Drawback of DDA :-

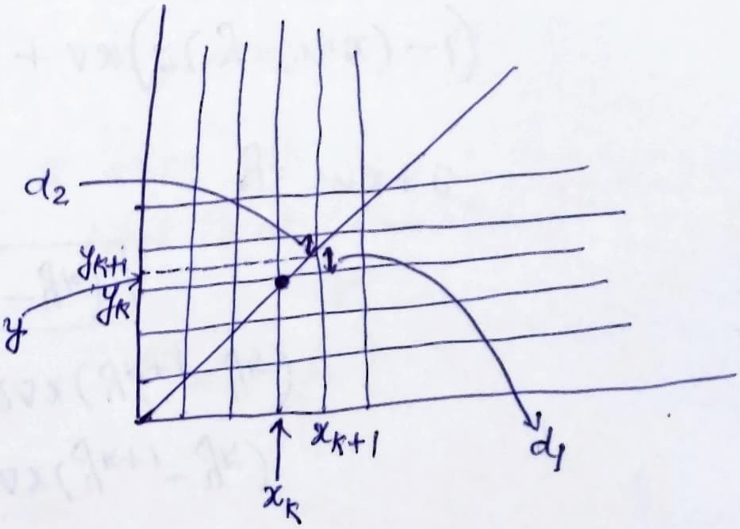
for every eq^n we have to use $\underline{\text{Round fu}^n}$
avoid

Bresenham's Algo :-

I : When $m < 1$

x_{k+1} — unit interval

$y_{k+1} \rightarrow ?$



II : $m > 1$

$y_{k+1} \rightarrow$ unit interval

$x_{k+1} \rightarrow ?$

III : $m = 1$

$x_{k+1} \rightarrow$ unit interval, and

$y_{k+1} \rightarrow$ unit interval

Let $m < 1$ (case I)

$$y = mx + c$$

$$\cancel{y_{k+1} = m(x_{k+1}) + c}$$

$$\boxed{y = m(x_k + 1) + C} \quad \text{——— (1)}$$

Decision Parameter (P_k) = $\Delta x (d_1 - d_2)$ to select y_k OR y_{k+1}

$d_1 = y - y_k$

$d_1 = m(x_k+1) + c - y_k$

$d_2 = y_{k+1} - y$

$d_2 = y_k + 1 - [m(x_k+1) + c]$

$d_1 - d_2 = m(x_k+1) + c - y_k - [y_k + 1 - [m(x_k+1) + c]]$

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

$\Delta x(d_1 - d_2) = \Delta x\left[2\frac{\Delta y}{\Delta x}(x_k+1) - 2y_k + 2c - 1\right]$

Initial decision Parameter $= 2\Delta y(x_k+1) - 2\Delta x y_k + 2\Delta x c - \Delta x$

$$\boxed{P_k = 2\Delta y x_k + 2\Delta y - 2\Delta x y_k + \Delta x(2c-1)}$$

put value of c here

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

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

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

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

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

put value of c in P_k $\qquad y = mx + c$

$P_k = 2\Delta y x_k + 2\Delta y - 2\Delta x y_k + \Delta x(2(y - mx) - 1)$

$= 2\Delta y x_k + 2\Delta y - 2\Delta x y_k + 2\Delta x y - 2\Delta x m(x) - \Delta x$

$= 2\Delta y x_k + 2\Delta y - 2\Delta x y_k + 2\Delta x y - 2\cancel{\Delta x}\frac{\Delta y}{\cancel{\Delta x}} \cdot x - \Delta x$

$= 2\Delta y x_k + 2\Delta y - 2\Delta x y_k + 2\Delta x y - 2\Delta y x - \Delta x$

$= \cancel{2\Delta y x_k} + 2\Delta y - \cancel{2\Delta x y_k} + \cancel{2\Delta x y_k} - \cancel{2\Delta y x_k} - \Delta x$

$$\boxed{P_k = 2\Delta y - \Delta x}$$ Initially

and

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

Decision:

If $P_k \geq 0$

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

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

Nextpoint (x_{k+1}, y_{k+1})

$\Downarrow$

$(x_k + 1, y_k + 1)$

If $P_k < 0$

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

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

Next Point (x_{k+1}, y_{k+1})

$\Downarrow$

$(x_k + 1, y_k)$

Similarly if m is greater than 1 ($m > 1$)
replace $x \leftrightarrow y$

$$\boxed{P_k = 2\Delta x - \Delta y}$$

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

Decision:

If $P_k \geq 0$

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

$\Rightarrow x_{k+1} = x_k + 1$

Next point

(x_{k+1}, y_{k+1})

$\Downarrow$

$(x_k + 1, y_k + 1)$

If $P_k < 0$

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

$x_{k+1} = x_k$

Next Point

(x_{k+1}, y_{k+1})

$\Downarrow$

(x_k, y_{k+1})

ex- $m>1$

$(1,1)$ ———— $(6,7)$

$m = \frac{7-1}{6-1} = \frac{6}{5} = 1.2 > 1$

$\Delta x = 6-1 = 5 \quad 2\Delta x = 10$

$\Delta y = 7-1 = 6 \quad 2\Delta y = 12$

When $m>1$

$P_k = 2\Delta x - \Delta y$

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

If $P_k \geq 0 \Rightarrow x_{k+1} = x_k + 1$

If $P_k < 0 \Rightarrow x_{k+1} = x_k$

$P_k = 2\Delta x - \Delta y$
$= 10 - 6 = 4 > 0$

k(iteration)	(x_k, y_k)	P_k	(x_{k+1}, y_{k+1})
1:	$(1,1)$	4	$(2,2)$

$P_{k+1} = P_k + 2\Delta x - 2\Delta y(x_{k+1} - x_k)$
$= 4 + 10 - 12(2-1)$
$= 14 - 12$
$= 2 > 0$

2:	$(2,2)$	2	$(3,3)$

$P_{k+1} = 2 + 10 - 12(3-2)$
$= 12 - 12 = 0$

3:	$(3,3)$	0	$(4,4)$

$P_{k+1} = 0 + 10 - 12(4-3)$
$= -2 < 0$

4:	$(4,4)$	-2	$(4,5)$

$P_{k+1} = -2 + 10 - 12(4-4)$
$= 8 > 0$

5:	$(4,5)$	8	$(5,6)$

$P_{K+1} = 8+10-12(5-4)$
$= 18-12$
$= 6 > 0$

6: (5,6) 6 (6,7)

(1,1)(2,2)(3,3)(4,4)(4,5)(5,6)(6,7)

Que:- (1,1) — (8,6)
(1,1)(2,2)(3,2)(4,3)(5,3)(6,4)(7,5),(8,6)

ex- (35,40) — (43,45)

$m = \frac{45-40}{43-35} = \frac{5}{8} = 0.6 < 1$

$\Delta x = 43-35$
$= 8$
$2\Delta x = 16$
$\Delta y = 45-40$
$= 5$
$2\Delta y = 10$

So $P_K = 2\Delta y - \Delta x$

$P_{K+1} = P_K + 2\Delta y - 2\Delta x(y_{K+1} - y_K)$

If $P_K \geq 0 \Rightarrow y_{K+1} = y_K + 1$

N.C.$= (x_{K+1}, y_{K+1})$

$P_K < 0 \Rightarrow y_{K+1} = y_K$

N.C.$= (x_{K+1}, y_K)$

Initial Parameter

$P_K = 2\Delta y - \Delta x = 10 - 8 = 2 > 0$

K	(x_K, y_K)	P_K	(x_{K+1}, y_{K+1})
1	(35,40)	2	(36,41)

$P_{K+1} = P_K + 2\Delta y - 2\Delta x(y_{K+1} - y_K)$
$= 2 + 10 - 16(41-40)$
$= 12 - 16 = -4 < 0$

2	(36,41)	-4	(37,41)

$P_{K+1} = -4 + 10 - 16(41-41)$
$= 6 > 0$

3	(37,41)	6	(38,42)

$$P_{k+1} = 6+10-16(42-41)$$
$$= 16-16 = 0$$

4. (38,42) $\quad 0 \quad$ (39,43)

$$P_{k+1} = 0+10-16(43-42)$$
$$= 10-16 = -6 > 0$$

5 (39,43) $\quad -6 \quad$ (40,43)

$$P_{k+1} = -6+10-16(43-43)$$
$$= -6+10 = 4 > 0$$

6 (40,43) $\quad 4 \quad$ (41,44)

$$P_{k+1} = 4+10-16(44-43)$$
$$= 14-16$$
$$= -2 < 0$$

7 (41,44) $\quad -2 \quad$ (42,44)

$$P_{k+1} = -2+10-16(44-44)$$
$$= 8 > 0$$

8 (42,44) $\quad 8 \quad$ (43,45)

~~40,43~~ (35,40)(36,41)(37,41)(38,42)(39,43)(40,43)(41,44)
(42,44)(43,45)

Que:- Generate the intermediate Points using BLDA b/w two end points (3,2) and (4,6)