Polygon Clipping

Outline

- Polygon Clipping

- Polygon Clipping Algorithms

  - Sutherland Hodgeman

  - Weiler Atherton

- Summary

Polygon Fill Area Clipping

- Typically support only fill areas that are polygons, and convex
- Cannot directly apply a line clipping because the result would not be a closed polyline

Before Clipping
(a)

After Clipping
(b)

Before Clipping

After Clipping
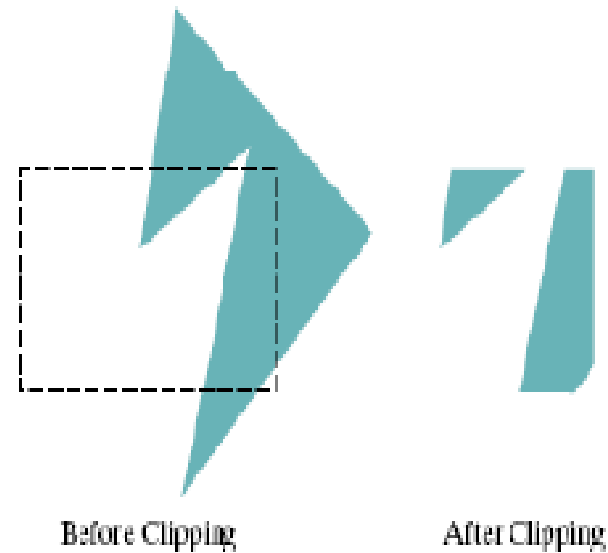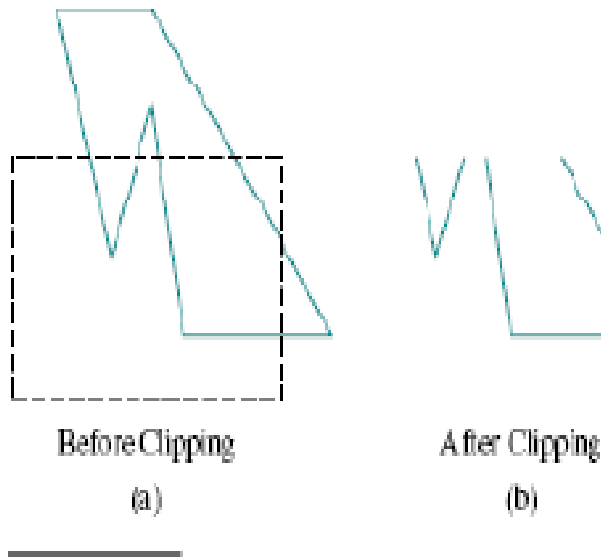
Polygon Fill Area Clipping

- Clip a polygon fill area by determining the new shape for the polygon as each clipping-window edge is processed

Original Polygon   Clip Left   Clip Right   Clip Bottom   Clip Top

Figure 6-23

Processing a polygon fill area against successive clipping-window boundaries.

Create a new vertex list at each clipping boundary, and then pass this new vertex list to the next boundary clipper
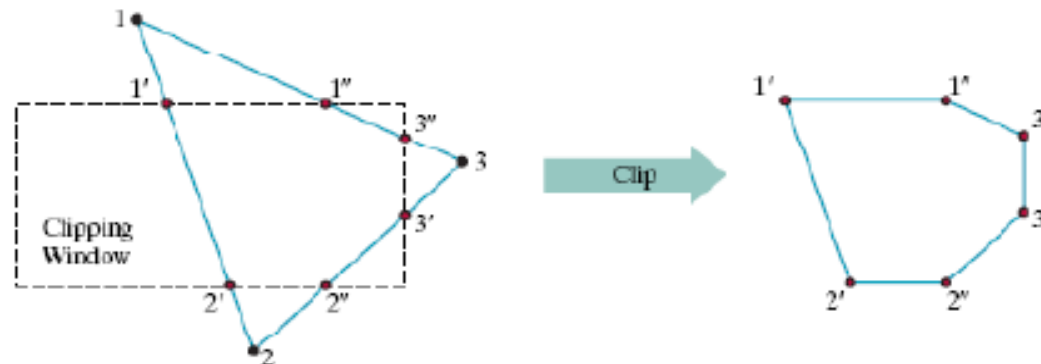

FIGURE 6-25   A convex-polygon fill area (a), defined with the vertex list {1, 2, 3}, is clipped to produce the fill-area shape shown in (b), which is defined with the output vertex list

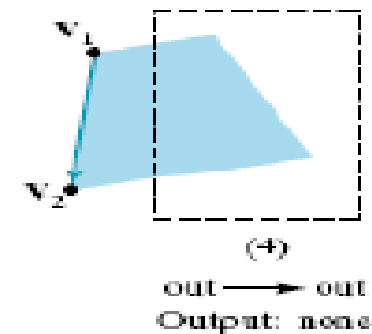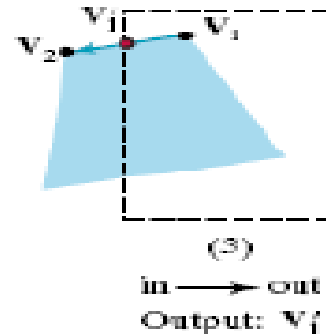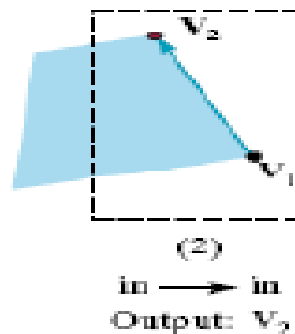# Polygon Clipping Algo:Sutherland-Hodgeman

- Send the pair of endpoints for each successive polygon line segment through the series of clippers (left, right, bottom, and top)
- Operating in parallel, as a clipper completes the processing of one pair of vertices, the next pair of endpoints is processed
- There are four possible cases

  1. The first edge endpoint is outside and the second endpoint is inside

  2. Both endpoints are inside

  3. The first endpoint is inside and the second endpoint is outside

  4. Both endpoints are outside

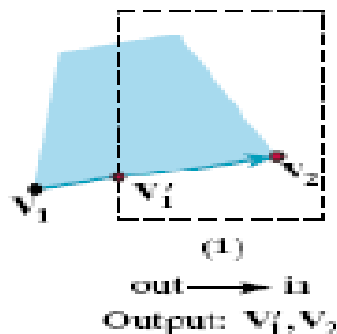# Polygon Clipping Algo:Sutherland-Hodgeman

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Sutherland-Hodgeman Algorithm(Cont....)

- Passing of vertices from one clipping stage to the next, the output from each clipper can be formulated

  1. If the first input vertex is outside and the second vertex is inside, the intersection point with the border and the second vertex are sent to the next clipper

  2. If both input vertices are inside, only the second vertex is sent to the next clipper

  3. If the first vertex is inside and the second vertex is outside, the intersection point is sent to the next clipper

  4. If both input vertices are outside, no vertices are sent
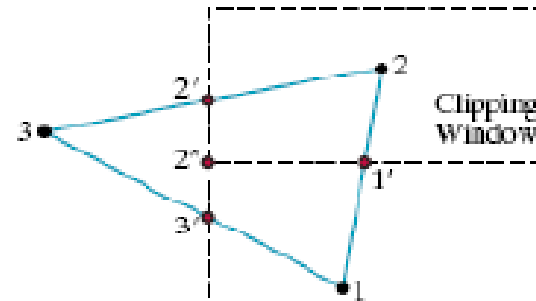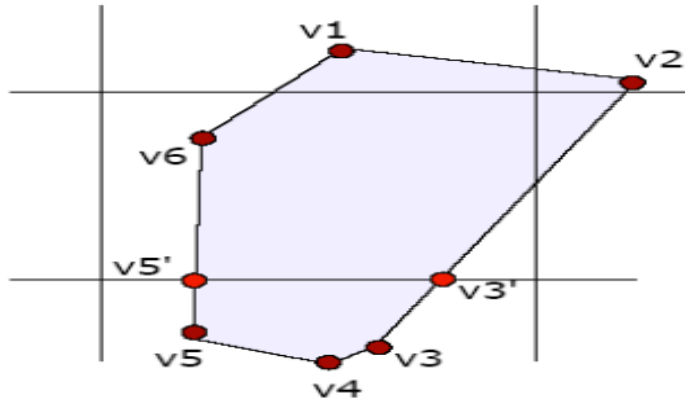
Sutherland-Hodgeman Algorithm(Cont.....)

Input Edge:	Left Clipper	Right Clipper	Bottom Clipper	Top Clipper
{1,2}: (in – in) → {2}				
{2,3}: (in – out) → {2'}	{2, 2'}: (in – in) → {2'}		
{3,1}: (out – in) → {3', 1}	{2', 3'}: (in – in) → {3'}	{2', 3'}: (in – out) → {2'}	
	{3', 1}: (in – in) → {1}	{3', 1}: (out – out) → { }	
	{1,2}: (in – in) → {2}	{1, 2}: (out – in) → {1', 2}	{2', 1'}: (in – in) → {1'}
		{2, 2'}: (in – in) → {2'}	{1', 2}: (in – in) → {2}
			{2, 2'}: (in – in) → {2'}
			{2', 2''}: (in – in) → {2''}

Sutherland-Hodgeman Algorithm(Cont.....)

- Left border:

v1 v2	both inside	v1 v2
v2 v3	both inside	v2 v3
.....	" "	....

v1,v2,v3,v4v5,v6,v1

- Bottom Border:

v1 v2	both inside	v1 v2
v2 v3	v2 i, v3 o	v2 v3'
v3 v4	both outside	none
v4 v5	both outside	none
v5 v6	v5 o, v6 i	v5' v6
v6 v1	both inside	v6 v1

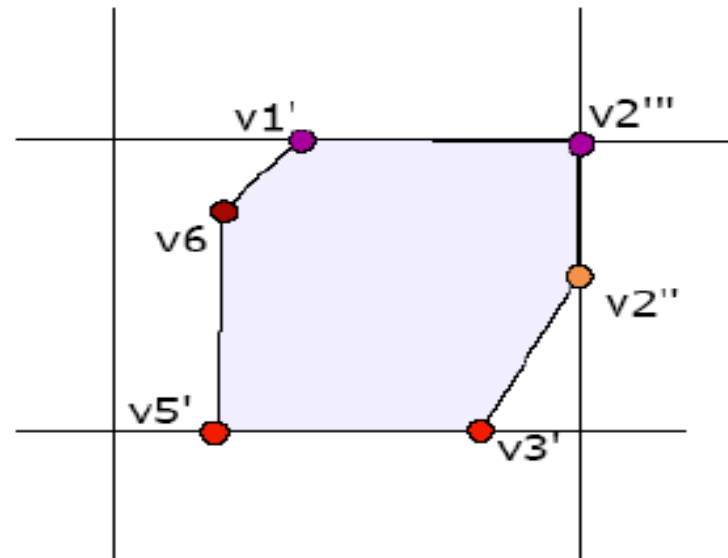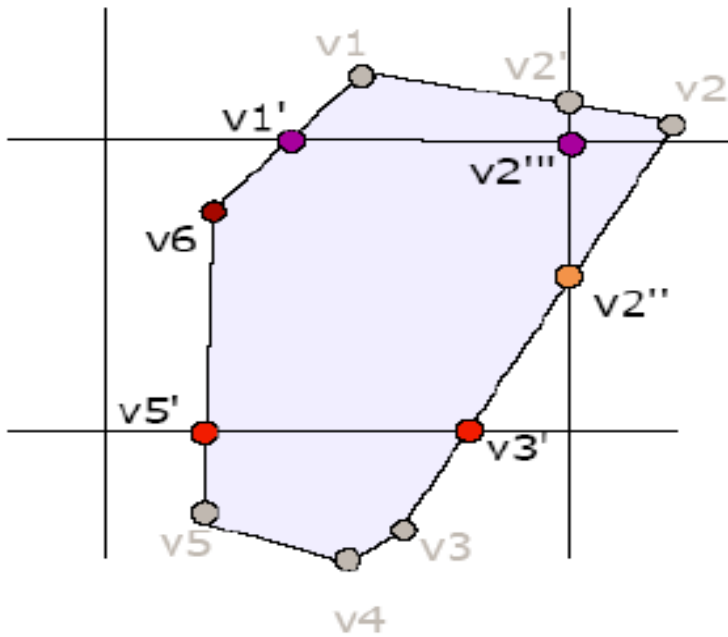v1,v2,v3',v5',v6,v1
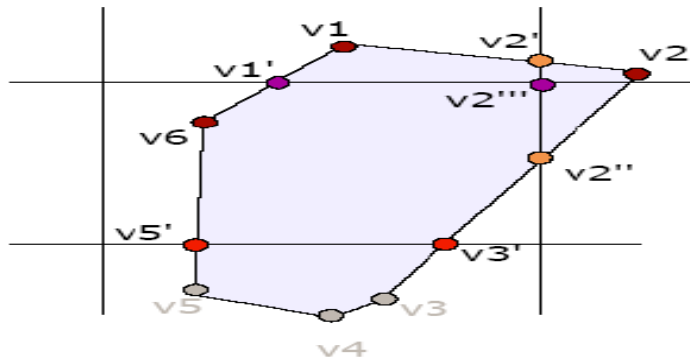
- v1,v2,v3',v5',v6,v1

- Right border:

v1 v2	v1 i, v2 o	v1 v2'
v2 v3'	v2 o, v3'i	v2'' v3'
v3' v5'	both inside	v3' v5'
v5' v6	both inside	v5' v6
v6 v1	both inside	v6 v1

v1,v2',v2'',v3',v5',v6,v1

- Top Border:

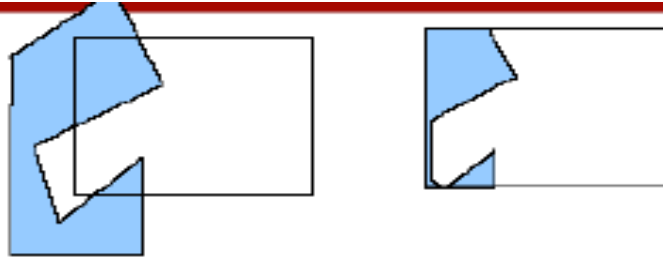| v1 v2'	both outside	none
v2' v2''	v2' o, v2'' i	v2''' v2''
v2'' v3'	both inside	v2'' v3'
v3' v5'	both inside	v3' v5'
v5' v6	both inside	v5' v6
v6 v1	v6 i, v1 o	v6 v1'

v2''',v2'',v3',v5',v6,v1'

Sutherland-Hodgeman Algorithm(Cont.....)

Issues in Clipping

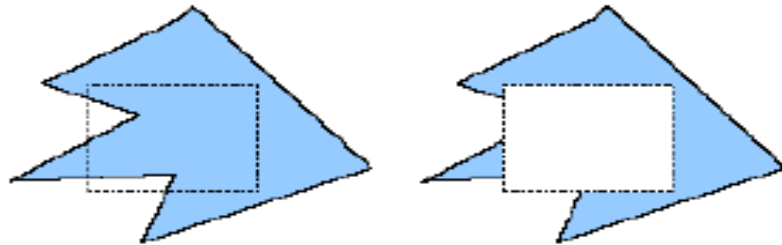- Problem in Sutherland-Hodges. Weiler-Atherton has a solution

- Clipping other shapes: Circle, Ellipse, Curves.

- Clipping a shape against another shape

- Clipping the exteriors.

Summary

- It correctly clips convex polygons

- But display extraneous lines for concave polygons

Resources

- https://en.wikipedia.org/wiki/Sutherland-hodgeman-algorithm
- https:// www.tutorialandexample.com/polygon-clipping/
- https://iq.opengenus.org/sutherland-hodgeman-algorithm