

Clipping :-

A procedure that identifies those portions of a picture that are either inside or outside of a specified region of space is called Clipping.

The region against which an object is to be clipped is called a clip window.

- ① Point Clipping
- ② Line Clipping
- ③ Area Clipping (polygons)
- ④ Curve Clipping
- ⑤ Text Clipping

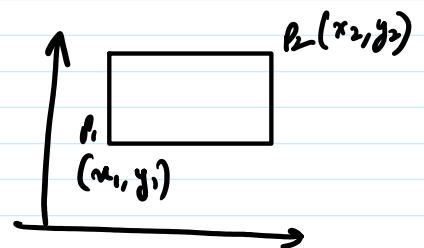
Point Clipping :-

Assuming that clip window is a rectangle in standard position, a point $P = (x, y)$ is displayed if it satisfies :-

$$x_{w_{min}} \leq x \leq x_{w_{max}}$$

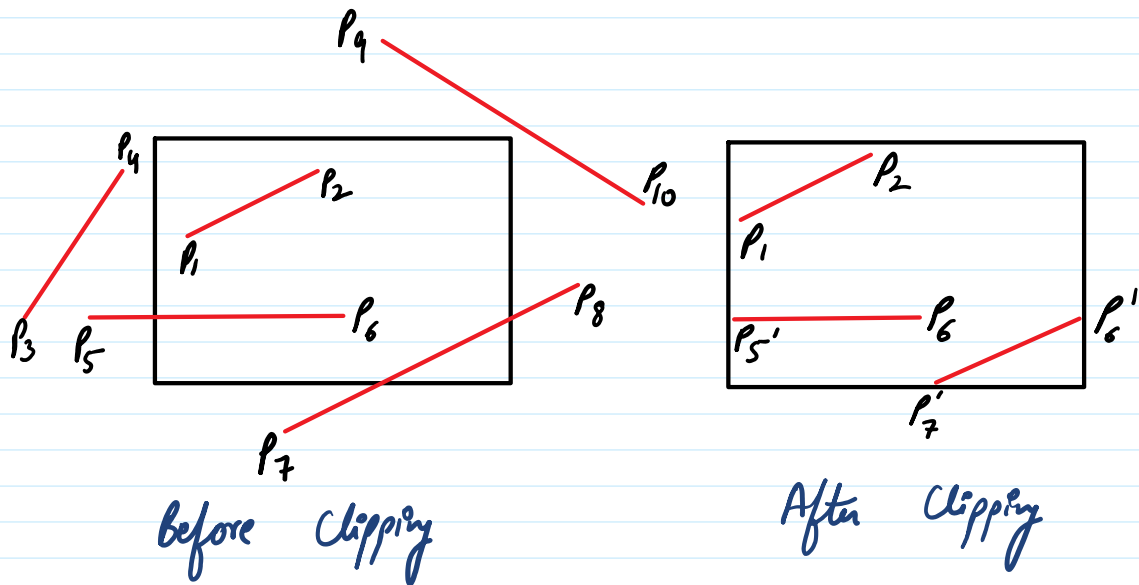
$$y_{w_{min}} \leq y \leq y_{w_{max}}$$

where $(x_{w_{min}}, x_{w_{max}}, y_{w_{min}}, y_{w_{max}})$



are the edges of the clip window.

Line Clipping :-



Cohen-Sutherland Line Clipping :-

Oldest and most popular

Every line end-point in a picture is assigned a four-digit binary code, called region code.

Region code identifies the location of the point relative to the boundaries of the clipping rectangle.

Each bit position is used to indicate one of the four relative to the coordinate positions.

bit 1 → left

bit 2 → right

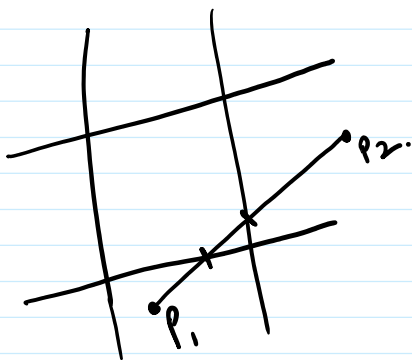
bit 3 → below

bit4 → above

1001	1000	1010
0001	0000 Window	0010
0101	0100	0110

↑ ↑ ↑ ↑
above below right left

- ① Assign region code for each end point.
- ② The line is accepted if both end points have a region code 0000.
- ③ If not accepted,
Logical AND operation with both region codes.
 - If the result is not 0000 the reject the line.
 - Else clip.



- ① Select a point which is outside the window
- ② Find the intersection point at the window boundary
- ③ End point is replaced with the intersection point, update.

Intersection points

Let endpoint coordinates of line be (x_1, y_1) and (x_2, y_2) , the y coordinate of the intersection point with a vertical boundary,

$$y = y_1 + m(x - x_1)$$

$x \rightarrow$ can be either x_{wmin} or x_{wmax} .

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

Similarly, intersection with a horizontal boundary

$$x = x_1 + \frac{y - y_1}{m}$$

$y \rightarrow y_{wmin}$ or y_{wmax}

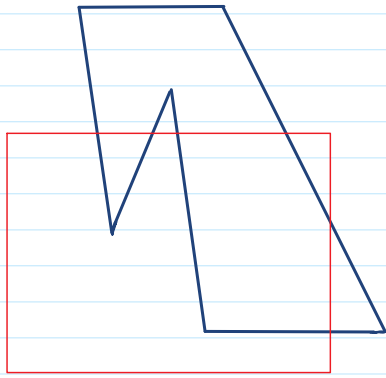
Reading Exercises :-

“Liang-Barsky Line Clipping”

“Nicholl-Lee-Nicholl Line Clipping”

Polygon Clipping :-

The output of a polygon clipper is a sequence of vertices that defines the clipped polygon boundaries.

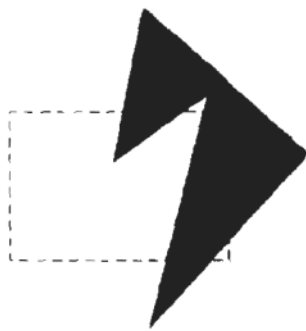


Before Clipping



After Clipping

Polygon processed by a
line-clipping algorithm.



Before Clipping



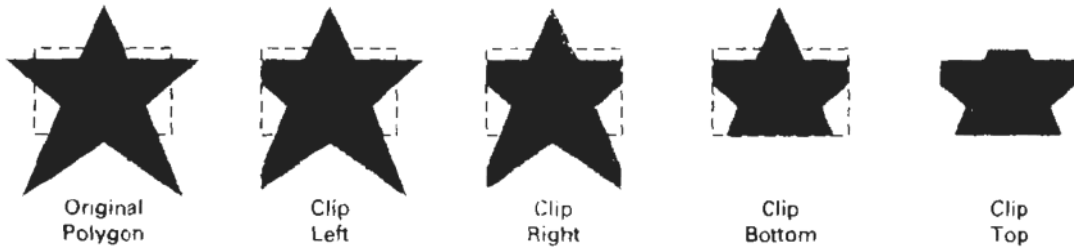
After Clipping

A correctly clipped polygon

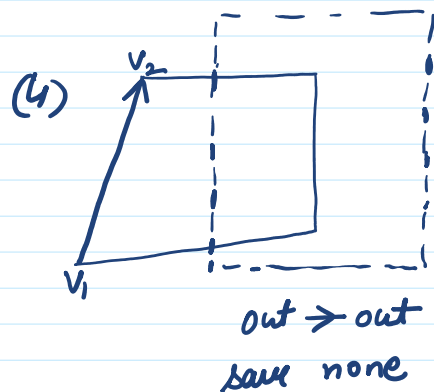
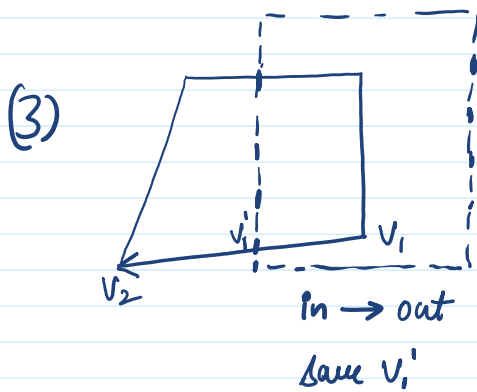
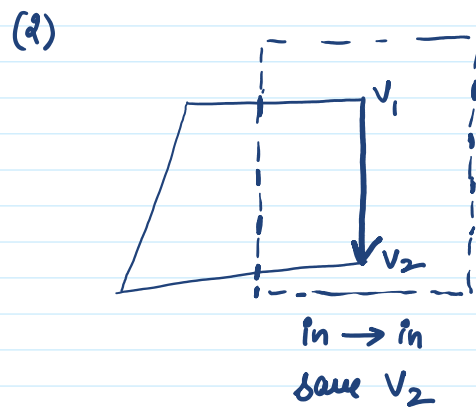
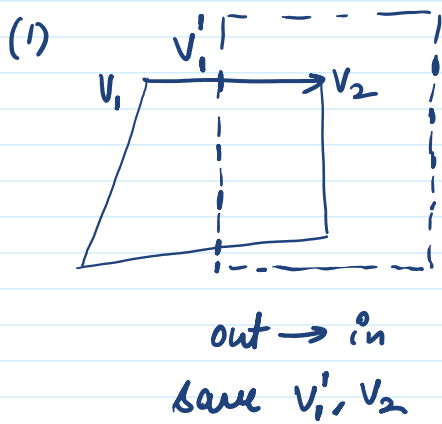
For polygon clipping, we require an algorithm that will generate one or more closed areas that are then scan converted for the appropriate area fill.

Sutherland - Hodgeman Polygon Clipping:-

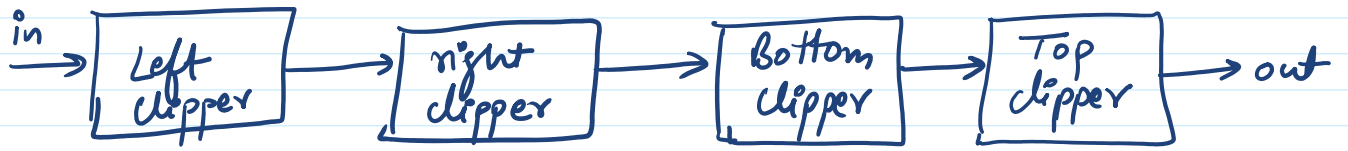
by processing the polygon boundary as a whole against each window edge.



To obtain new sequence of vertices,
four cases



Processing of pairs of polygon vertices against
the left window boundary.



Reading Exercise:—

“Weiler-Atherton Polygon Clipping”