Computer Graphics

Midpoint Circle Algorithm

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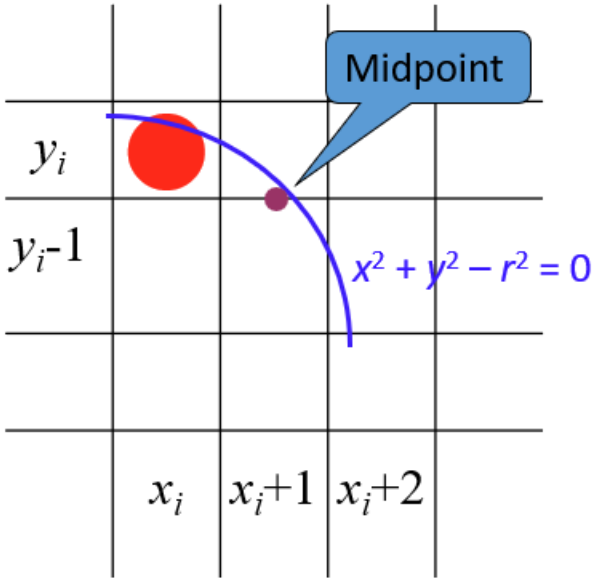
Midpoint Circle Algorithm

- Given the Center point and radius of circle-
- Mid-Point Circle Drawing Algorithm attempts to generate the points of one octant.
- The points for other octants are generated using the eight-symmetry property.



Assuming that we have just plotted the pixels at (x_i, y_i).

Which is next? (x_i+1, y_i) OR $(x_i+1, y_i - 1)$.

- The one that is closer to the circle.

Midpoint Circle Algorithm

- The decision parameter is the circle at the midpoint between the pixels y_i and $y_i - 1$.

$$p_i = f_{circle}(x_i + 1, y_i - \tfrac{1}{2})$$
$$= (x_i + 1)^2 + (y_i - \tfrac{1}{2})^2 - r^2$$

- Decision Parameter: $p_0 = 1 - r$
- If $p_i < 0$, the midpoint is inside the circle and the pixel y_i is closer to the circle boundary.
- If $p_i \geq 0$, the midpoint is outside the circle and the pixel y_i - 1 is closer to the circle boundary.

The Algorithm

- **Step1:** Put x =0, y =r
  We have p=1-r
- **Step2:** Repeat steps while x ≤ y
  Plot (x, y)
  If (p<0)
  Then set: p = p + 2x + 3
  Else
  p = p + 2(x-y)+5
  y =y - 1
  x =x+1 (end loop)
- **Step3:** End

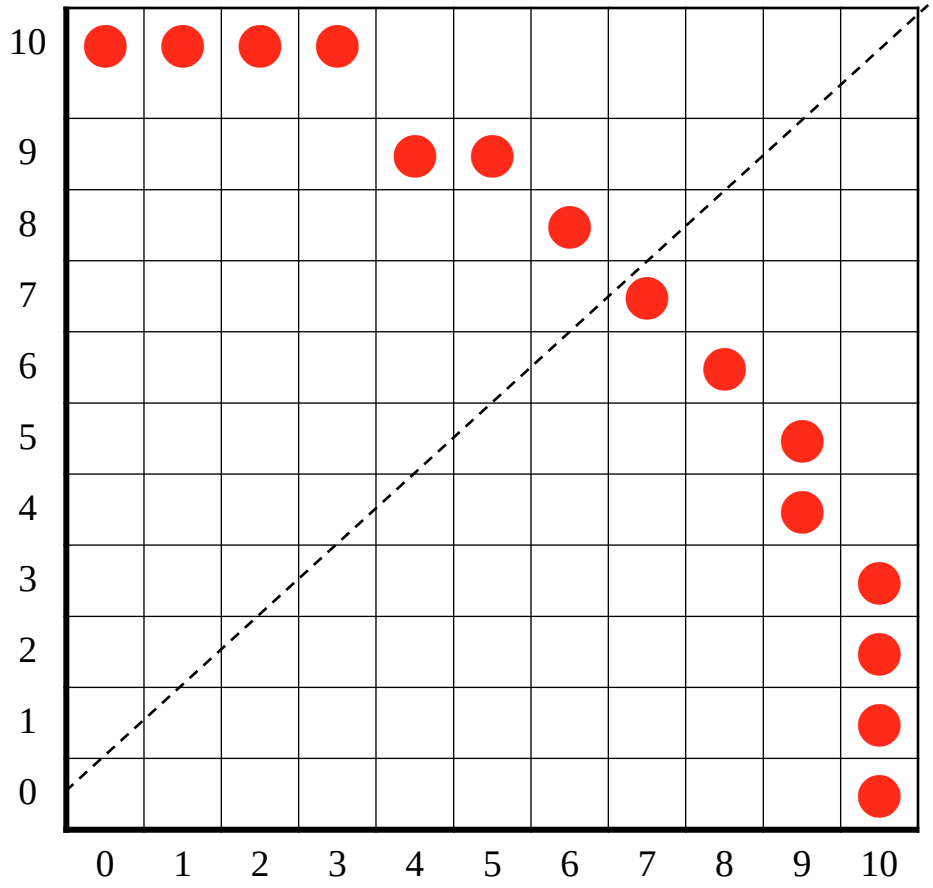
Example-01

$r = 10$

$p_0 = 1 - r = -9$

Initial point $(x_0, y_0) = (0, 10)$

i	P	(x_i, y_i)
0	-9	(0,10)
1	-6	(1,10)
2	-1	(2,10)
3	6	(3,10)
4	-3	(4,9)
5	8	(5,9)
6	5	(6,8)
7	6	(7,7)



Practice

Given the center point coordinates (4, -4) and radius as 10, generate all the points to form a circle.