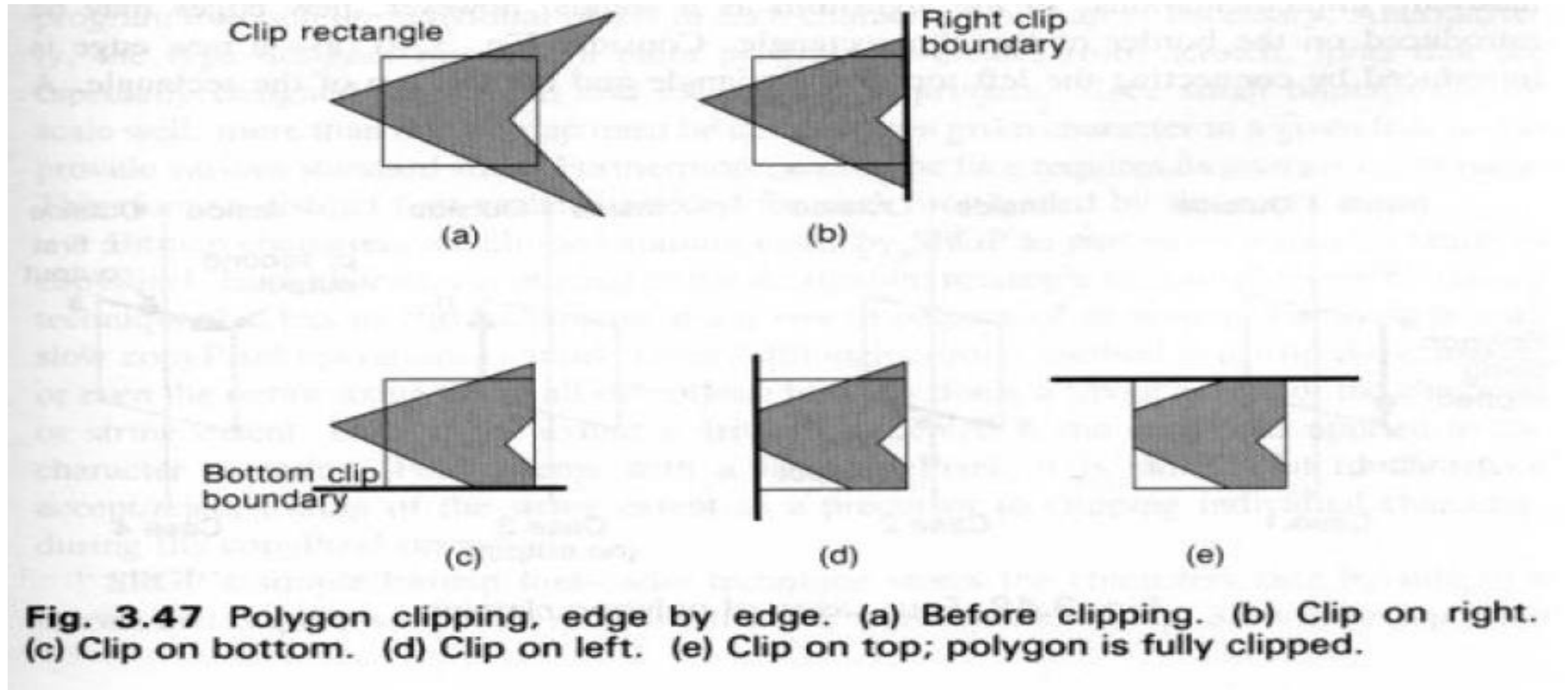


Clipping

Sutherland-Hodgman Polygon Clipping

Sutherland-Hodgman Polygon Clipping



Sutherland-Hodgman Polygon Clipping

- Divide and Conquer Strategy
 - Clip against a single infinite clip edge and get new vertices
 - Repeat for next clip edge
- Adding Vertices to Output List

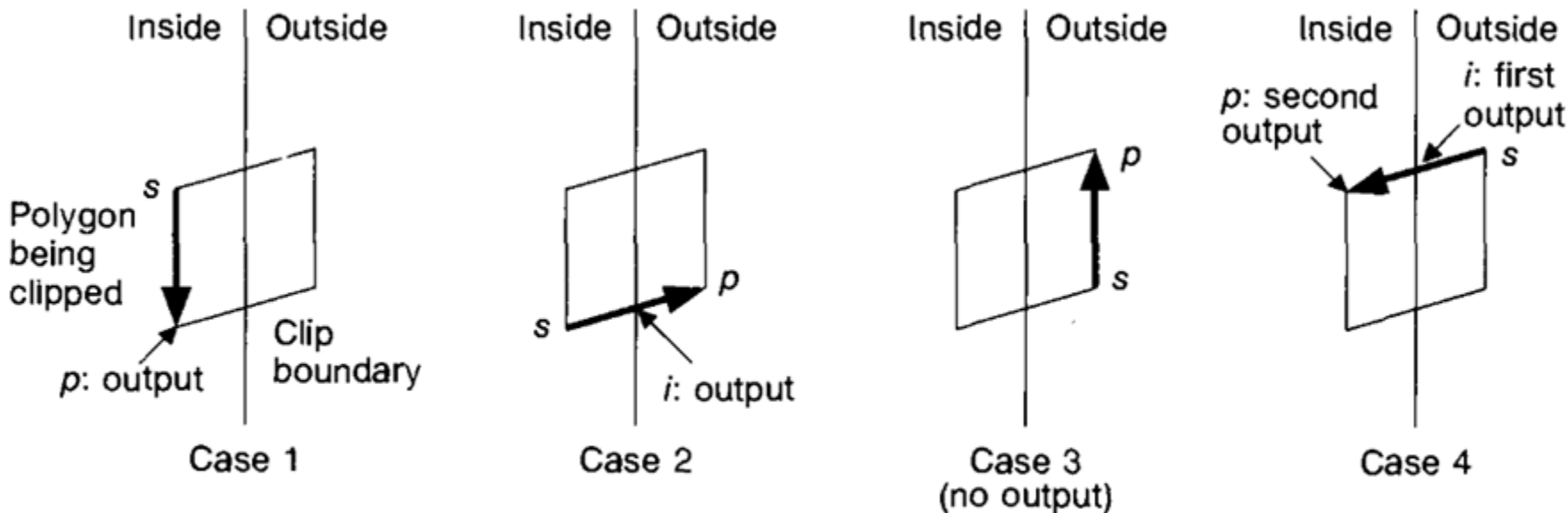


Fig. 3.48 Four cases of polygon clipping.

Sutherland-Hodgman Polygon Clipping

Input:

1. Polygon described by an input of list of vertices: v_1, v_2, \dots, v_n
2. Convex clip region C

Algorithm:

Inputlist : v_1, v_2, \dots, v_n

For each clip edge e in E do

$S \leftarrow v_n$

$P \leftarrow v_1$

$j \leftarrow 1$

 While ($j < n$)

 do, if both S & P inside the clip region,

 Add p to output list

 else if S inside & P outside, then

 Find intersection point i

 Add i to output list

 else if S outside and P inside, then

 find intersection point i

 add i to output list

 add P to output list

 else if S and P both outside

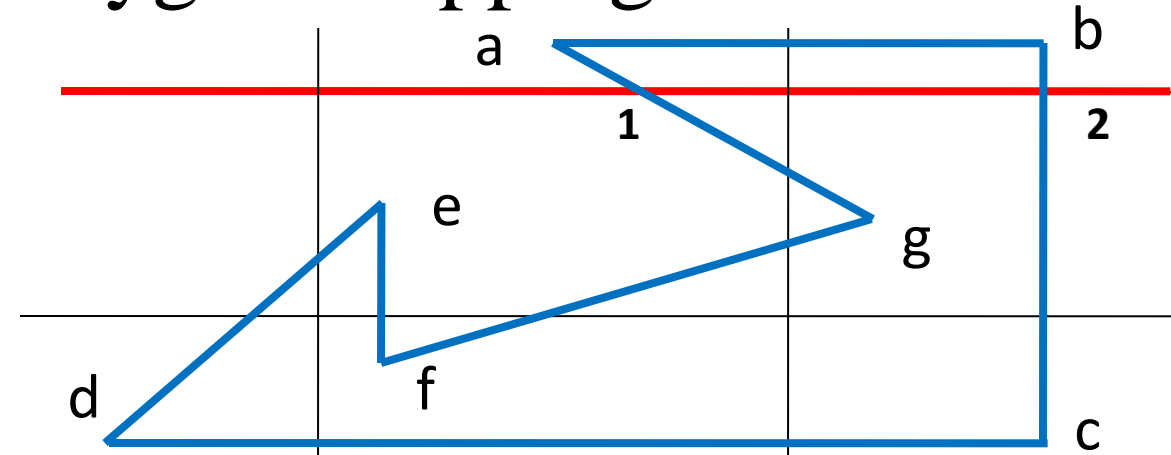
 do nothing

$S \leftarrow v_j$

$j \leftarrow j + 1$

Sutherland-Hodgman Polygon Clipping

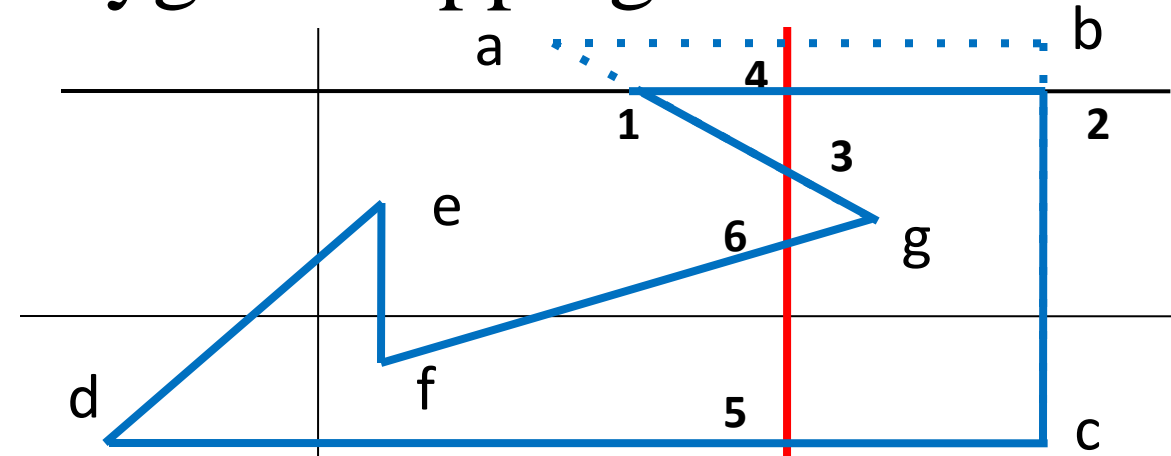
- a, b, c, d, e, f, g
- S = g, P = a
- Output: 1, 2, c, d, e, f, g



SP	Intersection	Output	Comments
g, a	1	1	g inside, a outside
a, b	-	-	Both outside
b, c	2	2,c	b outside, c inside
c, d	-	d	Both inside
d, e	-	e	Both inside
e, f	-	f	Both inside
f, g	-	g	Both inside

Sutherland-Hodgman Polygon Clipping

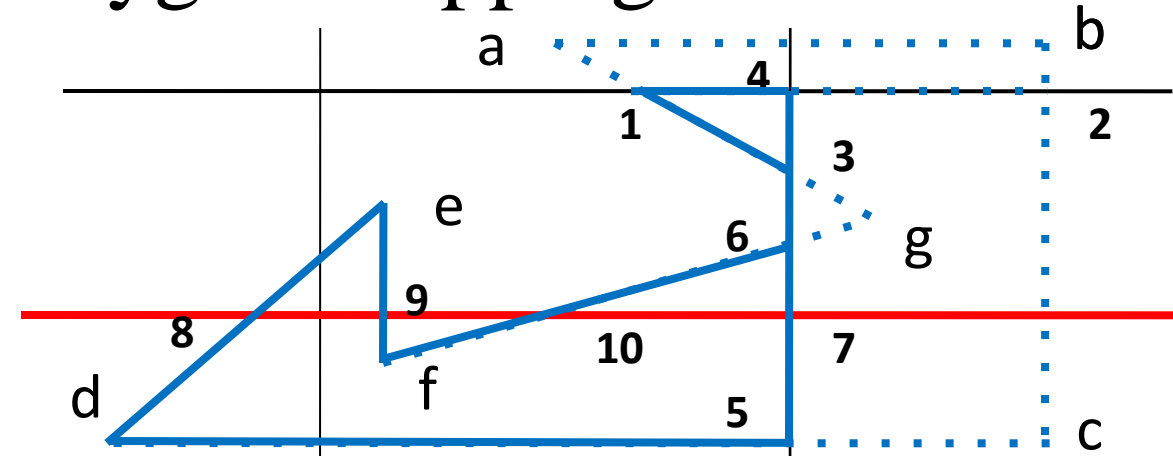
- Output of previous iteration
1, 2, c, d, e, f, g
- $S = g$, $P = 1$
- Output: 3, 1, 4, 5, d, e, f, 6



SP	Intersection	Output	Comments
g, 1	3	3, 1	g outside, 1 inside
1, 2	4	4	1 inside, 2 outside
2, c	-	-	Both outside
c, d	5	5, d	d inside, c outside
d, e	-	e	Both inside
e, f	-	f	Both inside
f, g	6	6	f inside, g outside

Sutherland-Hodgman Polygon Clipping

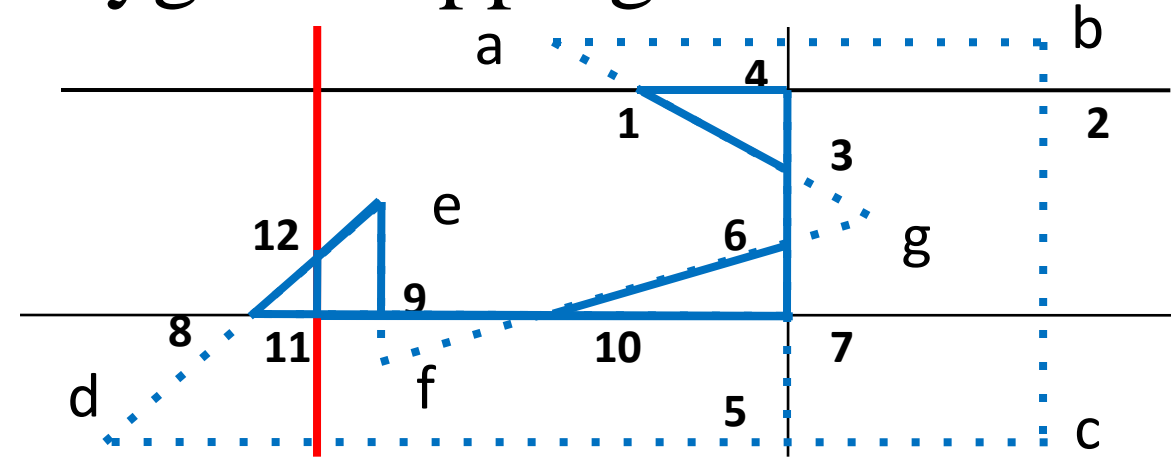
- Output of previous iteration
3, 1, 4, 5, d, e, f, 6
- $S = 6$, $P = 3$
- Output: 3, 1, 4, 7, 8, e, 9, 10, 6



SP	Intersection	Output	Comments
6, 3	-	3	Both inside
3, 1	-	1	Both inside
1, 4	-	4	Both inside
4, 5	7	7	4 inside, 5 outside
5, d	-	-	Both outside
d, e	8	8, e	e inside, d outside
e, f	9	9	e inside, f outside
f, 6	10	10, 6	6 inside, f outside

Sutherland-Hodgman Polygon Clipping

- Output of previous iteration
3, 1, 4, 7, 8, e, 9, 10, 6
- $S = 6$, $P = 3$
- Output: 3, 1, 4, 7, 11, 12, e,
9, 10, 6



SP	Intersection	Output	Comments
6, 3	-	3	Both inside
3, 1	-	1	Both inside
1, 4	-	4	Both inside
4, 7	-	7	Both inside
7, 8	11	11	7 inside, 8 outside
8, e	12	12, e	e inside, 8 outside
e, 9	-	9	Both inside
9, 10	-	10	Both inside
10, 6	-	6	Both inside

Clipping Circles (and Ellipses)

- Analytical
 - Intersect circle's extent (square of size of circle's diameter) with clip rectangle
 - Run the algorithm of polygon clipping
 - No intersect : trivial reject
 - Intersect : divide into quadrants (and later octants if needed) and repeat
 - Compute intersection by solving equations
- During Scan Conversion
 - When circle is relatively small or scan conversion is fast
 - After extent checking scissor on a pixel by pixel basis

➤ Similar Approach for Ellipses!

Thank you 😊