A.P. SHAH INSTITUTE OF TECHNOLOGY
Department of Computer Science and Engineering
Data Science

Semester : III Subject : CG Academic Year: 20 - 20

Que: Explain Liang Barsky line clipping algorithm, what are its benefits over cohen Sutherland algorithm? clip the line with co-ordinated (5, 10) and (35, 30) against the window $(x_{min}, y_{min}) = (10, 10)$ and $(x_{max}, y_{max}) = (20, 20)$

Ans:- Algorithm :-

Step 1:- Get the endpoints of line as (x_1, y_1) and (x_2, y_2)

Step 2:- Calculate $\Delta x, \Delta y, p_k, q_k$

Step 3:- Assign $t1 = 0, t2 = 1$

(a) If $p_k = 0$; line is parallel
If $q_k < 0$; line lies outside window (Regict)

(b) If $p_k < 0$; find $t1$
$t1 = \max(0, q_k / p_k)$
else $p_k > 0$; find $t2$
$t2 = \min(1, q_k / p_k)$

(c) If $t1 > t2$; line is completely outside (rejected)
else find new value of x & y from the formula
$x = x_1 + t\Delta x$
$y = y_1 + t\Delta y$

$p_1 = -\Delta x$ $q_1 = x_1 - x_{wmin}$
$p_2 = \Delta x$ $q_2 = x_{wmax} - x_1$
$p_3 = -\Delta y$ $q_3 = y_1 - y_{wmin}$
$p_4 = \Delta y$ $q_4 = y_{wmax} - y_1$

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SR. No	Cohen Sutherland Algo	Liang Barsky Algo
1.	It is less efficient	It is more efficient
2.	In this Algo., each intersection requires both multiplication & a division	2. In this algo., each update of parameters requires only one division
3.	It follows the encoding approach	3) It follows the parametric approach
4.	It repeatedly calculates intersection along a line path even though the line may be completely outsid the clip window	4) In this window intersection are calculated only once when final values have been computed
5.	It can be used only on a rectangular clip window	5. It can be used for 1-D 2-D, 3-D line clipping and Sometimes 4-D line clipping

Numerical Solution :-

Given :-

$x_{wmin} = 10$

$x_{wmax} = 20$

$y_{wmin} = 10$

$y_{wmax} = 20$

$m(5, 10) \Rightarrow x_1 = 5 \quad y_1 = 10$

$N(35, 30) \Rightarrow x_2 = 35 \quad y_2 = 30$

$p_1 = -\Delta x = -30$

$p_2 = \Delta x = 30$

$p_3 = -\Delta y = -20$

$p_4 = \Delta y = 20$

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$\Delta x = x_2 - x_1$
$= 35 - 5 = (30)$
$\Delta y = y_2 - y_1$
$= 30 - 10 = (20)$

$q1 = x_1 - x_{wmin} = 5 - 10 = -5$
$q2 = x_{wmax} - x_1 = 20 - 5 = 15$
$q3 = y_1 - y_{wmin} = 10 - 10 = 0$
$q4 = y_{wmax} - y_1 = 20 - 10 = 10$

if $P_K < 0$
P_1, P_3
$t_1 = \max(0, -5/-30, 0/-20)$
$\max(0, 0.166, 0)$
$t_1 = 0.166$

if $P_K > 0$
P_2, P_4
$t_2 = \min(1, \frac{15}{30}, \frac{10}{20})$
$= \min(1, 0.5, 0.5)$
$t_2 = 0.5$

As $t_1 < t_2$ calculate new x, y co-ordinates

for t_1
$x = x_1 + t\Delta x$
$= 5 + 0.166(30)$
$= 9.96$
$y = y_1 + t\Delta y$
$= 10 + 0.166(20)$
$= 13.32$

for t_2
$x = x_1 + t\Delta x$
$= 5 + (0.5)(30)$
$= 20$
$y = y_1 + t\Delta y$
$= 10 + (0.5)(20)$
$= 20$

New co-ordinate of M'N' $M' = (9.98, 13.32)$
$N' = (20, 20)$