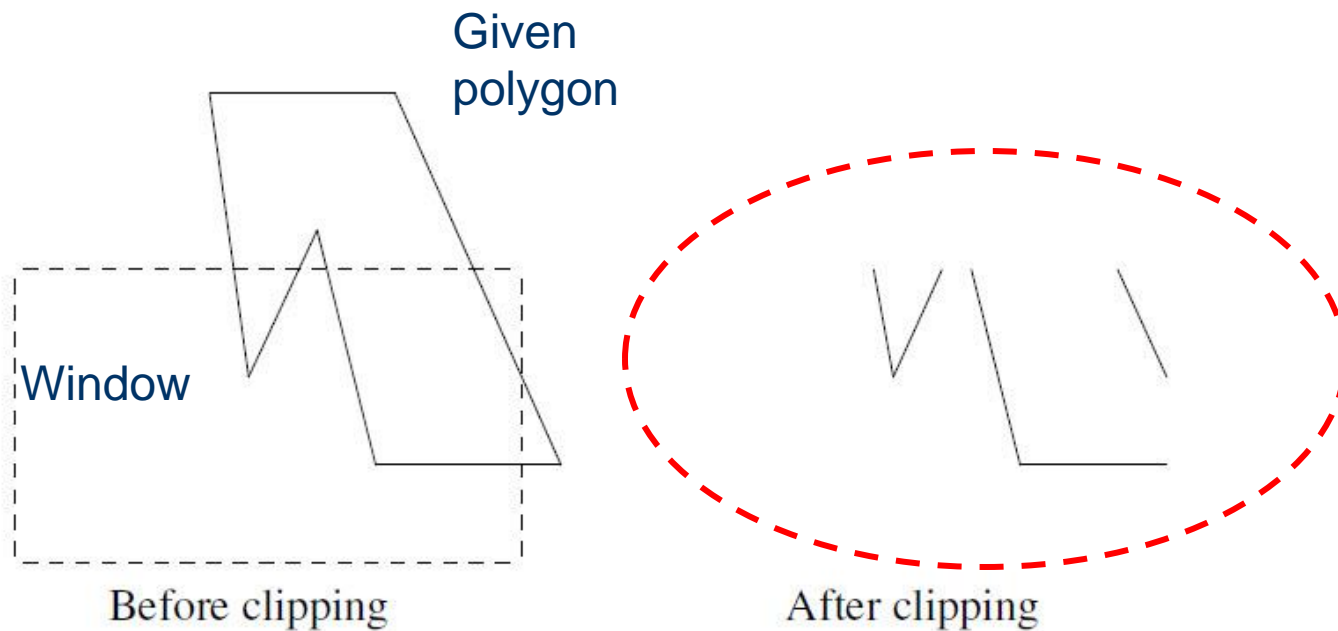


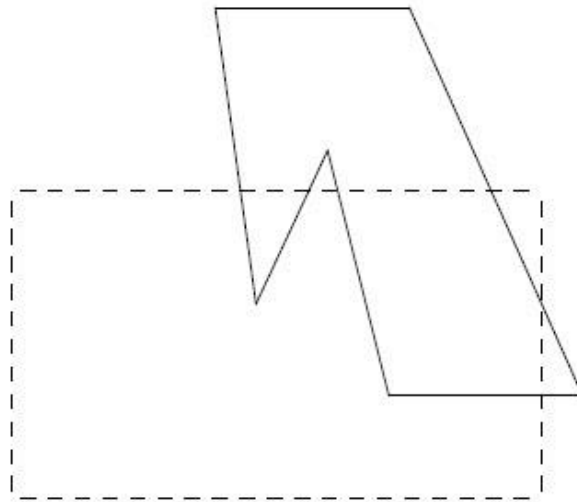
# Polygon Clipping

Can not simply use a line clipper since it may generate a series of unconnected line segments

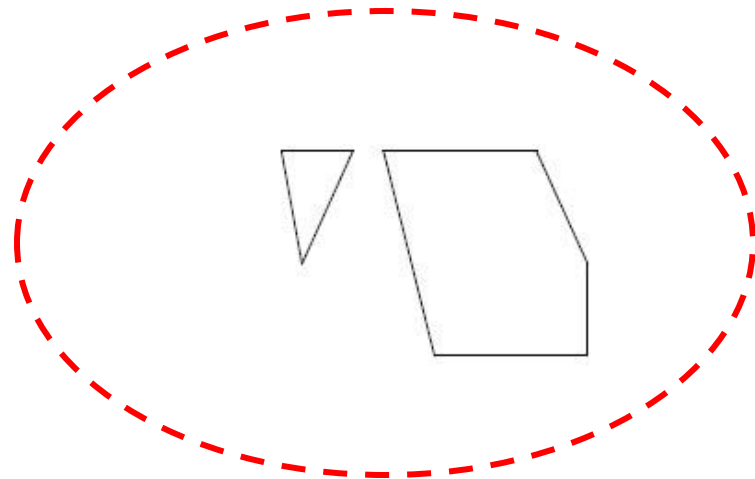


# Polygon Clipping

A polygon clipper should generate one or more closed areas



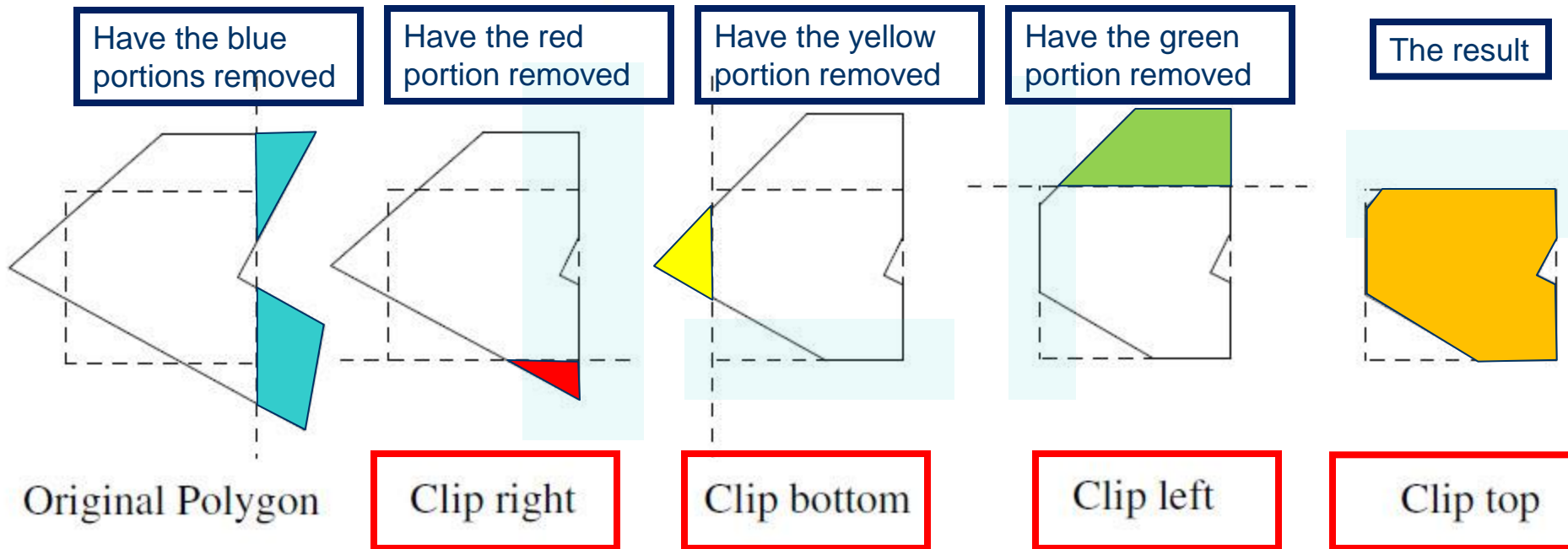
Before clipping



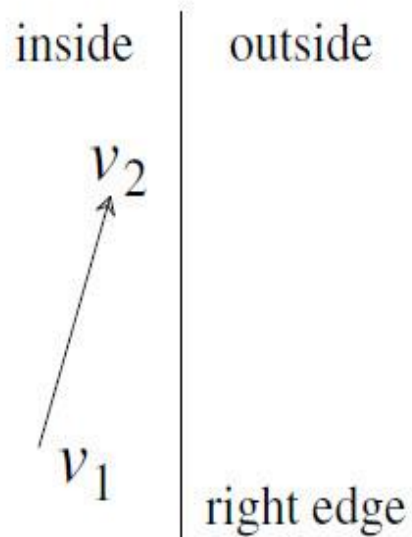
After clipping

# Sutherland-Hodgman Algorithm

- clip polygon boundary against the four edges of the window separately

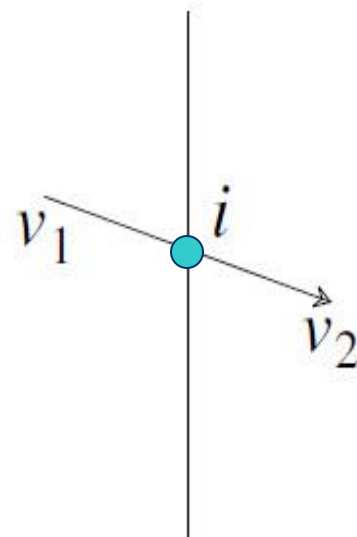


- For each edge of the window, traverse (directed) edges of the polygon and output vertices according to the following rules:



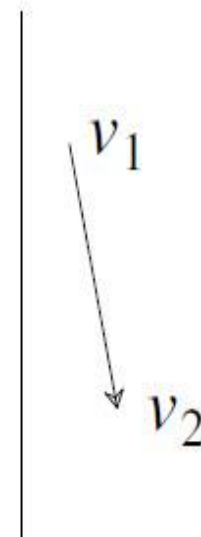
$v_2$  is output

(a)



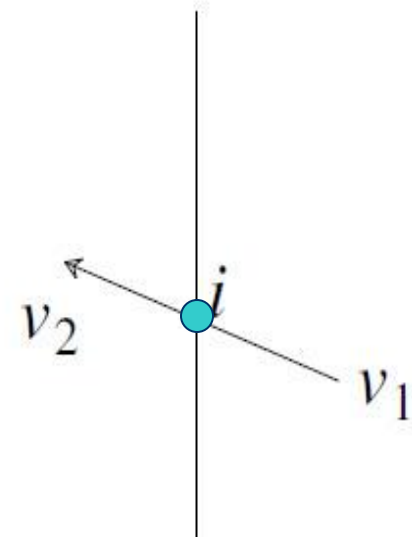
$i$  is output

(b)



No output

(c)

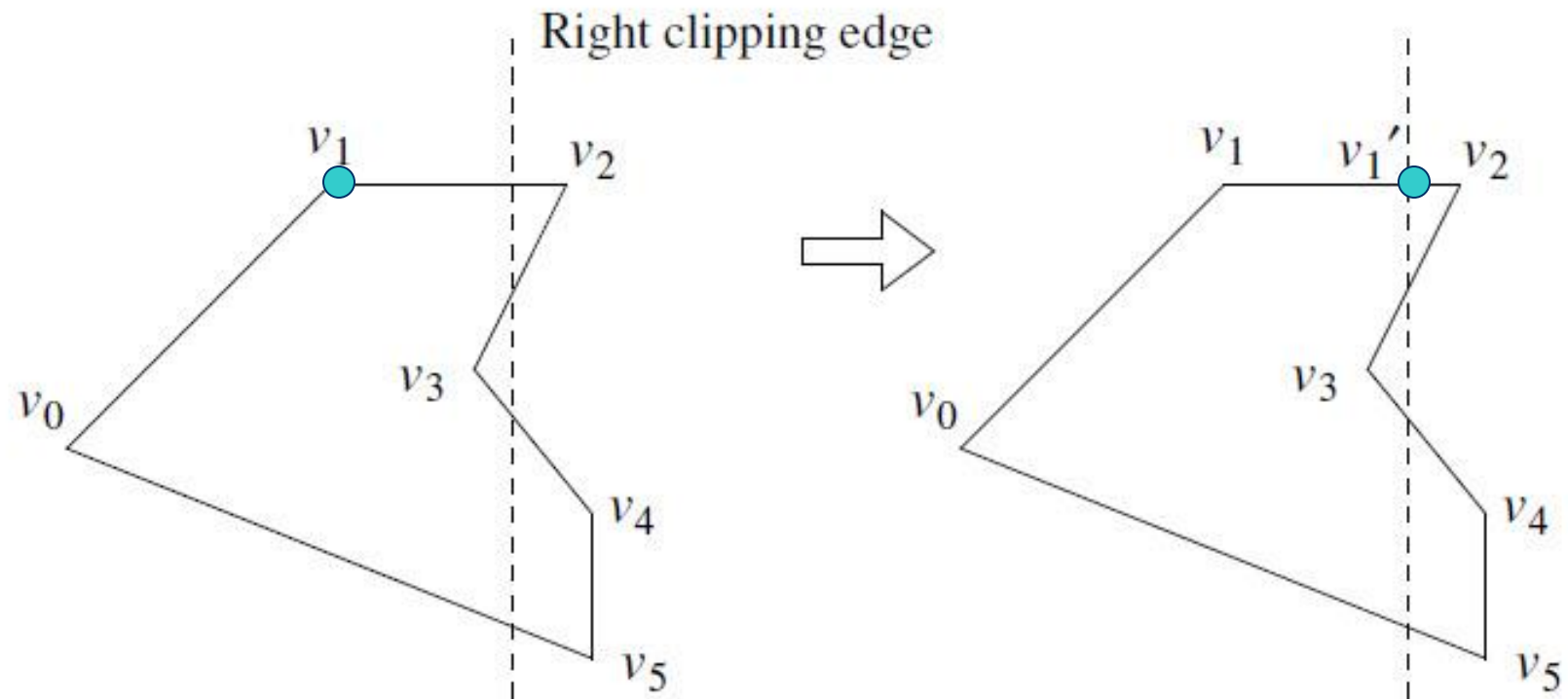


$i$  and  $v_2$  are output

(d)

# An Example

(clipping against the right edge of the window)

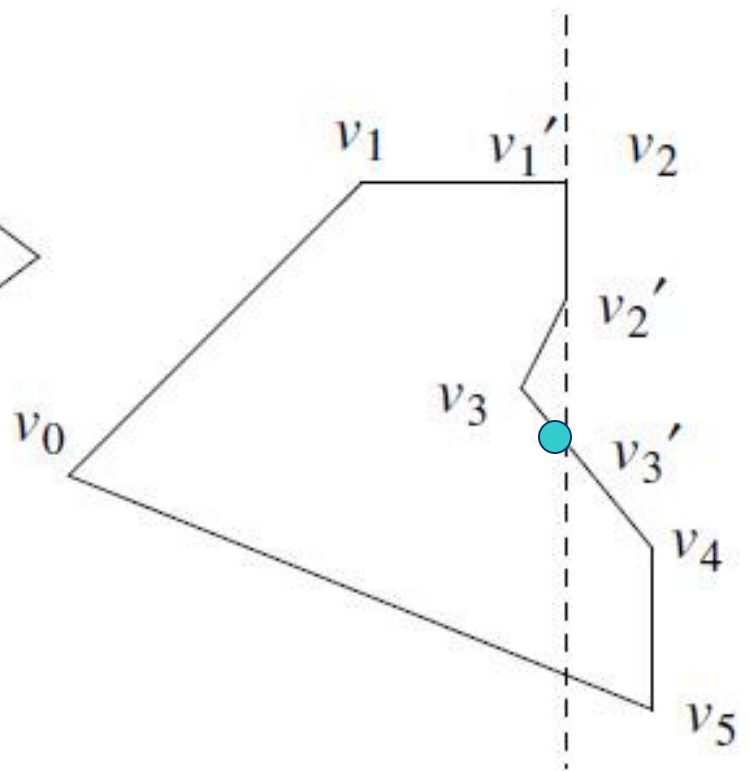
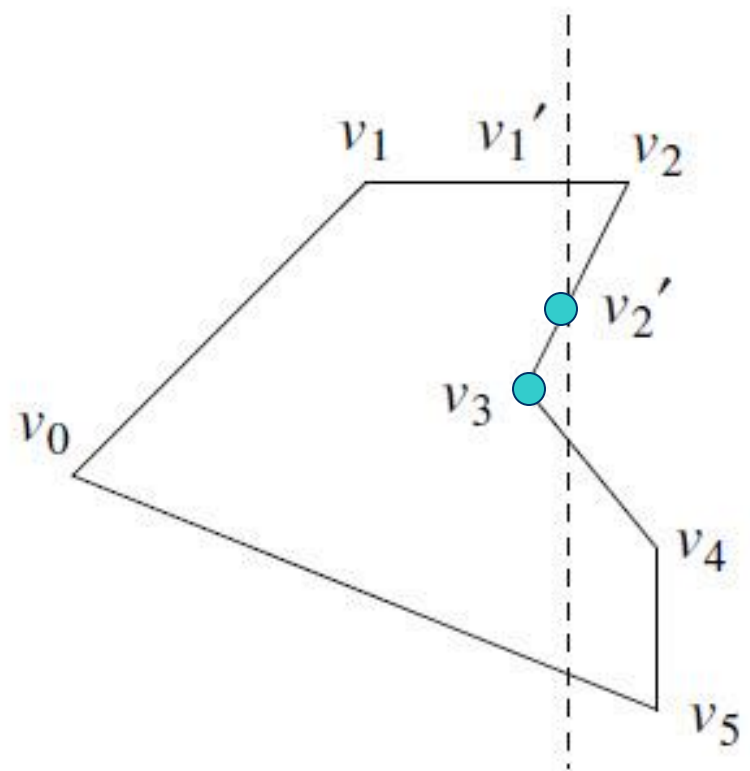


Start with  $v_0v_1$   
Output:  $v_1$

Process  $v_1v_2$   
Output:  $v_1v_1'$

Start with  $v_0v_1$   
Output:  $v_1$

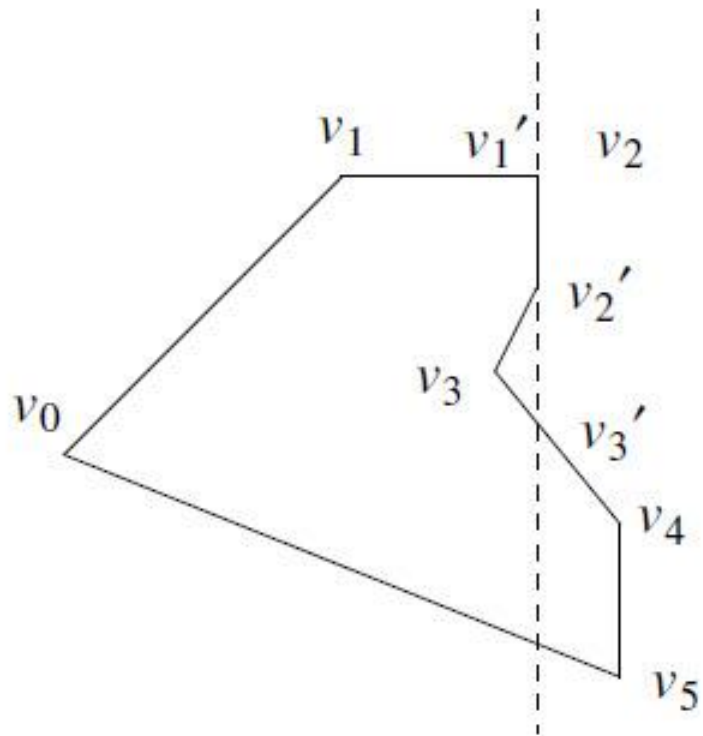
Process  $v_1v_2$   
Output:  $v_1v_1'$



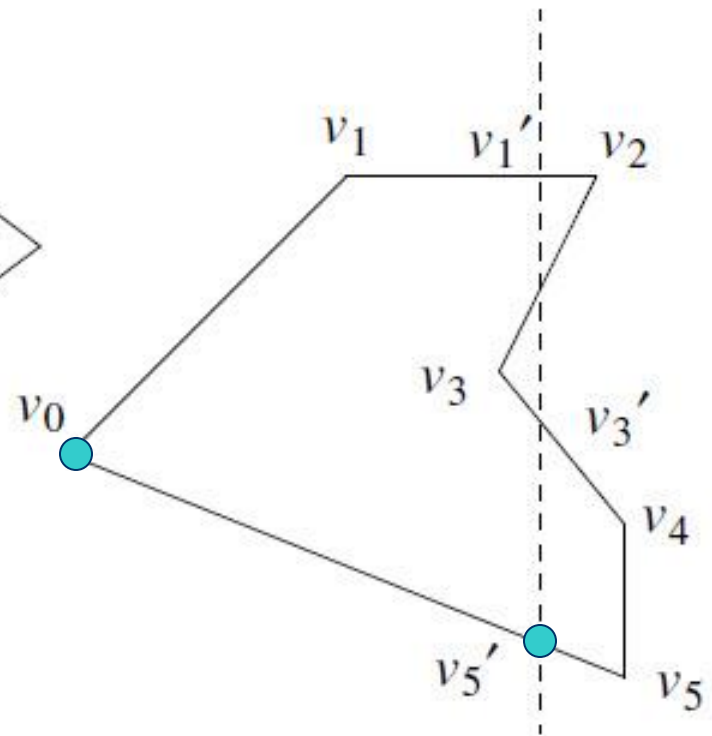
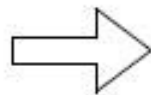
Process  $v_2v_3$   
Output:  $v_1v_1'v_2'v_3$

Process  $v_3v_4$   
Output:  $v_1v_1'v_2'v_3v_3'$

# Example (con't)



Process  $v_4v_5$   
Output:  $v_1v_1'v_2'v_3v_3'$



Process  $v_5v_0$   
Output:  $v_1v_1'v_2'v_3v_3'v_5'v_0$



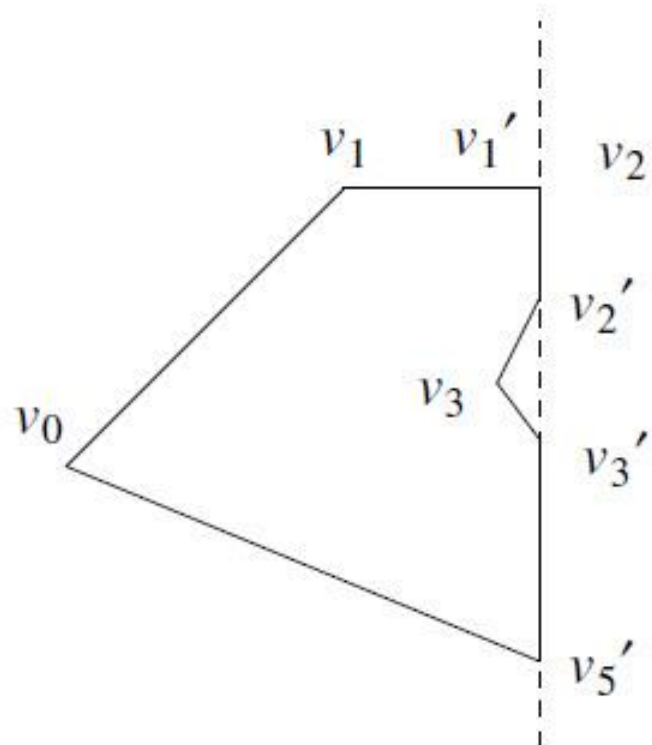
Process  $v_4v_5$

Output:  $v_1v_1'v_2'v_3v_3'$



Process  $v_5v_0$

Output:  $v_1v_1'v_2'v_3v_3'v_5'v_0$

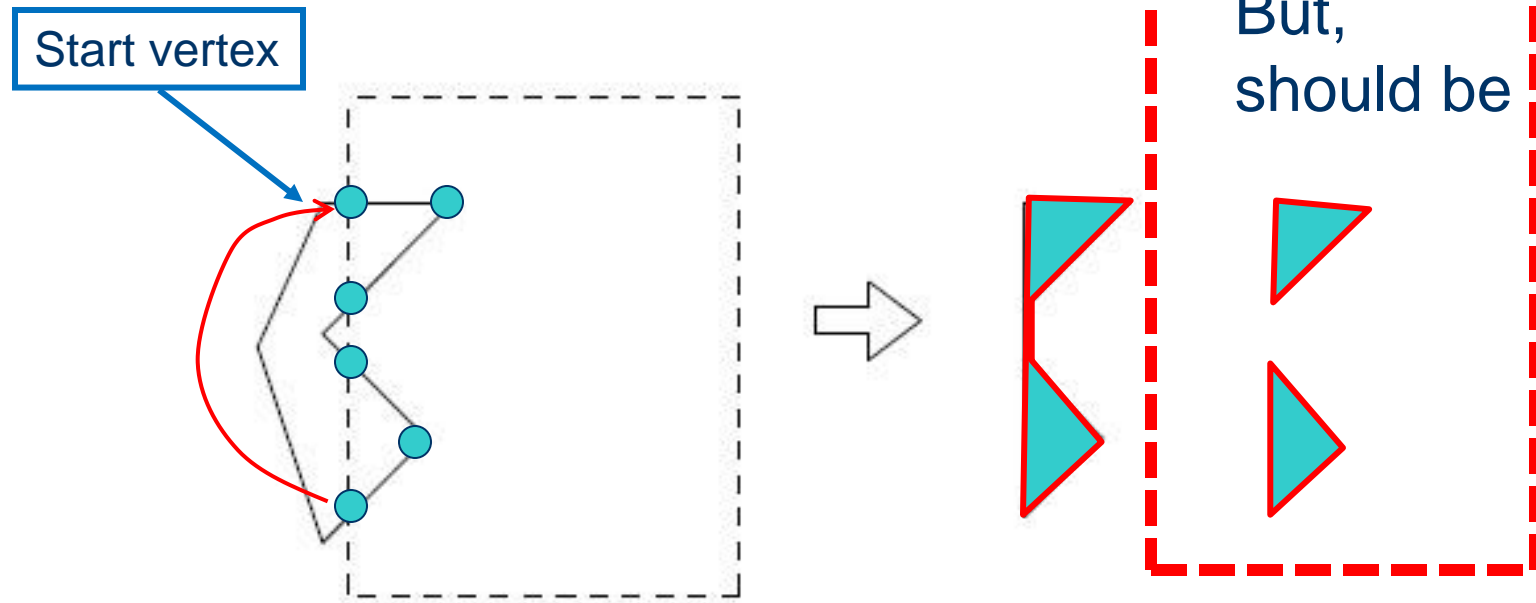


Result:  $v_1v_1'v_2'v_3v_3'v_5'v_0$



Disadvantage of S-H algorithm:

- Output is always a connected area



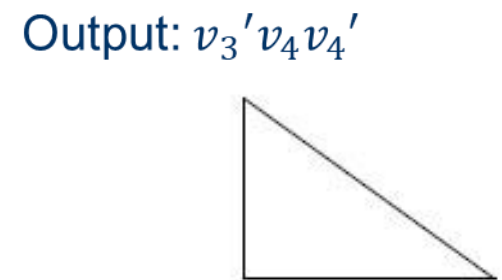
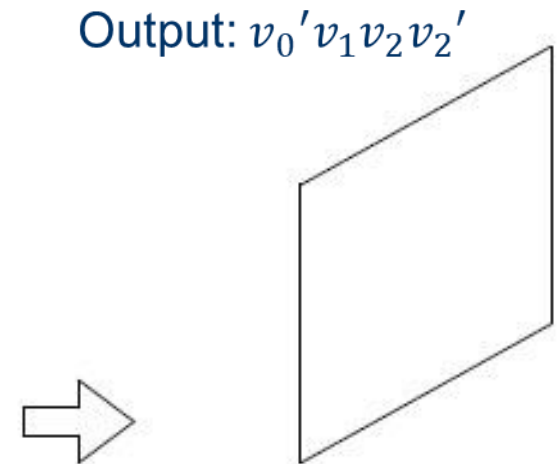
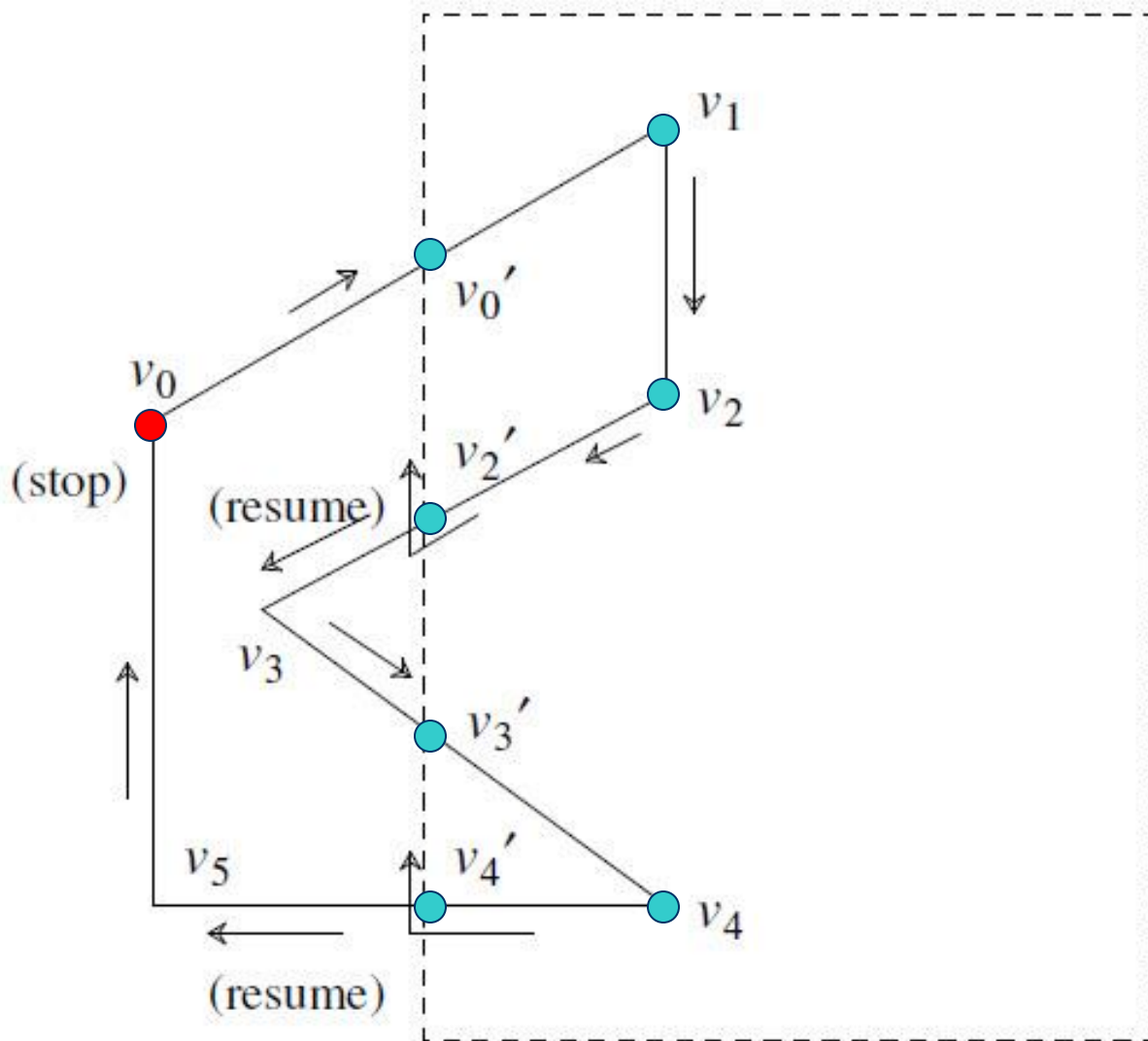
Remedy: using **Weiler-Atherton's** approach

Remedy: using **Weiler-Atherton's** approach

For **clockwise processing** of polygon vertices in S-H clipping algorithm:

- For an outside-to-inside pair of vertices, follow the polygon boundary
- For an inside-to-outside pair of vertices, follow the window boundary in a clockwise direction

Start with edge  $v_0v_1$ :





# End of Polygon Clipping

Can any of these algorithms be extended to a 3D algorithm?

Cyrus-Beck algorithm?

Sutherland-Hodgman algorithm?

Wiler-Atherton algorithm?