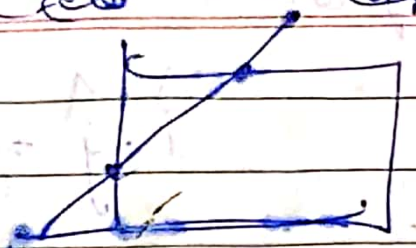
~~Cyrus Beck~~ Liang Barsky Line Clipping

Mathematician

Algorithm ___ ___



2 times Cohen

28

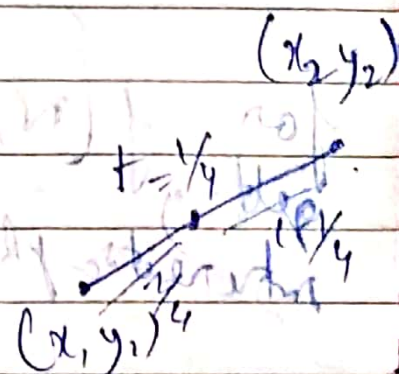
Based on Line parametric eq. –

(x_1, y_1) (x_2, y_2)

t – range $0 \le t \le 1$

Starting $t = 0$ (x_1, y_1)

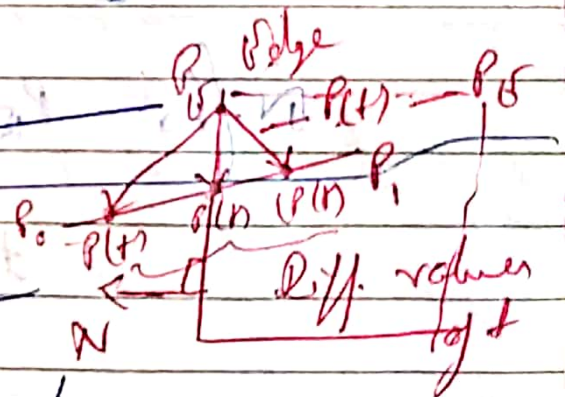
(x_2, y_2) $(t = 1)$



24

$x = 3/4\, x_1 + 1/4\, x_2$

$y = 3/4\, y_1 + 1/4\, x_2$



Cyrus Beck Line Clipping –

Better than Cohen meth.

Parametric eq.

$P(t) = P_0 + t(P_1 - P_0)$ ——— (1)

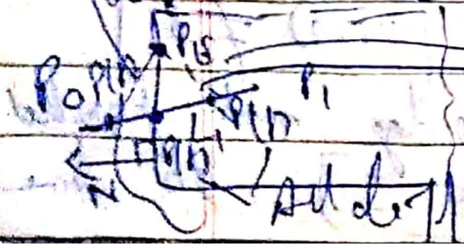
$[t = 0 - 1]$

$f(N, P_E) > 0$ $P(0) = P_0$

$P(1) = P_1$ $t = 0$

$P_1 - P_E$

$f(N, P_E) < 0$



Added value

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Date

Page

$f(N, P_E) = N \cdot (P(t) - P_E)$

dot product

$\hat{i} \cdot \hat{j} = |\hat{i}||\hat{j}| \cos\theta$

90°

$\cos 90° = 0$

$= 0$ (on edge)

< 0 (inside)

> 0 (outside)

for $f(N, P_E) = 0$

getting intersection pt. $(N \cdot P(t) - P_E) = 0$

$N \cdot [P_0 + t(P_1 - P_0) - P_E] = 0$

$N \cdot (P_0 - P_E) + N \cdot (P_1 - P_0) t = 0$

$t = -N(P_0 - P_E) / N \cdot (P_1 - P_0)$

$$t = \frac{-N \cdot (P_0 - P_E)}{N \cdot (P_1 - P_0)}$$

$D = P_1 - P_0$

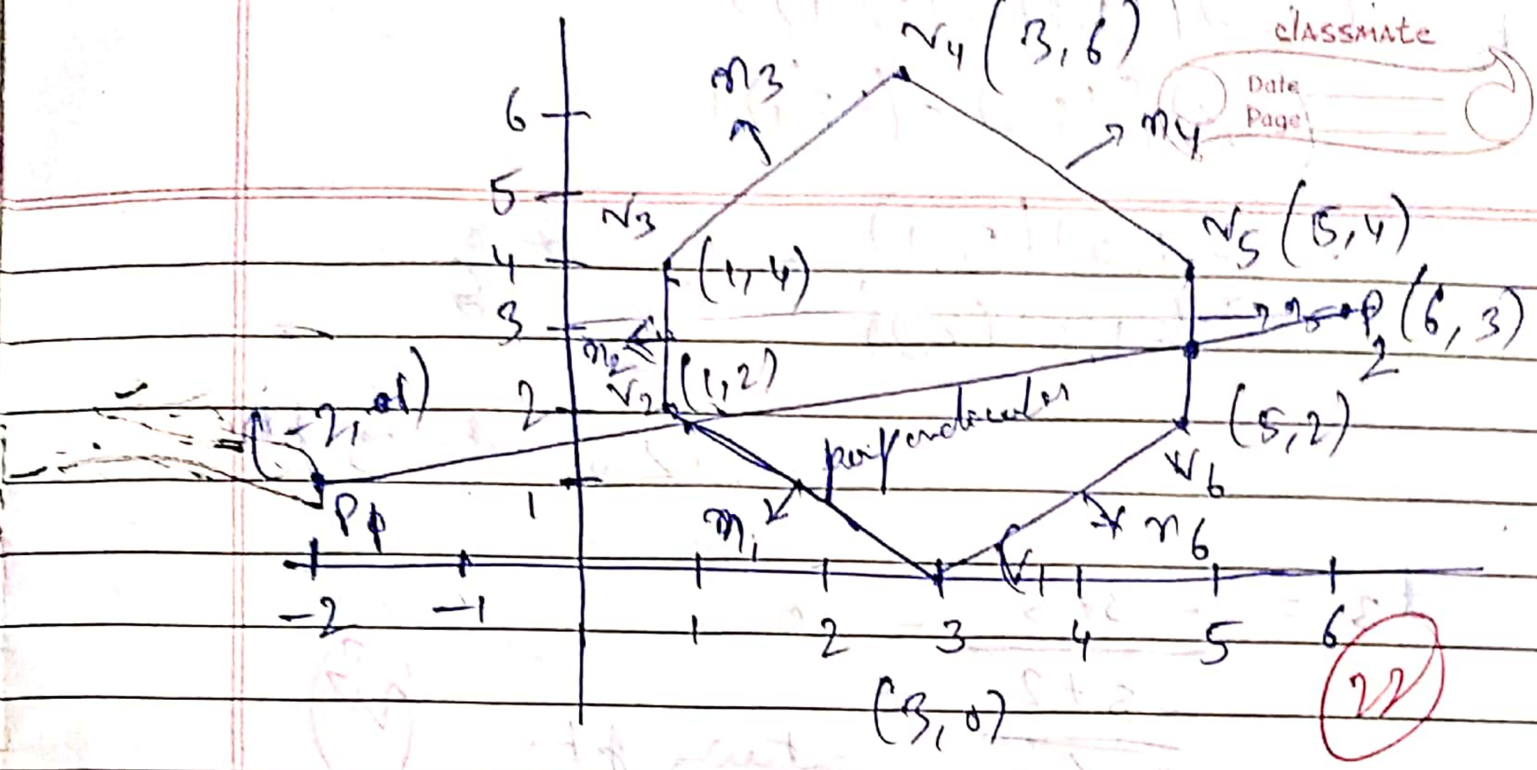
$$t = \frac{-N \cdot (P_0 - P_E)}{N \cdot D}$$

$[N \cdot D \neq 0]$

edge not parallel to line

$t \rightarrow [0 \text{ to } 1]$

Scanned with CamScanner



$P_1 = (-2,1)$

$P_2 = (6,3)$

Normal vector

$n_1\ (-1,-1)$ $\quad$ $n_4\ (1,1)$

$n_2\ (-1,0)$ $\quad$ $n_5\ (1,0)$

$n_3\ (-1,1)$ $\quad$ $n_6\ (1,-1)$

$$t_i = \frac{n_i\,(v_i - P_1)}{n_i\cdot(P_2 - P_1)}$$

$$t_1 = \frac{(-1,-1)[(3,0)-(-2,1)]}{(-1,-1)\cdot[(6,3)-(-2,1)]}$$

$$= \frac{(-1,-1)(5,-1)}{(-1,-1)(8,2)} = \frac{-5+1}{-8-2} = \frac{-4}{-10}$$

$D < 0$ entering pt.

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Date

Page

$$t_2 = \frac{(-1,0)[(1,2)-(-2,1)]}{(-1,0)[(6,3)-(-2,1)]}$$

$$= \frac{(-1,0)(3,1)}{(-1,0)(8,2)} = \frac{-3}{-8}$$

$D < 0$ entering pt.

$$t_3 = \frac{-3+3}{-8+2} = 0$$

$D < 0$ entering pt.

$$t_4 = \frac{10}{10} = 1$$

$D > 0$ leaving pt.

$t_5 = 7/8$ $D > 0$

$t_6 = \frac{6}{6} = 1$ leaving.

$D > 0$

t_1 t_2 t_3

Smallest

$$P(t) = P_0 + t(P_1 - P_0)$$

$$= (-2,1) + 4/10[(6,3) - (-2,1)]$$

$$= [6/5, 9/5]$$

Largest t_4 t_5 t_6

$P(t) = (8, 11/4)$