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Informatika B

1. Dik : A (2,5)
radius : 13
Dit : Pembuatan lingkaran dengan algoritma bressenham mid point algorithm!
Jawab :
-> ($x = x.x_2$, $y = y.y_2$)
x_0, y_0 = (0, 13) (x_2, y_2) = (2,5) initial point

-> $P_0 = 1 - r$
$= 1 - 13 = -12$
-> $P_k < 0$: plot $(x_k + 1, y_k)$
↳ $P_{k+1} = P_k + 2(x_k + 1) + 1$
$P_k \geq 0$: plot $(x_k + 1, y_k - 1)$
↳ $P_{k+1} = P_k + 2(x_k + 1) + 1 - 2(y_k - 1)$

-> Menentukan Pixel
$k = 0$, $P_0 = -12$, (1, 13)
$k = 1$, $P_1 = P_0 + 2(x + 1) + 1$
$= -12 + 2(0 + 1) + 1$
$= -9$, (2, 13)
$k = 2$, $P_2 = -9 + 2(1 + 1) + 1$
$= -4$, (3, 13)
$k = 3$, $P_3 = -4 + 2(2 + 1) + 1$ → $P_2 + 2(x_2 + 1) + 1$
$= 3$, (4, 12)
$k = 4$, $P_4 = 3 + 2(3 + 1) + 1 - 2(13 - 1)$ → $P_3 + 2(x_3 + 1) + 1 - 2(y_3 - 1)$
$= 3 + 8 + 1 - 24$
$= -12$, (5, 12)
$k = 5$, $P_5 = -12 + 2(4 + 1) + 1$ → $P_4 + 2(x_4 + 1) + 1$
$= -1$, (6, 12)
$k = 6$, $P_6 = -1 + 2(5 + 1) + 1$ → $P_5 + 2(x_5 + 1) + 1$
$= -1 + 12 + 1$
$= 12$, (7, 11)
$k = 7$, $P_7 = 12 + 2(6 + 1) + 1 - 2(12 - 1)$ → $P_6 + 2(x_6 + 1) + 1 - 2(y_6 - 1)$
$= 12 + 14 + 1 - 22$
$= 5$, (8, 10)
$k = 8$, $P_8 = 5 + 2(7 + 1) + 1 - 2(11 - 1)$ → $P_7 + 2(x_7 + 1) + 1 - 2(y_7 - 1)$
$= 5 + 16 + 1 - 20$
$= 2$, (9, 9)

Tabel Pixel

k	P_k	(x_{k+1}, y_{k+1})	$2x_{k+1}$	$2y_{k+1}$	(b,a)
0	-12	(1, 13)	2	26	(3,18)
1	-9	(2, 13)	4	26	(4,18)
2	-4	(3, 13)	6	26	(5,18)
3	3	(4, 12)	8	24	(6,17)
4	-12	(5, 12)	10	24	(7,17)
5	-1	(6, 12)	12	24	(8,17)
6	12	(7, 11)	14	22	(9,16)
7	5	(8, 10)	16	20	(10,15)
8	2	(9, 9)	18	18	(11,14)

2. a.) Matriks transformasi

Matriks translasi $= \begin{bmatrix} 1 & 0 & tx \\ 0 & 1 & ty \\ 0 & 0 & 1 \end{bmatrix}$ Matriks rotasi $= \begin{bmatrix} \cos 30^\circ & -\sin 30^\circ & 0 \\ \sin 30^\circ & \cos 30^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix}$

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \left(\begin{bmatrix} 1 & 0 & tx \\ 0 & 1 & ty \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos 30^\circ & -\sin 30^\circ & 0 \\ \sin 30^\circ & \cos 30^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & tx \\ 0 & 1 & ty \\ 0 & 0 & 1 \end{bmatrix} \right) \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

$$= \left(\begin{bmatrix} 1 & 0 & -2 \\ 0 & 1 & -3 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \sqrt{3}/2 & -1/2 & 0 \\ 1/2 & \sqrt{3}/2 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix} \right) \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

$$= \left(\begin{bmatrix} 1 & 0 & -2 \\ 0 & 1 & -3 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \sqrt{3}/2 & -1/2 & 2\sqrt{3}/2 \\ 1/2 & \sqrt{3}/2 & 1 \\ 0 & 0 & 1 \end{bmatrix} \right) \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

Perhitungan :

$P' = Tx \times R \times T \times P$

$= Tx(R \times T) \times P$

$= (Tx(R \times T)) \times P$

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} \sqrt{3}/2 & -1/2 & \sqrt{3}+2 \\ 1/2 & \sqrt{3}/2 & -2 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

b. Titik (4,3)

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} \sqrt{3}/2 & -1/2 & \sqrt{3}+2 \\ 1/2 & \sqrt{3}/2 & -2 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 4 \\ 3 \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} 3\sqrt{3} + 1/2 \\ 3\sqrt{3}/2 \\ 1 \end{bmatrix}$$

3.) Dik : Balok P

{(0,0,1), (3,0,1), (3,2,1), (0,2,1), (0,0,0), (3,0,0), (3,2,0), (0,2,0)}

Jawab :

$$m_{obj} = \begin{bmatrix} 0 & 3 & 3 & 0 & 0 & 3 & 0 \\ 0 & 0 & 2 & 2 & 0 & 2 & 2 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

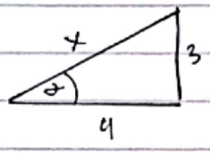
$$m_{Line} = \begin{bmatrix} 4 & 4 \\ -1 & 2 \\ -1 & 3 \\ 1 & 1 \end{bmatrix}$$

↳ $$m_{Tr} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -4 & 1 & 1 & 1 \end{bmatrix}$$

$$m_{Line\,Tr} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -4 & 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 4 & 4 \\ -1 & 2 \\ -1 & 3 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 3 \\ 0 & 4 \\ 1 & 1 \end{bmatrix}$$

m_{Rx} = Rotasi sebagai α dimana α adalah sudut antara 2-axis dengan B' yang diproyeksikan ke 2y-plane

B' Projected = (0, 3, 4)



$x = \sqrt{3^2 + 4^2} = 5$

$\sin \alpha = 3/5$

$\cos \alpha = 4/5$

$$\Rightarrow \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 4/5 & -3/5 & 0 \\ 0 & 3/5 & 4/5 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

⇒ B'' (B' yang diproyeksikan ke XZ-plane) adalah (0, 0, 5)

↳ B'' sudah ada di Z-axis, tidak perlu mencari m_{Ry}, alias m_{Ry} adalah

matrizes identitas

$$mR_z = \begin{bmatrix} \cos 90^\circ & \sin 90^\circ & 0 & 0 \\ -\sin 90^\circ & \cos 90^\circ & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$m_{Trans} = mTr \cdot mRx \cdot mRz \cdot mRx^{-1} \cdot mTr^{-1}$$

$$= \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -4 & 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 4/5 & -3/5 & 0 \\ 0 & 3/5 & 4/5 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 4/5 & 3/5 & 0 \\ 0 & -3/5 & 4/5 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 4 & -1 & -1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & 4/5 & -3/5 & 0 \\ -4/5 & 9/25 & 12/25 & 0 \\ 3/5 & 12/25 & 16/25 & 0 \\ -19/5 & 84/25 & -63/25 & 1 \end{bmatrix}$$

$$m_{obj'} = mTrans \cdot mobj$$

$$= \begin{bmatrix} -3/5 & -3/5 & 1 & 1 & 0 & 0 & 8/5 & 8/5 \\ 12/25 & -48/25 & -6/5 & 6/5 & 0 & -12/5 & -42/25 & \\ 16/25 & 61/25 & 17/5 & 8/5 & 0 & 9/5 & 69/25 & 24/25 \\ -30/25 & -323/25 & -31/5 & 26/5 & 1 & -52/5 & -92/25 & \end{bmatrix}$$

4.) Clipping algoritma Cohen-Sutherland

1) Kategori 1 (visible) = GH

G = 0000

H = 0000 AND

0000 → Accept

2) Kategori 2 (not visible) = kL, AB

k = 0101

L = 1001 AND

0001 → Reject

A = 1000

B = 1010 AND

1000 → Reject

3) kategori 3 (kandidat clipping) = EF, CD, IJ

E = 0000

F = 0100 AND

0000

C = 1000

D = 0010 AND

0000

I = 1001

J = 0100 AND

0000

Garis yang tidak di clip

- Garis IJ → I (-3,5) J (0,2)

$$m = \frac{2-5}{0+3} = \frac{-3}{3} = -1$$

I' (-3,-2)

↳ $y = -3 + 1(-2+3)$
$= -3 + 1$
$= -2$

J' (-2,2)

↳ $x = x_1 + (y_{min} - y_1) / m$
$= 0 + (0-2) / 1$
$= -2$

- Garis EF → E (1,2) F (2,-1)

$$m = \frac{-1-2}{2-1} = \frac{-3}{1} = -3$$

E' (5/3, 0)

↳ $x = x_1 + (y_{min} - y_1) / m$
$= 1 + (0-2) / -3$
$= 1 + {}^{-2}/_{-3}$
$= 5/3$

- Garis CD → C (-1,5) D (5,2)

$$m = \frac{2-5}{5+1} = \frac{-3}{6} = \frac{-1}{2}$$

C' (-1,4)

↳ $x = x_1 + (y_{max} - y_1) / m$
$= -1 + (4-5) / (-1/2)$
$= -1 + 2 = -1$

D' (3, 9/2)

↳ $y = y_1 + m(x_{max} - y_1)$
$= 5 + (-1/2)(3-2)$
$= 5 - 1/2$
$= 9/2$