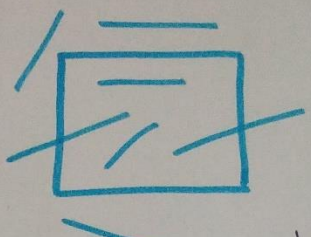
Cohen-Sutherland Line Clipping Algorithm



- In Cohen Sutherland Line Clipping algo, it determines which lines are outside or inside (or partially inside. Then it removes lines which are completely outside and clip the partial line which is outside clipping window.

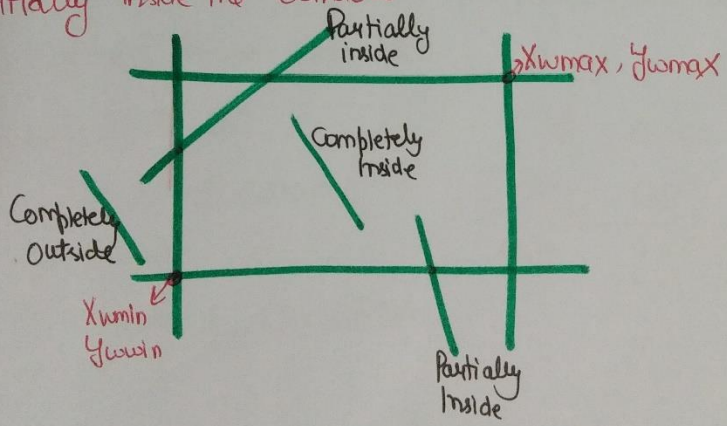
- Cohen Sutherland algorithm divides a two-dimensional space into 9 regions & then efficiently determines the lines & portions of lines that are inside the given rectangular area (clipping window)

There are three possible cases for any given line:

1) Completely inside the given rectangle (window).

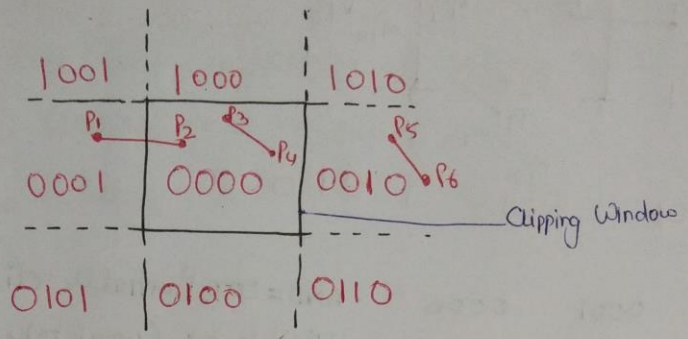
2) Completely outside the given rectangle (window).

3) Partially inside the window.



4 bit region Code (TBRL)

Top Bottom Right Left



Points :-

1) If both endpoints of a line have a region code 0000 then given Line is completely inside.

P3 0000
P4 0000 Line is completely inside

2) If region code of a line's end points have same position of 1 bit then line is completely outside

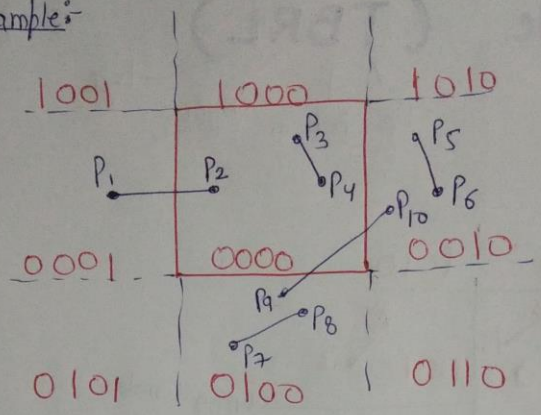
P5 0010
P6 0010 This line is completely outside

3) If the region code of both the end points are not 0000 or different region code then

Logical AND op^n.
If AND ≠ 0000
then Reject
else Partially Clipped Line.

P1 0001
P2 0000
AND 0000

Example:-



P_1P_2	0001	0000	AND=0000, Partially clipped.
P_3P_4	0000	0000	Visible or Completely Inside
P_5P_6	0010	0010	Outside Completely, Reject
P_7P_8	0100	0100	Outside completely, Reject
P_9P_{10}	0100	0010	AND=0000, Partically clipped

Clipping

We find out the intersection point and then remove the part of line which is outside the window.

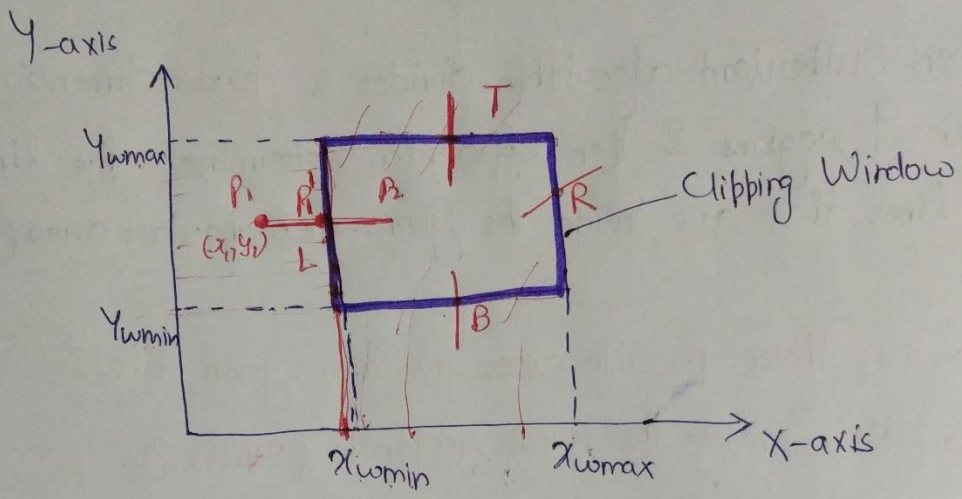
Lines which are partially inside are :-

P_1P_2

P_9P_{10}

Slope intercept method

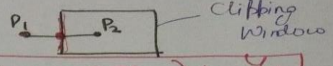
$$m = \frac{y_2 - y_1}{x_2 - x_1}$$


Y-axis
Ywmax
Ywmin
T
P1
R
P2
R
Clipping Window
(x1,y1)
L
B
Xwmin
Xwmax
X-axis

If a line cuts (intersect) at left of window.

x_{wmin} Constant

Find y y change.



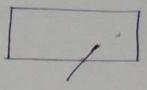
$$m = \frac{y - y_1}{x_{wmin} - x_1} \Rightarrow \boxed{y = m(x_{wmin} - x_1) + y_1}$$

* If a line cuts (intersect) at bottom of window.

y Constant and is y_{wmin}

x_w change

Find x



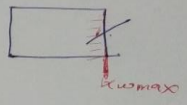
$$m = \frac{y_{wmin} - y_1}{x - x_1}$$

$$\boxed{x = \frac{1}{m}(y_{wmin} - y_1) + x_1}$$

* If a line cuts (intersect) at right of window -

x is constant and it is x_{wmax}

y change



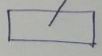
Find y $m = \frac{y - y_1}{x_{wmax} - x_1}$

$$\boxed{y = m(x_{wmax} - x_1) + y_1}$$

* If a line cuts (intersect) at top of window.

y is constant and is y_{wmax}

x change.



Find x $m = \frac{y_{wmax} - y_1}{x - x_1}$, $\boxed{x = x_1 + \frac{1}{m}(y_{wmax} - y_1)}$