

# Bresenham Line Drawing Algorithm

Procedure-

Given-

- Starting coordinates = (X1, Y1)
- Ending coordinates = (X2, Y2)

The points generation using Bresenham Line Drawing Algorithm involves the following steps-

## Step-01:

Calculate  $\Delta X$  and  $\Delta Y$  from the given input.

These parameters are calculated as-

- $\Delta X = X2 - X1$
- $\Delta Y = Y2 - Y1$

## Step-02:

Calculate the decision parameter  $P_k$ .

It is calculated as-

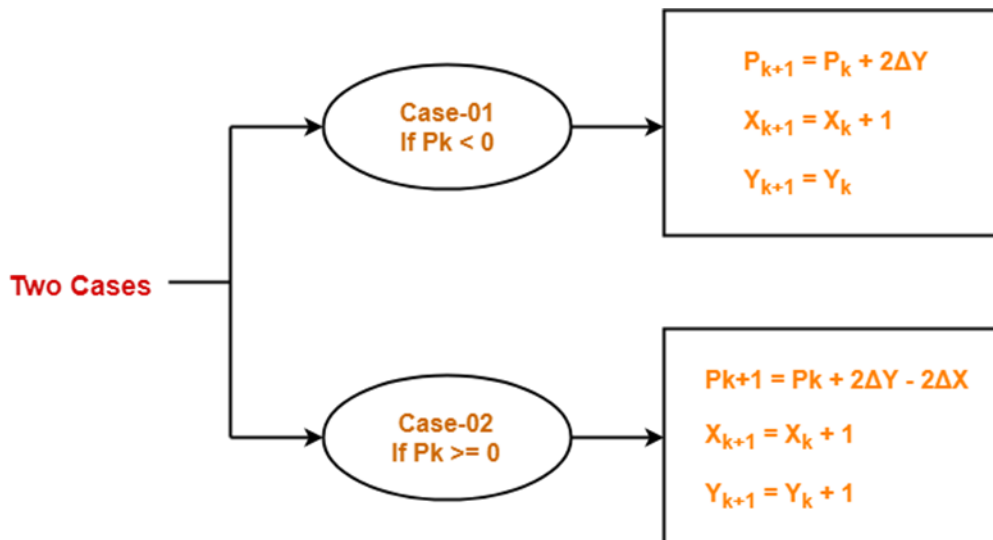
$$P_k = 2\Delta Y - \Delta X$$

## Step-03:

Suppose the current point is (Xk, Yk) and the next point is (Xk+1, Yk+1).

Find the next point depending on the value of decision parameter  $P_k$ .

Follow the below two cases-



## Step-04:

Keep repeating Step-03 until the end point is reached or number of iterations equals to  $(\Delta X - 1)$  times.

## PRACTICE PROBLEMS BASED ON BRESENHAM LINE DRAWING ALGORITHM-

### **Problem-01:**

Calculate the points between the starting coordinates (9, 18) and ending coordinates (14, 22).

Solution-

Given-

- Starting coordinates =  $(X_1, Y_1) = (9, 18)$
- Ending coordinates =  $(X_2, Y_2) = (14, 22)$

#### **Step-01:**

Calculate  $\Delta X$  and  $\Delta Y$  from the given input.

- $\Delta X = X_2 - X_1 = 14 - 9 = 5$
- $\Delta Y = Y_2 - Y_1 = 22 - 18 = 4$

#### **Step-02:**

Calculate the decision parameter.

$$P_k = 2\Delta Y - \Delta X$$

$$= 2 \times 4 - 5$$

$$= 3$$

So, decision parameter  $P_k = 3$

#### **Step-03:**

As  $P_k \geq 0$ , so case-02 is satisfied.

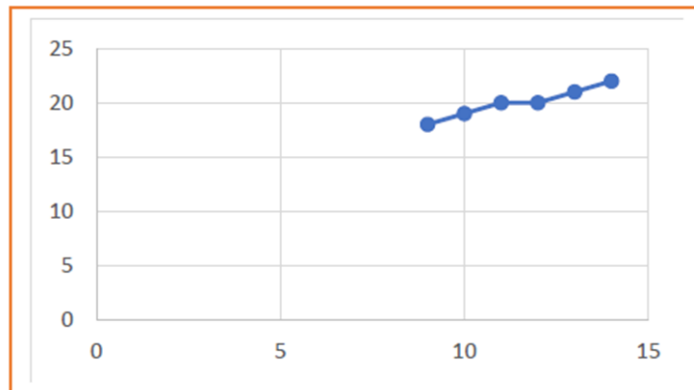
Thus,

- $P_{k+1} = P_k + 2\Delta Y - 2\Delta X = 3 + (2 \times 4) - (2 \times 5) = 1$
- $X_{k+1} = X_k + 1 = 9 + 1 = 10$
- $Y_{k+1} = Y_k + 1 = 18 + 1 = 19$

Similarly, Step-03 is executed until the end point is reached or number of iterations equals to 4 times.

(Number of iterations =  $\Delta X - 1 = 5 - 1 = 4$ )

$P_k$	$P_{k+1}$	$X_{k+1}$	$Y_{k+1}$
		9	18
3	1	10	19
1	-1	11	20
-1	7	12	20
7	5	13	21
5	3	14	22



### **Problem-02:**

Calculate the points between the starting coordinates (20, 10) and ending coordinates (30, 18).

Solution-

Given-

- Starting coordinates =  $(X_1, Y_1) = (20, 10)$
- Ending coordinates =  $(X_2, Y_2) = (30, 18)$

Step-01:

Calculate  $\Delta X$  and  $\Delta Y$  from the given input.

- $\Delta X = X_2 - X_1 = 30 - 20 = 10$
- $\Delta Y = Y_2 - Y_1 = 18 - 10 = 8$

Step-02:

Calculate the decision parameter.

$$P_k = 2\Delta Y - \Delta X$$

$$= 2 \times 8 - 10$$

$$= 6$$

So, decision parameter  $P_k = 6$

Step-03:

As  $P_k \geq 0$ , so case-02 is satisfied.

Thus,

- $P_{k+1} = P_k + 2\Delta Y - 2\Delta X = 6 + (2 \times 8) - (2 \times 10) = 2$
- $X_{k+1} = X_k + 1 = 20 + 1 = 21$
- $Y_{k+1} = Y_k + 1 = 10 + 1 = 11$

Similarly, Step-03 is executed until the end point is reached or number of iterations equals to 9 times.  
(Number of iterations =  $\Delta X - 1 = 10 - 1 = 9$ )

$P_k$	$P_{k+1}$	$X_{k+1}$	$Y_{k+1}$
		20	10
6	2	21	11
2	-2	22	12
-2	14	23	12
14	10	24	13
10	6	25	14
6	2	26	15
2	-2	27	16
-2	14	28	16
14	10	29	17
10	6	30	18

