Simple DDA

$y = mx + b$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{dy}{dx} = \frac{\Delta y}{\Delta x}$$

Now check m (slope)

If $m \leq 1$	$m > 1$
$x = x + 1$	$y = y + 1$
$y = y + m$ (old value)	$x = x + \frac{1}{m}$

This method is not so lengthy but floating point values is there.

Incremental DDA (To solve floating point problem)

find $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{dy}{dx} = \frac{\Delta y}{\Delta x}$.

$y_2 - y_1 = dy$

$x_2 - x_1 = dx$

$x = x + x_{inc}$

$y = y + y_{inc}$

common to both cases.

To find x_{inc} & y_{inc}

$x_{inc} = dx / steps$

$y_{inc} = dy / steps$

Cases	If $m \leq 1$	$m > 1$
	steps = dx	steps = dy

Simple DDA

⇒ $(x_1, y_1) = 4, 5$ $\quad (x_2, y_2) = (13, 12)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{12-5}{13-4} = \frac{7}{9} = 0.77 < 1$$

when $m \leq 1$

$$x_{k+1} = x + 1$$
$$y_{k+1} = y + m$$

x	y	x_{next}	y_{next}
4	5	4	5
$x_{next} = 4+1 = 5$	$y_{next} = 5 + 0.77 = 5.77$	5	6
$x_{next} = 5+1 = 6$	$y_{next} = y + m = 5.77 + .77 = 6.54$	6	7
$x_{next} = 6+1 = 7$	$y_{next} = 6.54 + .77 = 7.31$	7	7
$x_{next} = 7+1 = 8$	$y_{next} = 7.31 + .77 = 8.08$	8	8
$x_{next} = 8+1 = 9$	$y_{next} = 8.08 + .77 = 8.85$	9	9
$x_{next} = 9+1 = 10$	$y_{next} = 8.85 + .77 = 9.62$	10	10
$x_{next} = 10+1 = 11$	$y_{next} = 9.62 + .77 = 10.39$	11	10
$x_{next} = 11+1 = 12$	$y_{next} = 10.39 + .77 = 11.16$	12	11
$x_{next} = 12+1 = 13$	$y_{next} = 11.16 + .77 = 11.93$	13	12

Q pts are (1,1) and (4,3) using ~~Incremental~~ simple DDA Algo?

$$m = \frac{3-1}{4-1} = \frac{2}{3} = 0.66 < 1$$

$m < 1$

$x_{k+1} = x_{k+1}$

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

x	y	x_{next}	y_{next}
1	1	1	1
1+1=2	1+.66 =1.66	2	2
2+1=3	1.66+.66 = 2.32	3	2
3+1=4	2.32+.66 = 2.98	4	3
~~4+1=5~~	2.98+.66 = 3.64	~~4~~	

Simple DDA Algorithm

1. Slope of line is $m = \frac{y_2 - y_1}{x_2 - x_1}$

$$\therefore m = \frac{\Delta y}{\Delta x}$$

2. The algorithm based on the calculation of values Δx & Δy.

$$\therefore \Delta y = m \cdot \Delta x \quad — (1)$$

$$\Delta x = \Delta y / m \quad — (2)$$

3. Given line have the slope +ve or -ve
4. If slope is +ve, then Δx & Δy values are increased else Δx & Δy values are decreased.
5. If the +ve value of slope $|m| \leq 1$, we set-

$\Delta x = x_{k+1}$ & next y point is

$$y_{k+1} = y_k + m \quad — (3)$$

6. So, value of Y is also converted into integer
7. If the +ve value of slope $|m| > 1$, we get

$\Delta y = y_{k+1}$

$$x_{k+1} = x_k + (1/m) \quad — (4)$$

8. So, above two eq^{n}s are used those lines whose end points are left to right
9. If the lines from right to left, then X & Y values are decreased
10. so the eq^n are when $(m \leq 1) \Rightarrow x = x - 1$ & $y_{k+1} = y_k - m$ — (5)

when $(m > 1) \Rightarrow y = y - 1$, $x_{k+1} = x_k - (1/m)$ — (6).

11. Stop

Incremental DDA

$(x_1, y_1) = (1, 1)$

$(x_2, y_2) = (8, 5)$

Find $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x} = \frac{dy}{dx} = \frac{5-1}{8-1} = \frac{4}{7} = 0.57 < 1$

(1) $m = 0.57$, $\Delta y = 4$, $\Delta x = 7$.

(2) $m < 1$

Steps $= dx = \Delta x = 7$ $\quad k = 7$ iteration

(3) $x_{inc} = \frac{dx}{steps} = \frac{dx}{dx} = \frac{7}{7} = 1$

$y_{inc} = \frac{dy}{steps} = \frac{dy}{dx} = \frac{4}{7} = 0.57$

(4) $x_{next} = x + x_{inc} = 1 + 1 = 2$ $\quad y_{next} = y + y_{inc} = 1 + 0.57 = 1.57$ $\quad (2, 1.57)$

Steps	Starting pt.	New pts.	Final pts.
1.	(1,1)	(2, 1.57)	(2,2)
2.	(2, 1.57)	$x_{next} = 2+1 = 3$, $y_{next} = 1.57 + .57 = 2.14$ (3, 2.14)	(3,2)
3.	(3, 2.14)	$x_{next} = 3+1 = 4$, $y_{next} = 2.14 + .57 = 2.71$ (4, 2.71)	(4,3)
4.	(4, 2.71)	$x_{next} = 4+1 = 5$, $y_{next} = 2.71 + .57 = 3.28$ (5, 3.28)	(5,3)
5.	(5, 3.28)	$x_{next} = 5+1 = 6$, $y_{next} = 3.28 + .57 = 3.85$ (6, 3.85)	(6,4)
6.	(6, 3.85)	$x_{next} = 6+1 = 7$, $y_{next} = 3.85 + .57 = 4.42$ (7, 4.42)	(7,4)
7.	(7, 4.42)	$x_{next} = 7+1 = 8$, $y_{next} = 4.42 + .57 = 4.99$ (8, 4.99)	(8,5) final pt.

Incremental DDA

Consider line AB with A(0,0) and B(8,4) apply DDA algorithm & Calculate pixels on this line.

step1 Initial point (0,0) end point (8,4)

step2 $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x} = \frac{4-0}{8-0} = \frac{4}{8} = \frac{1}{2} < 1$

$m = 0.5$, $\Delta y = 4$, $\Delta x = 8$.

$m < 1$

step 3 steps = dx = Δx = 8 K=8 iteration

step 4 $x_{inc} = \frac{dx}{steps} = \frac{dx}{dx} = \frac{8}{8} = 1$

$y_{inc} = dy/steps = \frac{dy}{dx} = \frac{4}{8} = 0.5$

step 5 putpixel (0,0,1) color

step 6 $x_{next} = x + x_{inc}$

$= 0 + 1$

$= 1$

$y_{next} = y + y_{inc}$

$y = 0 + 0.5 = 0.5$

$y = 0.5$ (1, 0.5)

$x_{next} = (x + x_{inc})$ @, $y_{next} = y + y_{inc}$

$= 1 + 1$, $y = 0.5 + 0.5 = 1$

$= (2, 1)$

$x_{next} = 2 + 1$ $y_{next} = 1 + 0.5 = 1.5$

$= (3, 1.5)$

$x_{next} = 3 + 1$ $y_{next} = 1.5 + 0.5$

(4,2) $= 2$

$x_{next} = 4 + 1$ $y_{next} = 2 + 0.5$

5 $= 2.5$ (5, 2.5)

(6,3)
(7,3.5)
(8,4)

steps	starting pt	New pt	(rounded pt)
1	(0,0) initial pt	(1,0.5)	(1,1)
2	(1,0.5)	(2,1)	(2,1)
3.	(2,1)	(3,1.5)	(3,2)
4.	(3,2)	(4,2)	(4,2)
5.	(4,2)	(5,2.5)	(5,3)
6	(5,2.5)	(6,3)	(6,3)
7	(6,3)	(7,3.5)	(7,4)
8	(7,3.5)	(8,4)	(8,4) last point.