

BSc Computer Science

CS1541 Computer Graphics

MODULE I

BRESENHAM'S CIRCLE DRAWING METHOD

Prepared by

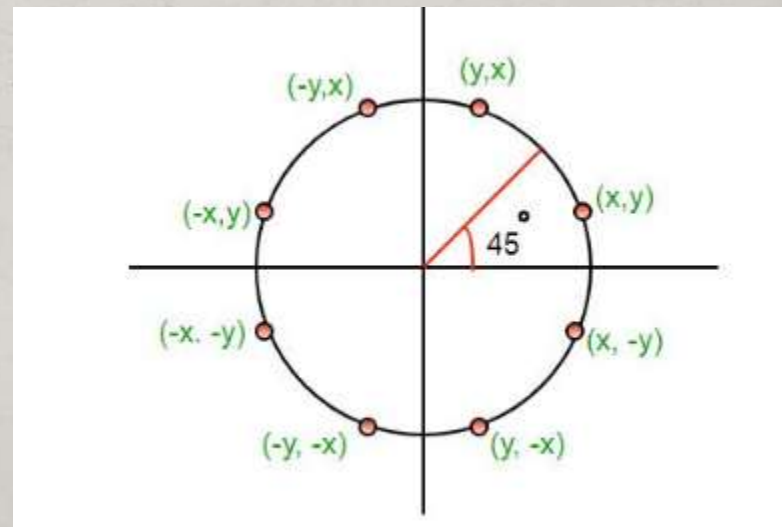
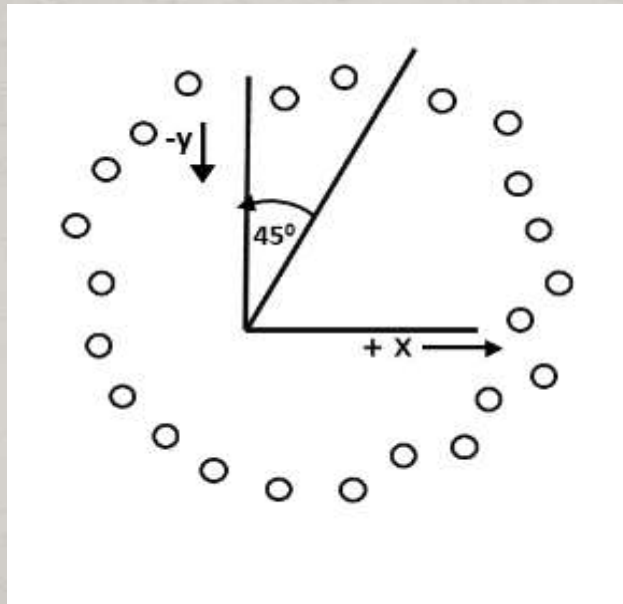
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Overview

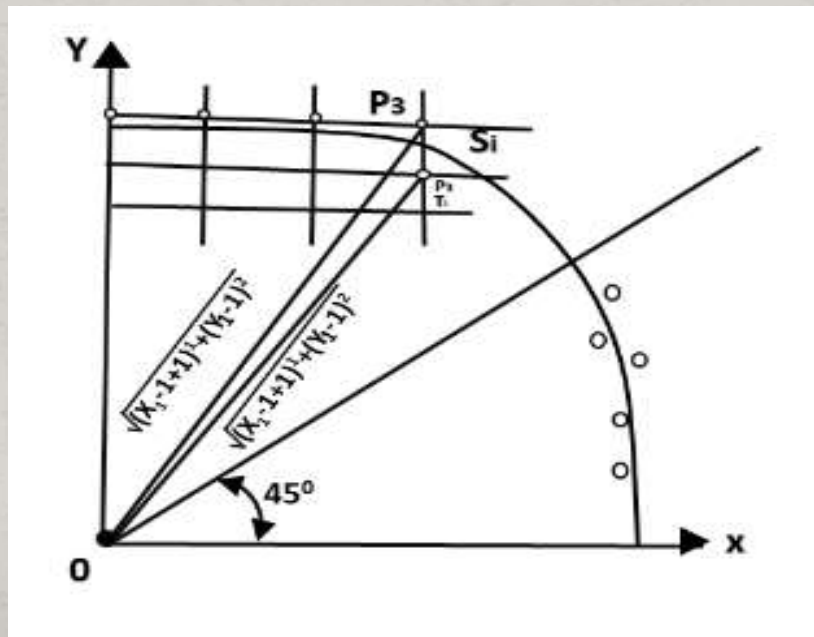
Points are generated from 90° to 45° , moves will be made only in the $+x$ & $-y$ directions.

The best approximation of the true circle will be described by those pixels in the raster that falls the least distance from the true circle.



Basic Principle

- generate the points from 90° to 45° .
- Each new point closest to the true circle can be found by taking either of two actions.
 - Move in the x-direction one unit or
 - Move in the x- direction one unit & move in the negative y-direction one unit.



The Method

□ $D(S_i)$ is the distance from the origin to the true circle squared minus the distance to point P3 squared.

□ $D(T_i)$ is the distance from the origin to the true circle squared minus the distance to point P2 squared.

$$D(S_i) = (x_{i-1} + 1)^2 + y_{i-1}^2 - r^2$$

$$D(T_i) = (x_{i-1} + 1)^2 + (y_{i-1} - 1)^2 - r^2$$

$$d_i = D(S_i) + D(T_i) = (x_{i-1} + 1)^2 + y_{i-1}^2 - r^2 + (x_{i-1} + 1)^2 + (y_{i-1} - 1)^2 - r^2$$

From this equation, we can drive initial values of d_i as
If it is assumed that the circle is centered at the origin, then at the first step $x = 0$ & $y = r$.

The Method

Therefore,

$$\begin{aligned}d_i &= (0+1)^2 + r^2 - r^2 + (0+1)^2 + (r-1)^2 - r^2 \\&= 1+1+r^2-2r+1-r^2 \\&= 3 - 2r\end{aligned}$$

Thereafter, if $d_i < 0$, then only x is incremented.

$x_{i+1} = x_i + 1$ $d_{i+1} = d_i + 4x_i + 6$ if $d_i \geq 0$, then x & y are incremented

$x_{i+1} = x_i + 1$ $y_{i+1} = y_i + 1$
 $d_{i+1} = d_i + 4(x_i - y_i) + 10$

Algorithm

Algorithm BresenCircle(X_0, Y_0, R)

[Draw a circle with center (X_0, Y_0) and radius R]

Step 1: [Initialize]

$X \leftarrow 0$ $Y \leftarrow R$ $P \leftarrow 3-2*R$

Step 2: [Plot 8 symmetric points at each step]

Repeat while $X \leq Y$

Plot($X_0 + X, Y_0 + Y$), Plot($X_0 + Y, Y_0 + X$),

Plot($X_0 - Y, Y_0 + X$), Plot($X_0 - X, Y_0 + Y$),

Plot($X_0 - X, Y_0 - Y$), Plot($X_0 - Y, Y_0 - X$),

Plot($X_0 + Y, Y_0 - X$), Plot($X_0 + X, Y_0 - Y$)

$X \leftarrow X+1$

If ($P < 0$)

$P \leftarrow P + 4 * X + 6$

else

$Y \leftarrow Y - 1$

$P \leftarrow P + 4 * (X - Y) + 10$

Endif

End Repeat

Step 3 : [Finished]

Return

Example

Origin (X₀,Y₀) → (50,50) and Radius R→15

Step	X	Y	P	Output
1	0	15	-27	(50, 65), (65,50), (35,50), (50,65), (50,35), (35,50), (65,50), (50, 35)
2	1	15	-17	
3	2	15	-3	
4	3	15	15	
5	4	14	-15	
6	5	14	11	
7	6	13	-7	
8	7	13	27	
9	8	12	21	
10	9	11	23	
11	10	10	33	

Thank You