(5)---------- $X_{K+1} = X_k + 1 / m$ And $Y_{K+1} = Y_k + 1$ ---------- (6)

Equation (3) to (6) are based on assumption that line proceeds from left to right as shown under in Figure-1

Figure – 1



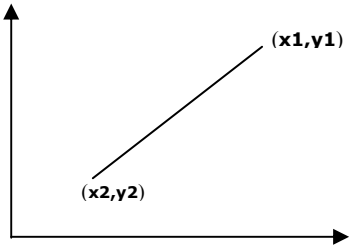


Figure - 2

Now, suppose the processing is reverse means line proceeds from right to left as in figure -2 then for 1st case the equation would become ,

For m <= 1 (Now consider ΔX = -1)

$$\Delta Y = m \Delta X$$

$$\Delta Y = - m \ (B'se \ \Delta X = -1)$$

$$Y_{K+1} - Y_k = - m$$

(7)---------- $Y_{K+1} = Y_k - m$ And $X_{K+1} = X_k - 1$ --------- (8)

Now, suppose m > 1 then we have ΔY = -1

$$\Delta Y = m \Delta X$$

$$-1 = m \Delta X \ (B'se \ \Delta Y = -1)$$

$$-1 / m = \Delta X$$

$$X_{K+1} - X_k = -1 / m$$

(9)---------- $X_{K+1} = X_k - 1 / m$ And $Y_{K+1} = Y_k - 1$ --------- (10)

Equation (3) to (10) can also be used to calculate line with –ve slope by considering absolute value of slope |m|

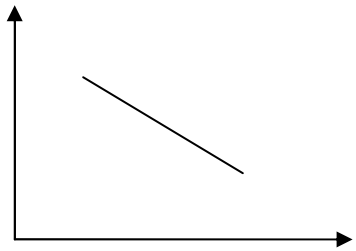


Figure with –ve slope line

For, slope |m| <= 1 then use equation (3) to (6) (no of columns more so X unit Incr/Decr)
For, slope |m| > 1 then use equation (7) to (10) (no of rows more so Y unit Incr/Decr)

The only disadvantage of DDA is it drifts away line from original position and that happens because of rounding operation while plotting a point on screen, otherwise it is faster than other line drawing algorithm (Bresnham line drawing Algorithm).