

EXPERIMENT NO. 07

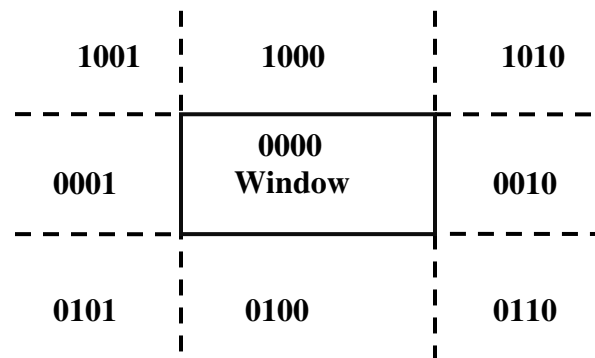
AIM: - To implement Cohen and Sutherland Line Clipping Algorithm for given line Segment and clipping window.

S/W REQUIRED: - Turbo C.

THEORY:-

Sutherland and Cohen Subdivision Line Clipping Algorithm

This is one of the oldest and most popular line clipping algorithm developed by Dan Cohen and Ivan Sutherland. To speed up the processing, this algorithm performs initial tests that reduce the number of intersections that must be calculated. The algorithm uses four digit (bit) codes to indicate which of the nine regions contains the endpoint of line. These four bit codes are called as region code or out codes. These codes identify the location of point relative to the boundaries of the clipping rectangle as shown below.



REGION CODE

Each bit position in the region code is used to produce one of the four relative coordinate positions of the point with respect to clipping window to left, right, top or bottom. The right hand bit is the first bit and bits are set to

Bit 1 is set to $X < X_{wmin}$

Bit 2 is set to $X > X_{wmin}$

Bit 3 is set to $Y < Y_{wmin}$

Bit 4 is set to $Y > Y_{wmin}$

- Region code is used to determine which line is completely inside or outside for intersection of the line with window boundary.

- Point outside window is compared to boundary of window to determine how much line is to discarded and remaining part of line is checked against other boundary.
- For line end point $P1(X1,Y1), P2(X2,Y2)$ intersection point with clipping boundary is calculated using slope intersection formula for line equation as
 1. Y co-ordinate of intersection with vertical boundaries

$$Y = Y1 + m(X - X1)$$

X is neither X_{wmin} nor X_{wmax} depending on boundary of window.
 2. X co-ordinate of intersection point inserted with horizontal boundaries

$$X = X1 + (Y - Y1) / m$$

Y is neither Y_{wmin} nor Y_{wmax} depending on boundary of window.

ALGORITHM:-

- 1) Read line end points $(X1, Y1)$ and $(X2, Y2)$.
- 2) Read clipping window co-ordinate.
- 3) Read $m = Y2 - Y1 / X2 - X1$
- 4) Assign region code.
- 5) If code = 0000 accept entire line and go to step 12.
- 6) If intercept = Left $XLY = m(XL - X1) + Y1$.
- 7) If intercept = Right $XRY = m(XR - X1) + Y1$.
- 8) If intercept = Bottom $Y2X = X1 + 1(YB - Y1) / m$
- 9) If intercept = Top $Y1X = X1 + 1(YT - Y1) / m$ and go to step 11.
- 10) Else discard entire line.
- 11) Discard portion of line which is outside of clip window.
- 12) Stop.

CONCLUSION: - Successfully implemented Cohen and Sutherland Line Clipping Algorithm for Clipping given line segment across the given clipping window.

SIGN

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