SNS COLLEGE OF ENGINEERING

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Department of Artificial intelligence and data science

Course Name – COMPUTER GRAPHICS

III Year / V Semester

Unit 1 – CLIPPING ALGORITHMS FOR LINES, REGULAR POLYGONS, CIRCLES AND ARCS

Topic :Graphics Input Primitives and Devices

CLIPPING

- Clipping is a process of dividing an object into visible and invisible portions and displaying the visible portion and discarding the invisible portion.
- Types of Clipping:

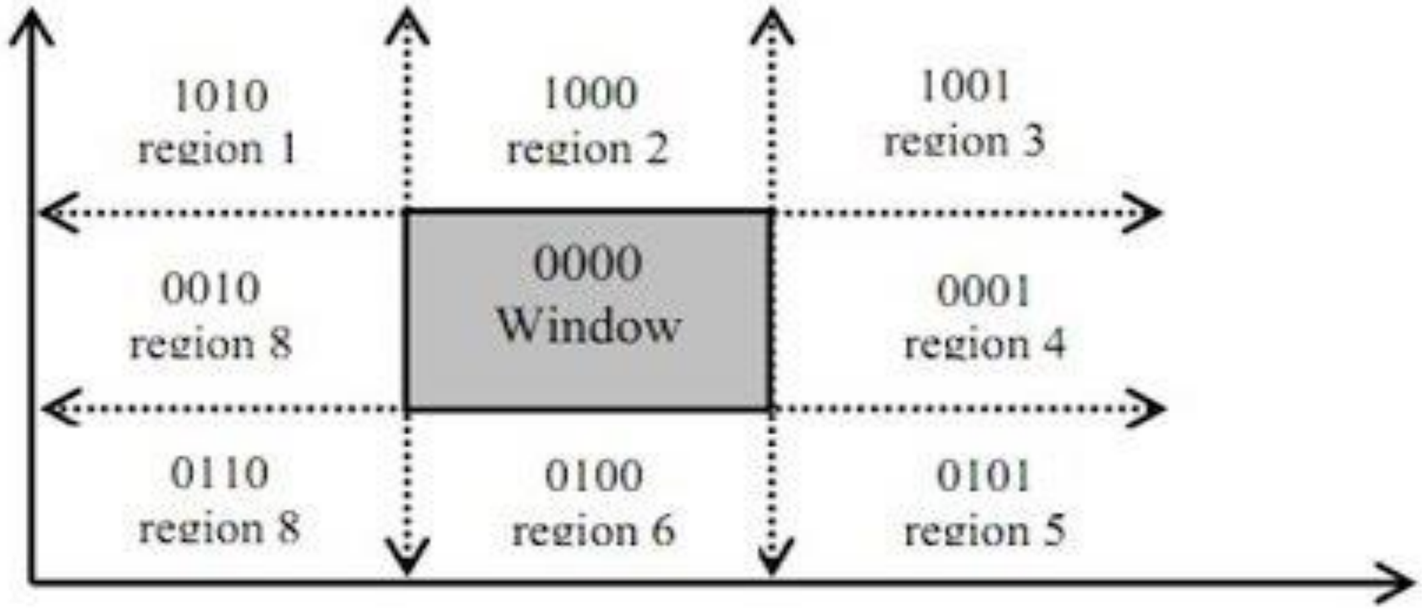
Generally we have Clipping algorithm for the following primitive type:

- Point Clipping
- Line Clipping
- Area Clipping (Polygon)
- Curve Clipping
- Text

COHEN SUTHERLAND LINE CLIPPING ALGORITHM

- In this algorithm, we will divide the view pane into nine equal segments that only serve the viewport.
- Now, we will represent the top, bottom, left, and right corner of the window with 4 bits. This 4bit can be described with the following point that:
- If an object lies within any particular corner position, that corner value will be 1, else it will be 0.
- The allocation of bits depends on **“TBRL”** (Top, Bottom, Right, Left) rule.

COHEN-SUTHERLAND LINE CLIPING ALGORITHM



With respect to a window, the line can be

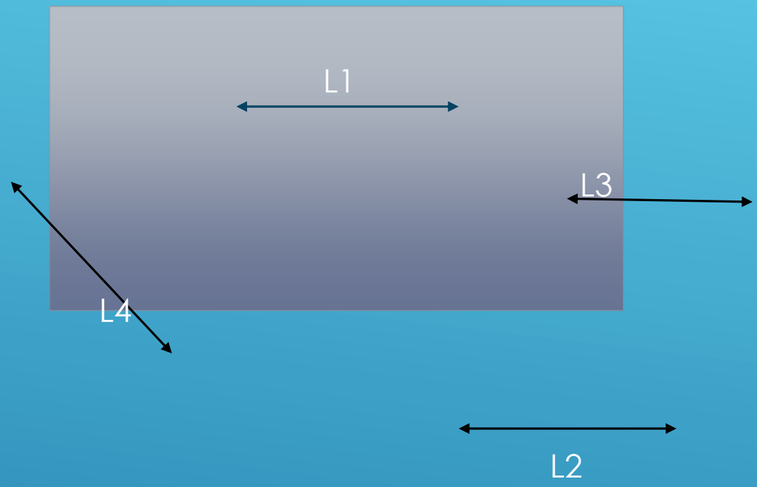
1) perfectly inside (L_1)
2) perfectly outside (L_2)
3) partially inside (L_3)
4) end points outside } (L_4)
   Line segment inside }

If the line is

perfectly inside (L_1) -> accept the line

perfectly outside (L_2) -> reject the line.

crosses window boundary (L_3, L_4)
-> clip the line.



Encode tht endpoints of the line

- If the two endpoints have the code 0000& AND is 0000 the line is completely inside .So accept the line
- If the two endpoints are non zero & their AND is non zero the line is completely outside .So reject the line

- If the two endpoints are non zero & their AND is 0000 the line is partially inside. So clip the line.
  - Clipping needs the intersection points(s)
  - If a point is outside any window boundary find the intersection point on the window boundary

1)End points L1

0000

0000

----------AND

0000

Completely inside accept the line

2)End points L2

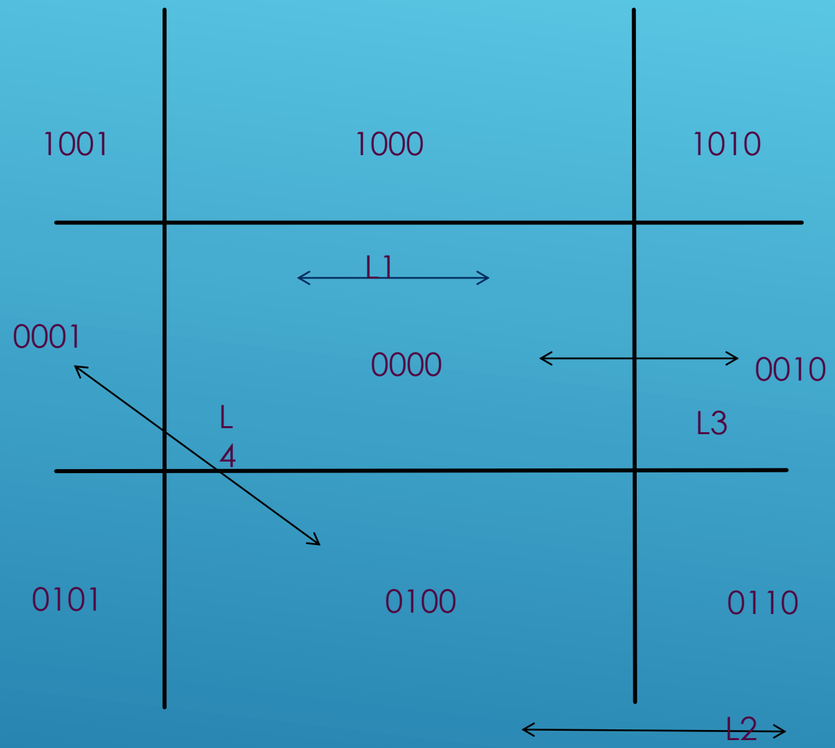
0100

0110

----------AND

0100

Completely outside, so reject the line



End points L3

0000

0010

----------AND

0000

partially inside , need clipping , find intersection point

End points L4

0001

0100

----------AND

0000

partially inside , need clipping , find intersection point

New points

0000

0000

----------AND

0000

Completely inside, so accept the line

New points

0001

0000

----------AND

0000

partially inside , need clipping , find intersection point

New points

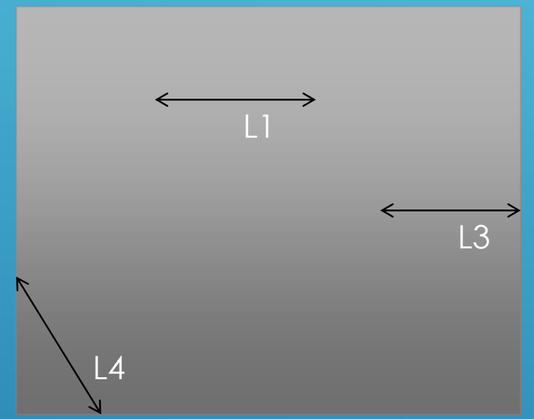
0000

0000

----------AND

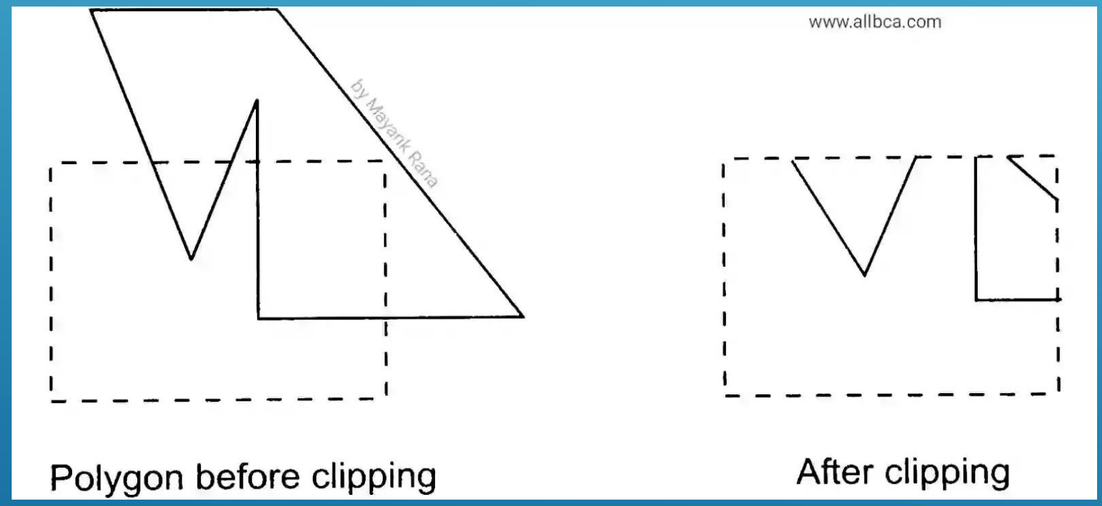
0000

Completely inside, so accept the line



POLYGON CLIPPING

- Sutherland Hodgeman polygon clipping algorithm is used for polygon clipping. In this algorithm, all the vertices of the polygon are clipped against each edge of the clipping window.
- Polygon clipping is the process of cutting off parts of a polygon that lie outside a given boundary
- The polygon clipping algorithm deals with four different clipping cases.
  - Left clip
  - Right clip
  - Top clip
  - Bottom clip

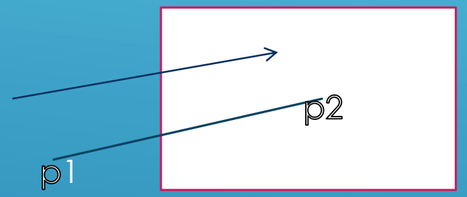


For each stage there are four cases to be checked for

Case 1:

if moving from outside to inside

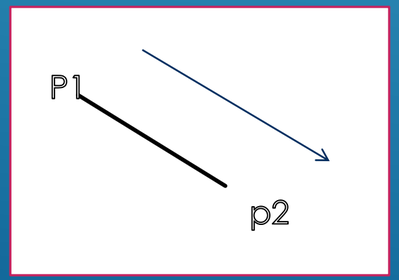
- Reject the start point and save the intersection point on wind boundary and vertex



Case 2:

if moving from inside to inside

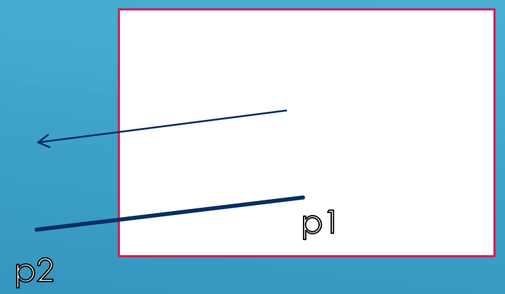
- Save the second vertex



Case 3:

if moving from inside to outside

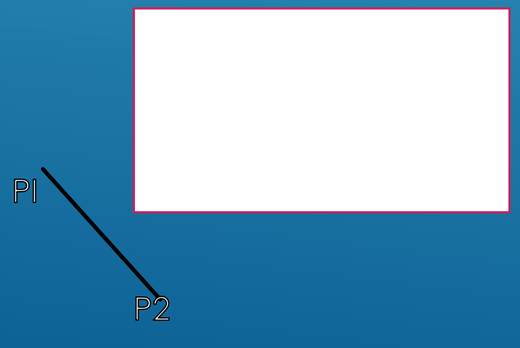
- Save intersection point and reject the end point

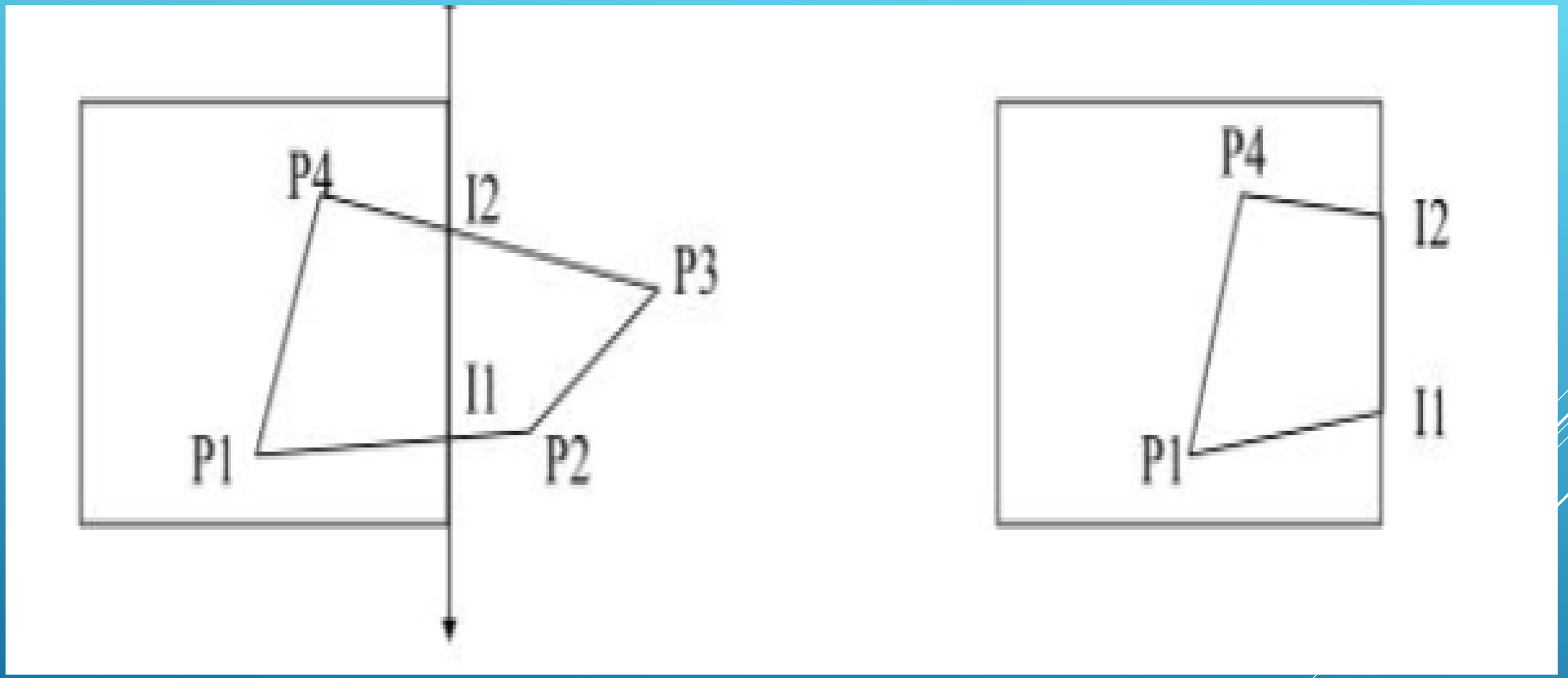


Case 4:

if moving from ouside to outside

- Save none




P4
I2
P3
I1
P1
P2
P4
I2
I1
P1

CLIPPING ALGORITHMS FOR CIRCLES AND ARCS

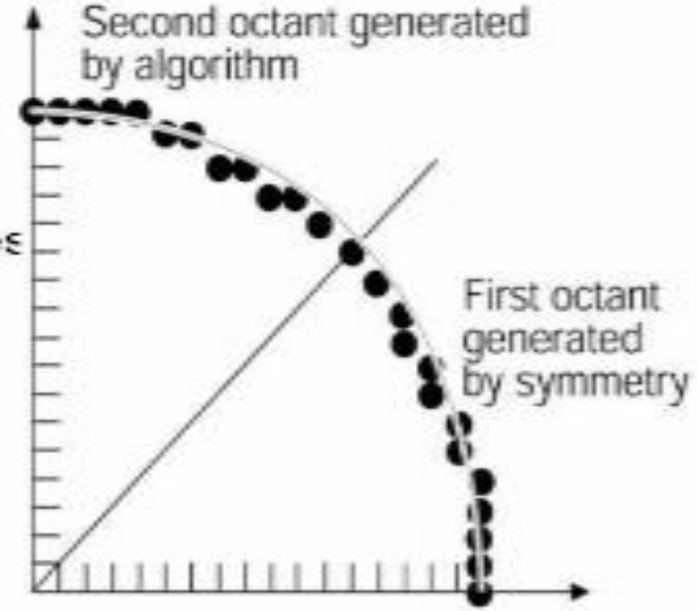
Clipping Circles

- Accept/Reject test
  – Does bounding box of the circle intersect with clipping box?
- If yes, condition pixel write on clipping box inside/outside tes

Also we can test Circle points by Point Clipping .

-the point P=(x, y) is display in clipping Boundry if

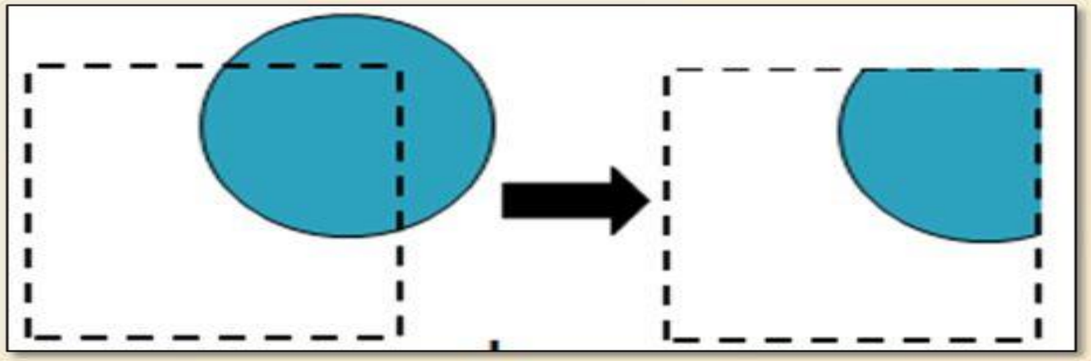
$x_{min} \leq x \leq x_{max}$ and $y_{min} \leq y \leq y_{max}$



CURVE CLIPPING

- Curve clipping procedures will involve non-linear equations (so requires more processing than for objects with linear boundaries In general, methods depend on how characters are represented).
- Clipping curves requires more work

  For circles we must find the two intersection points on the window boundary



THANK YOU