ICT 4203
Computer Graphics and Animation

Lecture 05
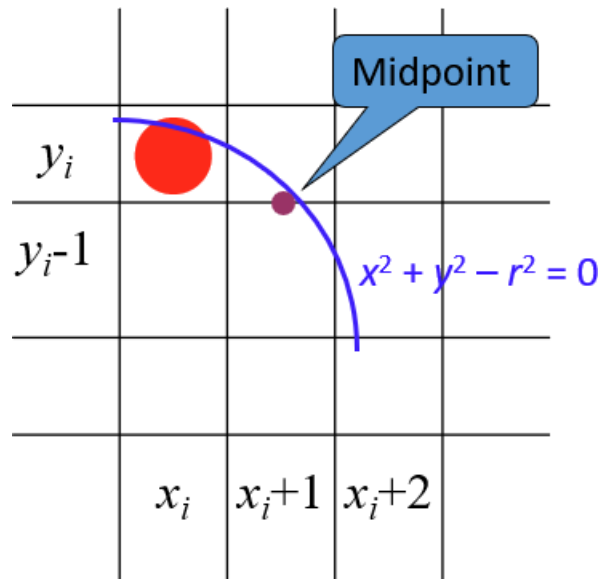Midpoint Circle Algorithm

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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 $y_i - 1$.

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

- 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
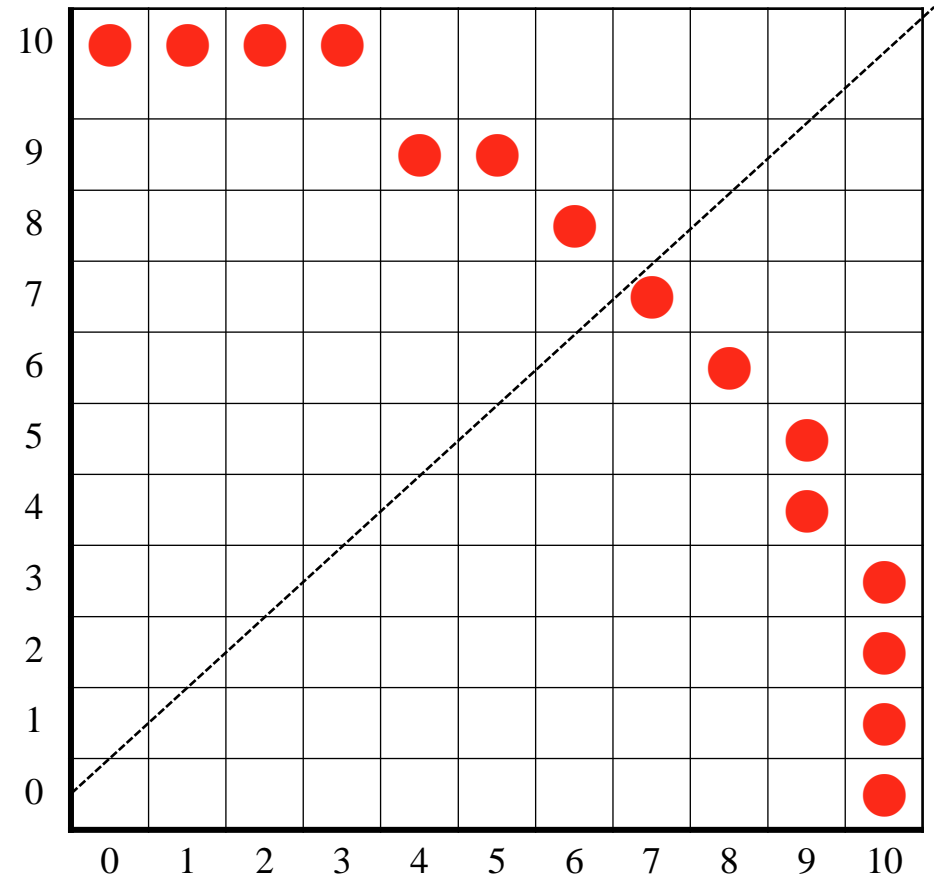
Example-01

$r = 10$
$p_0 = 1 - r = -9$
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.