
Algorithm 1 Bresenham - Straight Line

Draw a line segment from (x_0, y_0) to (x_1, y_1) , two points with integer coordinates.

Ensure: $x_0, y_0, x_1, y_1 \in \mathbb{Z}$, $x_0 < x_1$, $0 \leq y_1 - y_0 \leq x_1 - x_0$.

```
1:  $x \leftarrow x_0$ 
2:  $y \leftarrow y_0$ 
3:  $a \leftarrow x_1 - x_0$ 
4:  $b \leftarrow y_1 - y_0$   $\{0 \leq b \leq a\}$ 
5:  $output(x, y)$ 
6:  $d \leftarrow 0$   $\{d = a(y - y_0) - b(x - x_0)\}$ 
7: while  $x \leq x_1$  do
8:    $x \leftarrow x + 1$ 
9:    $d \leftarrow d - b$ 
10:  if  $2 * d < a$  then
11:     $y \leftarrow y + 1$ 
12:     $d \leftarrow d + a$ 
13:  end if
14:   $output(x, y)$ 
15: end while
```

Algorithm 2 Bresenham - Circle

Draw first quadrant of circle $x^2 + y^2 = r^2$, $0 \leq x \leq r$, $y \geq 0$.

Ensure: $r \in \mathbb{Z}$, $r \geq 1$.

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1:  $x \leftarrow r$ 
2:  $y \leftarrow 0$ 
3:  $d \leftarrow 0$   $\{d = x^2 + y^2 - r^2\}$ 
4:  $output8(x, y)$ 
5: while  $x < y$  do
6:    $output(x, y)$ 
7:    $x \leftarrow x + 1$ 
8:    $d \leftarrow d + 2 * x + 1$ 
9:   if  $d > y$  then
10:     $y \leftarrow y - 1$ 
11:     $d \leftarrow d - 2 * y + 1$ 
12:   end if
13: end while
```
