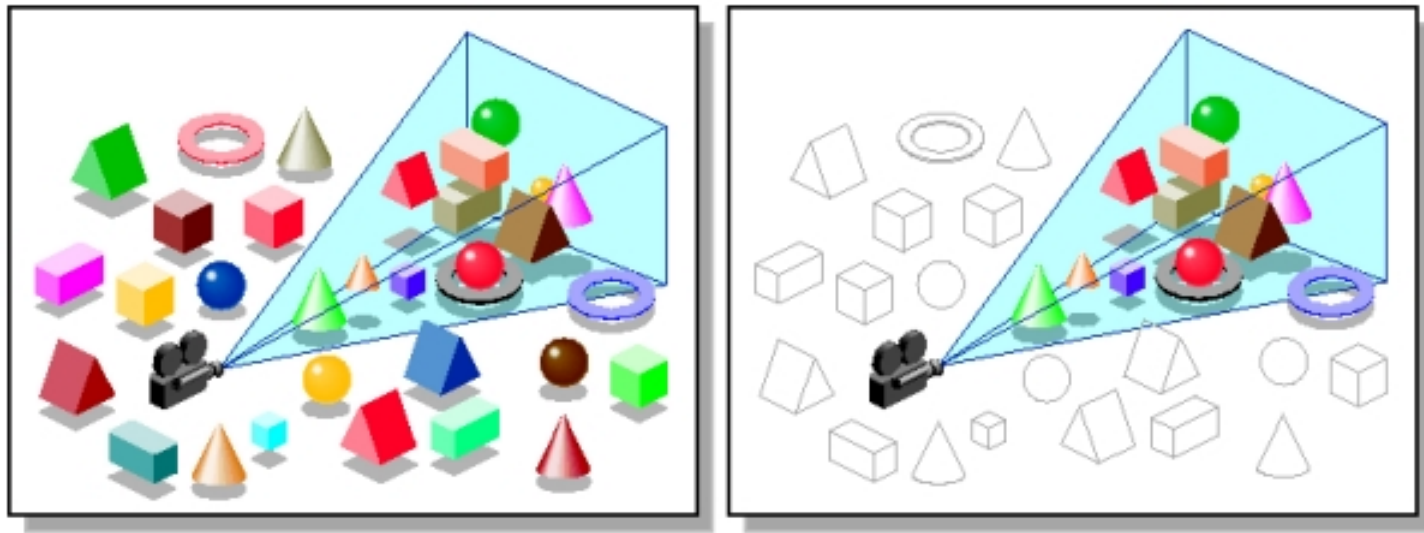


# Clipping di Poligoni

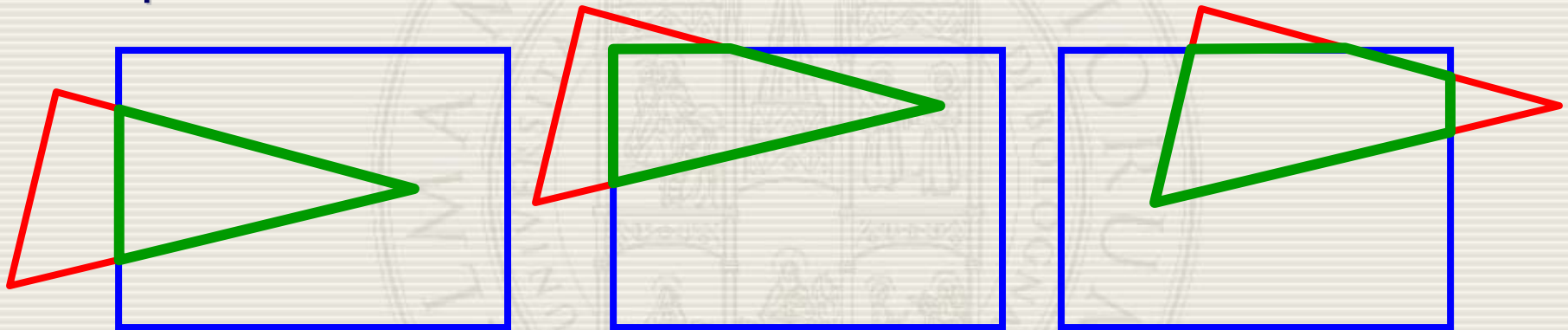


# Clipping di Poligoni in 2D

Il Clipping di Poligoni è complicato!

Cosa accade ad un triangolo durante il clipping?

- possibili situazioni:



triangolo → triangolo

triangolo → quadrilatero

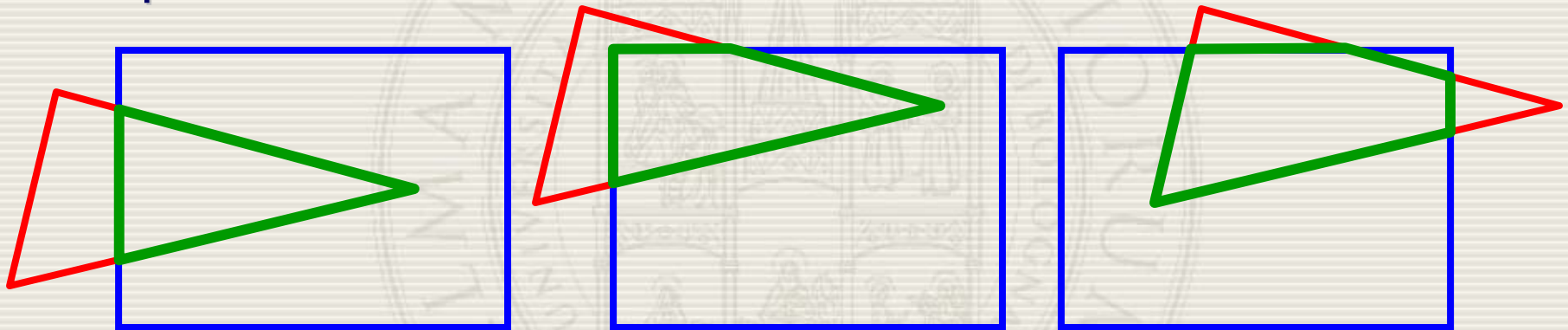
triangolo → pentagono

# Clipping di Poligoni in 2D

Il Clipping di Poligoni è complicato!

Cosa accade ad un triangolo durante il clipping?

- possibili situazioni:



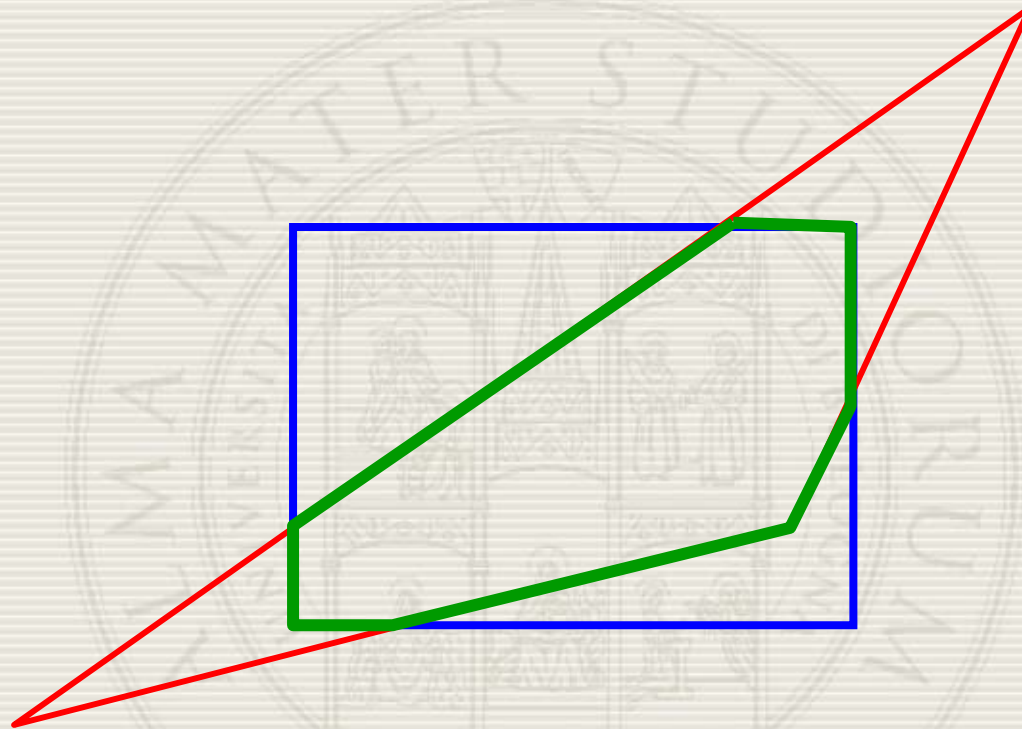
triangolo → triangolo

triangolo → quadrilatero

triangolo → pentagono

Quanti lati può avere un triangolo dopo il Clipping?

# Quanti lati?



fino a 7 lati

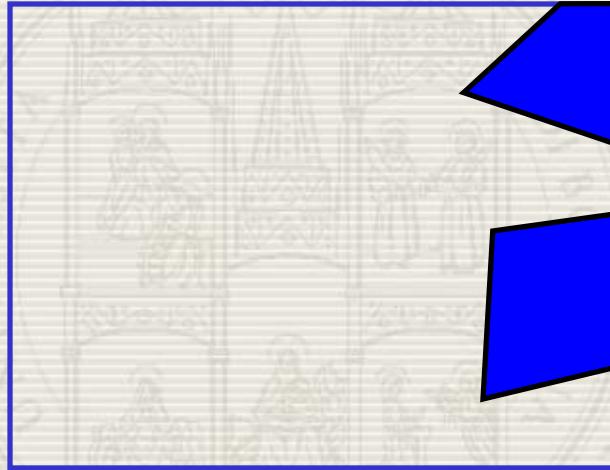
# Il Clipping di Poligoni è complicato!



Poligono concavo → più poligoni

# Il Clipping di Poligoni è complicato!

Un caso veramente difficile!

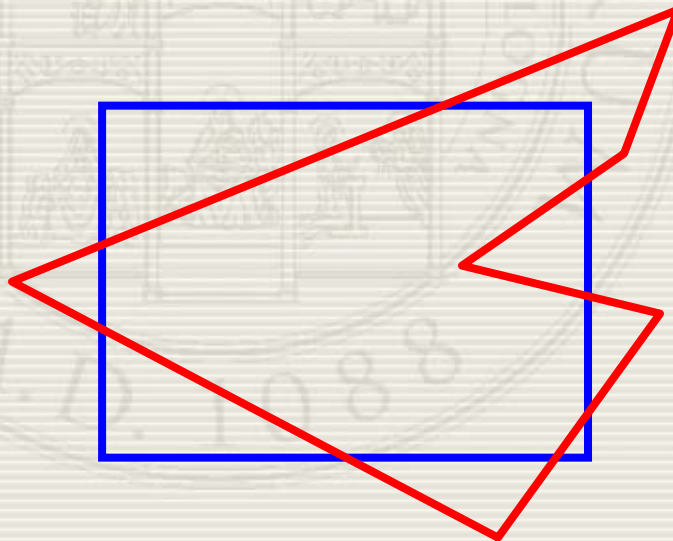


# Sutherland-Hodgman Clipping

Idea base:

- si considera ogni lato della window individualmente
- si fa il clip del poligono rispetto ai lati della window

....vediamo

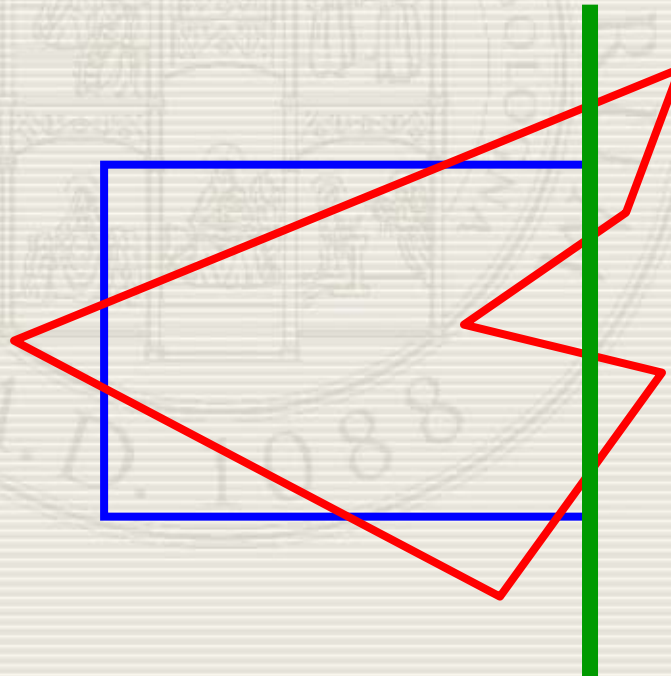




# Sutherland-Hodgman Clipping

Idea base:

- si considera ogni lato della window individualmente
- si fa il clip del poligono rispetto ai lati della window

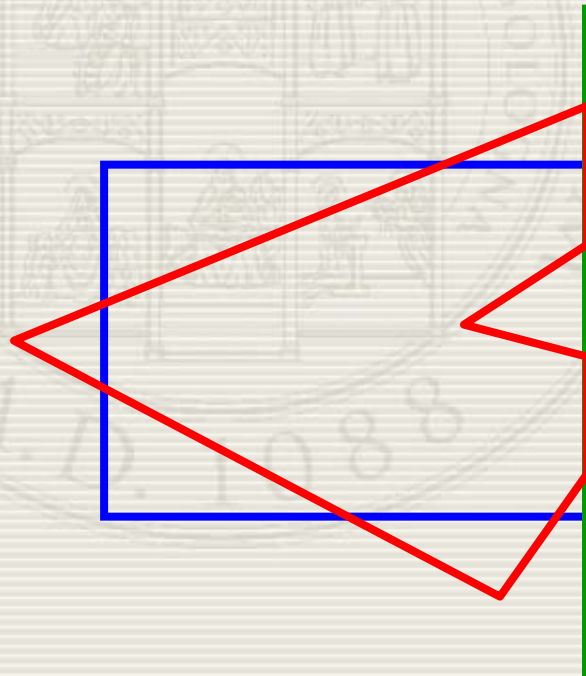




# Sutherland-Hodgman Clipping

Idea base:

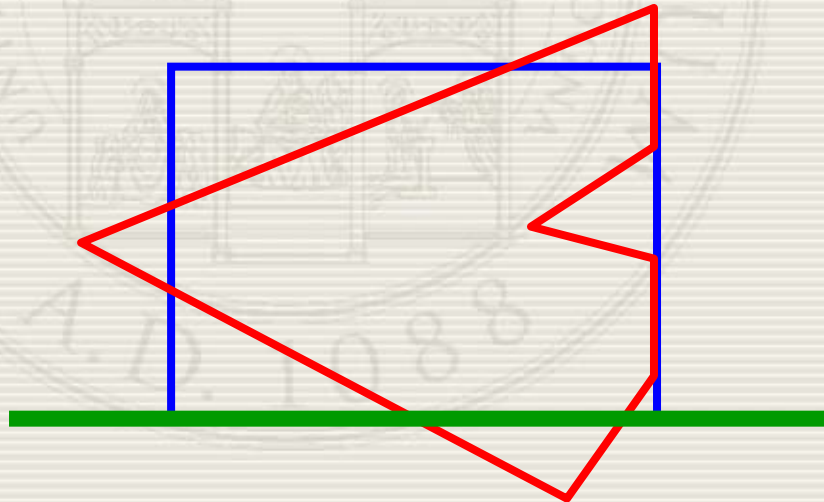
- si considera ogni lato della window individualmente
- si fa il clip del poligono rispetto ai lati della window



# Sutherland-Hodgman Clipping

Idea base:

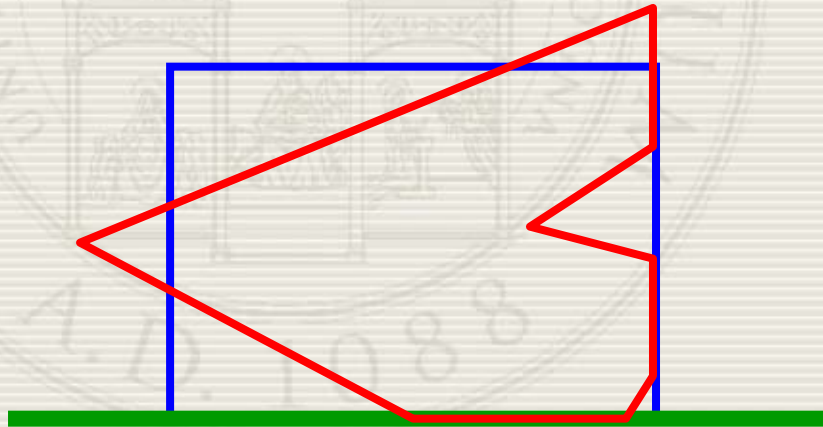
- si considera ogni lato della window individualmente
- si fa il clip del poligono rispetto ai lati della window



# Sutherland-Hodgman Clipping

Idea base:

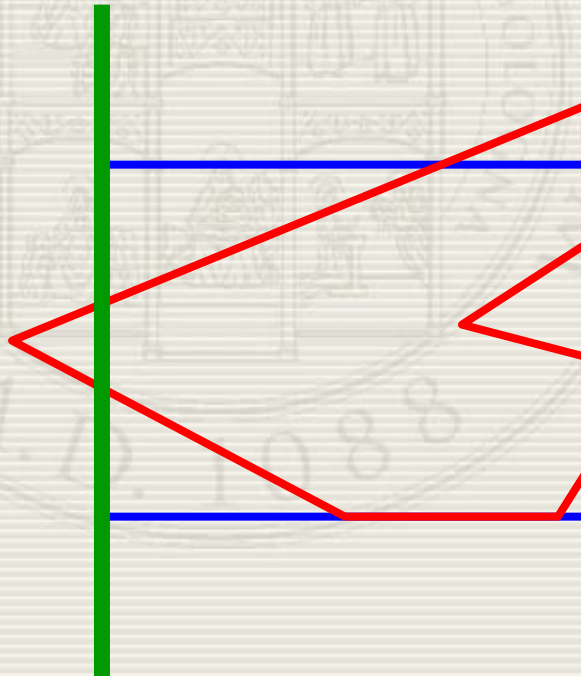
- si considera ogni lato della window individualmente
- si fa il clip del poligono rispetto ai lati della window



# Sutherland-Hodgman Clipping

Idea base:

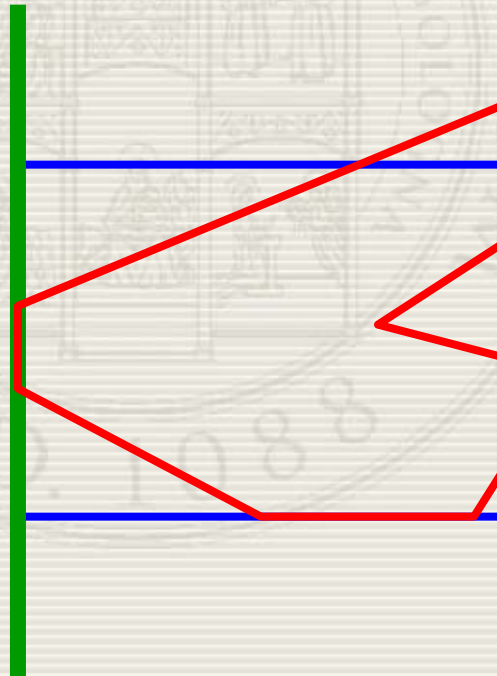
- si considera ogni lato della window individualmente
- si fa il clip del poligono rispetto ai lati della window



# Sutherland-Hodgman Clipping

Idea base:

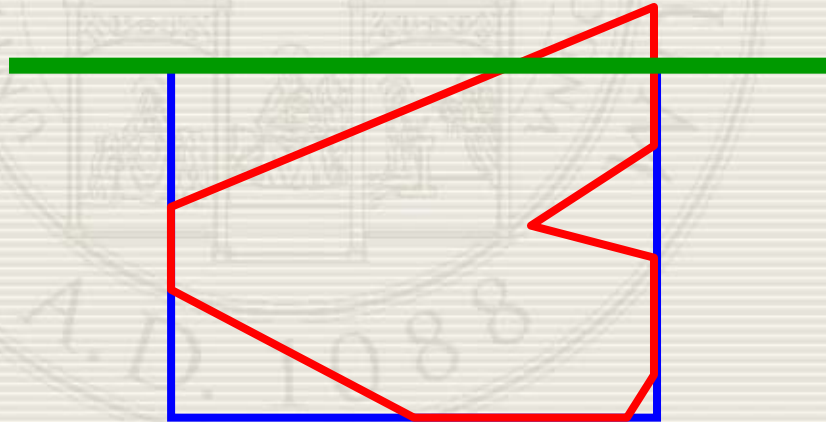
- si considera ogni lato della window individualmente
- si fa il clip del poligono rispetto ai lati della window



# Sutherland-Hodgman Clipping

Idea base:

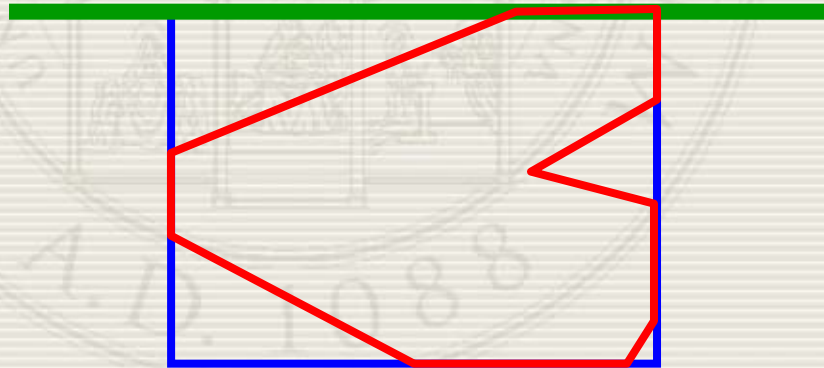
- si considera ogni lato della window individualmente
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# Sutherland-Hodgman Clipping

Idea base:

- si considera ogni lato della window individualmente
- si fa il clip del poligono rispetto ai lati della window

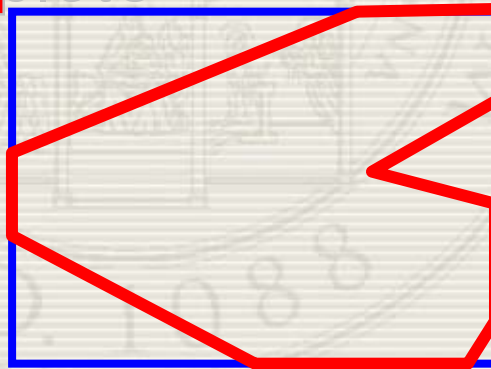




# Sutherland-Hodgman Clipping

Idea base:

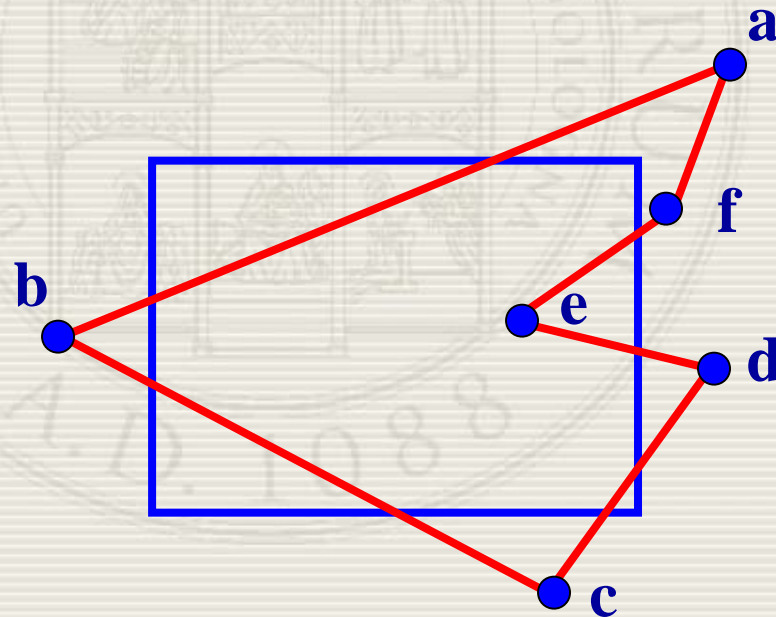
- si considera ogni lato della window individualmente
- si fa il clip del poligono rispetto ai lati della window
- dopo aver processato ogni lato, il clipping del poligono sarà completo



# Sutherland-Hodgman Clipping

Input/output dell'algoritmo:

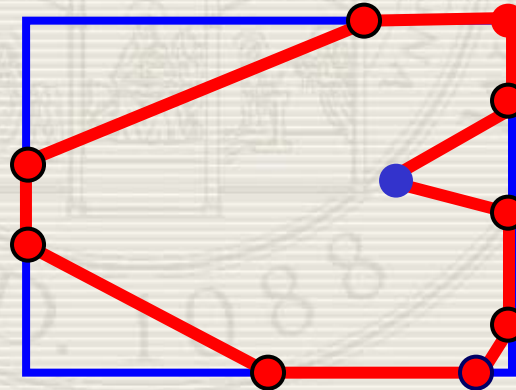
- input: lista dei vertici del poligono nell'ordine {abcdef}



# Sutherland-Hodgman Clipping

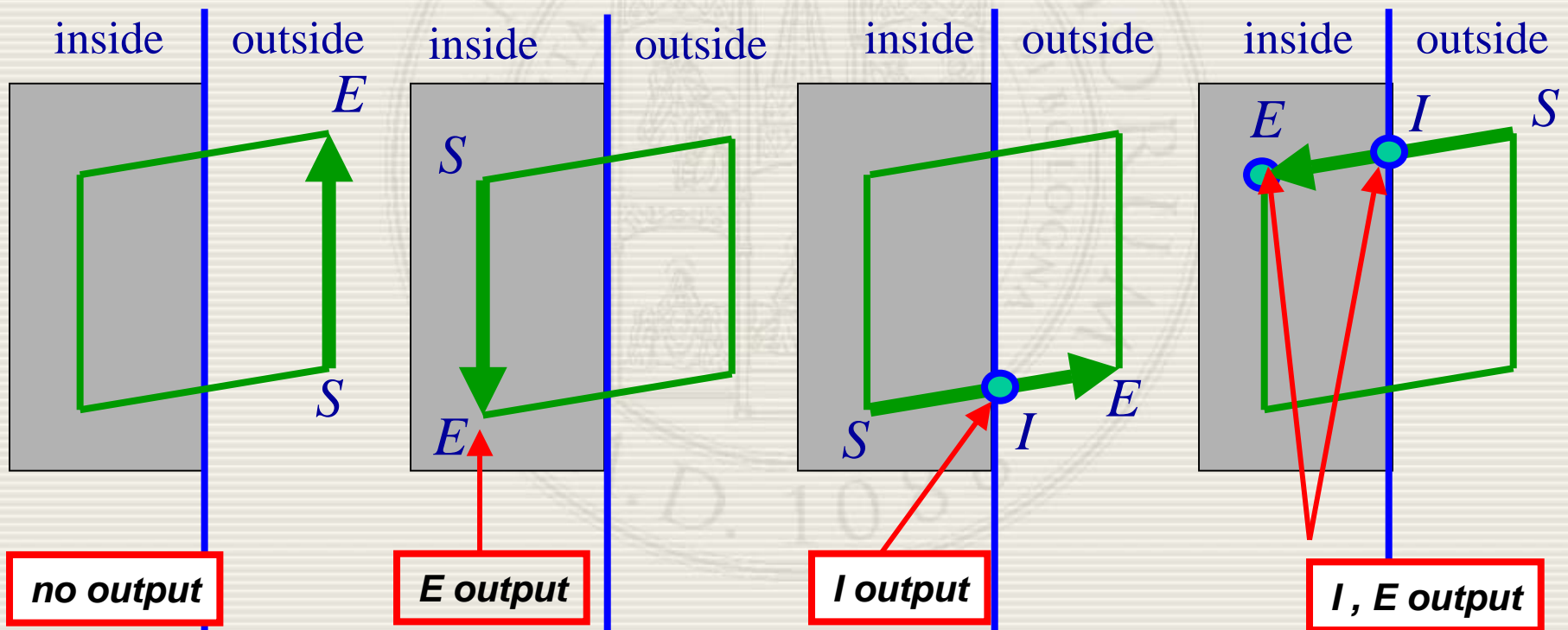
Input/output dell'algoritmo:

- input: lista dei vertici del poligono nell'ordine {abcdef}
- output: lista dei vertici del poligono, che consiste in alcuni di quelli iniziali e alcuni nuovi

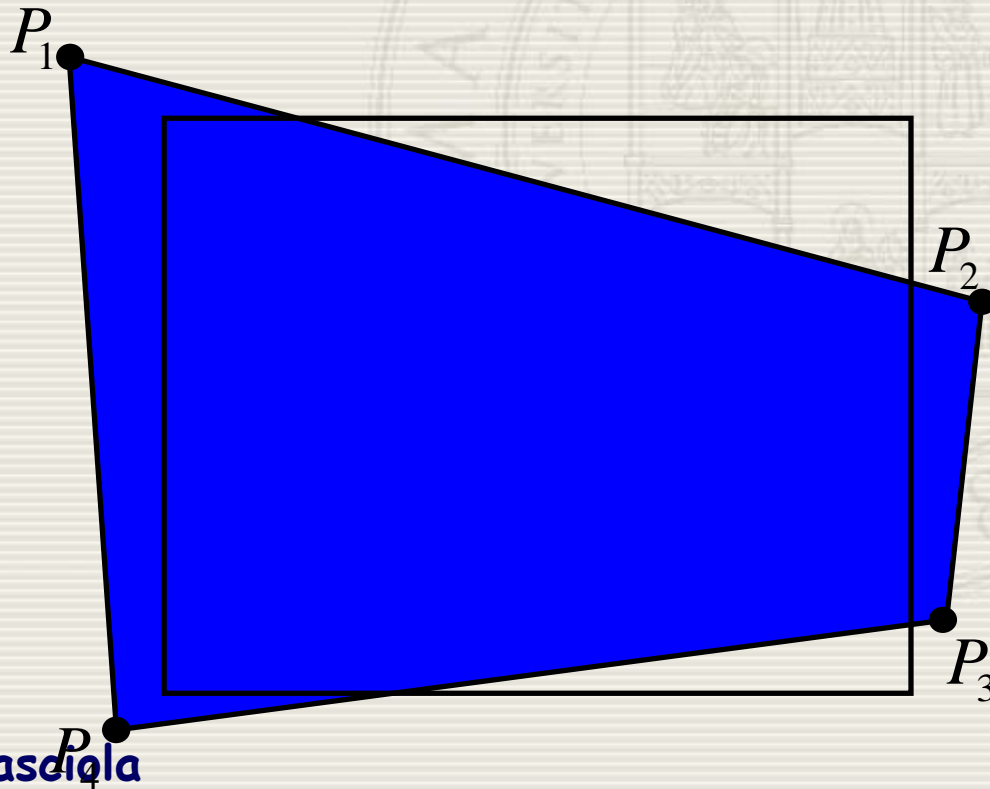
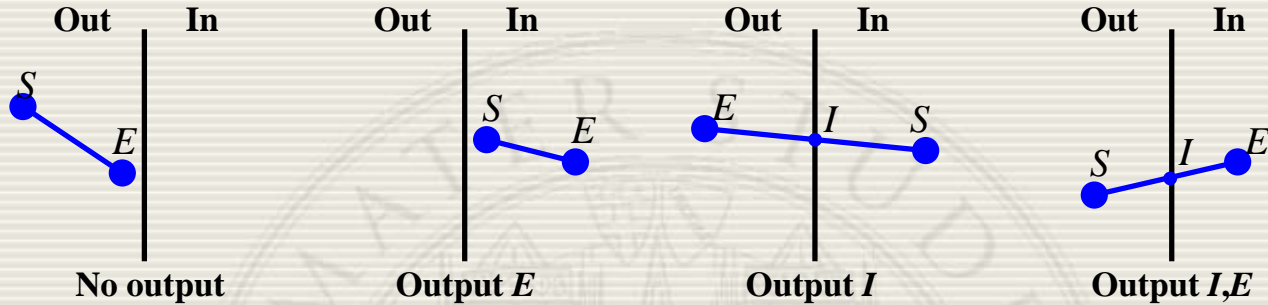


# Sutherland-Hodgman Clipping

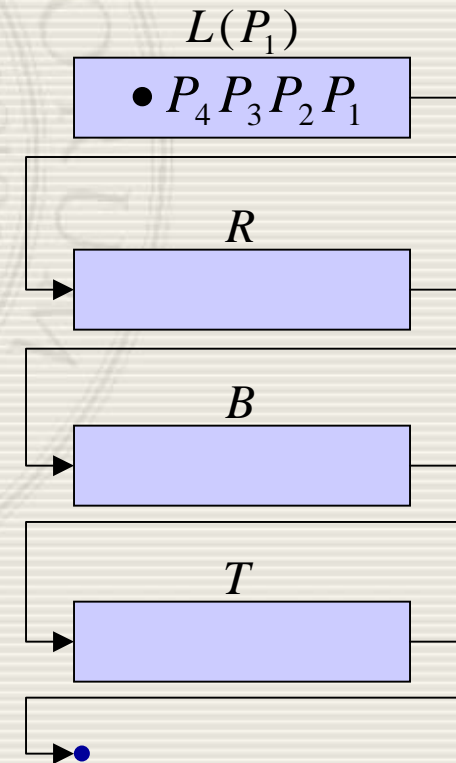
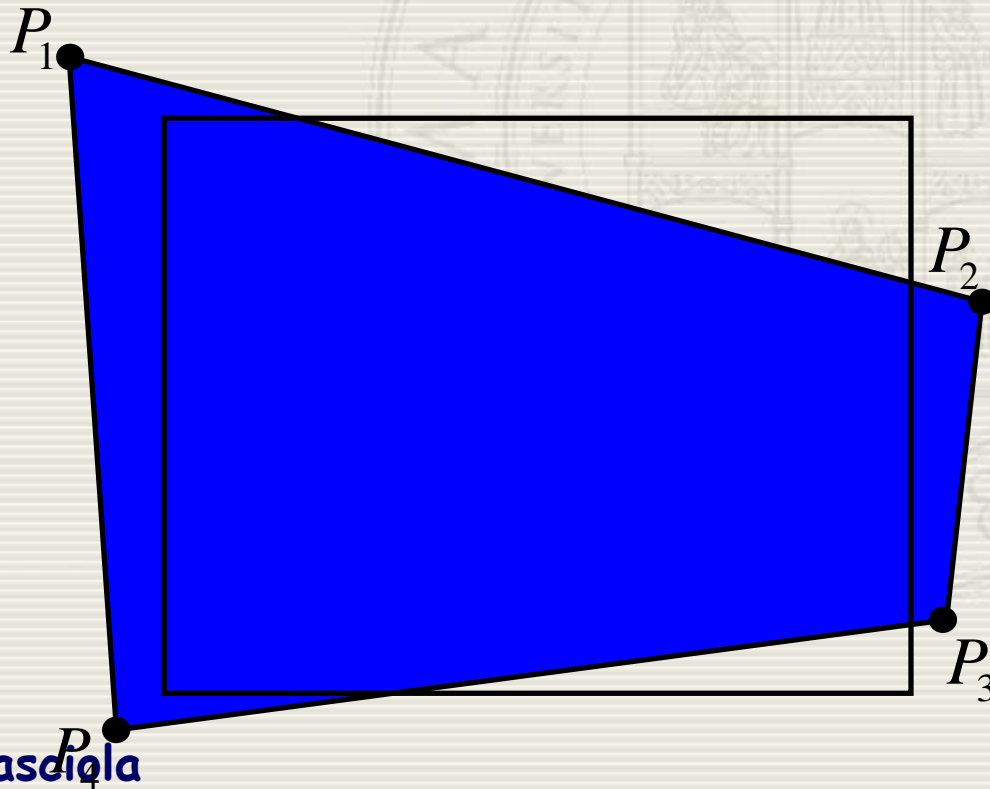
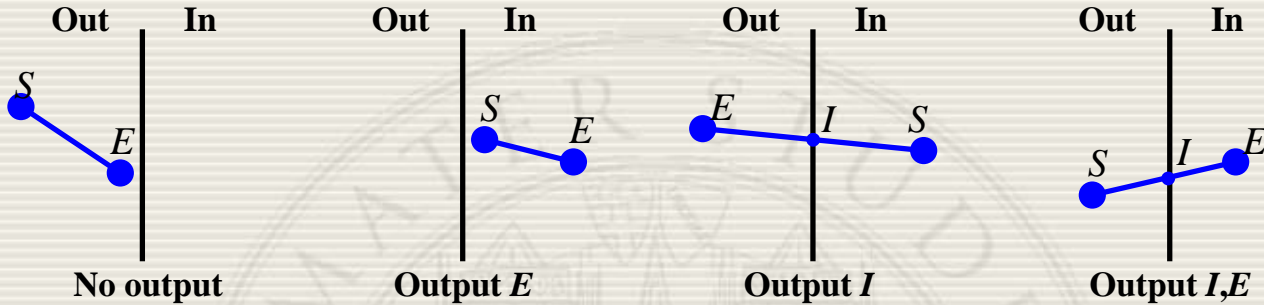
Il lato che va dal vertice S (Start) al vertice E (End) può trovarsi in uno dei seguenti quattro casi:



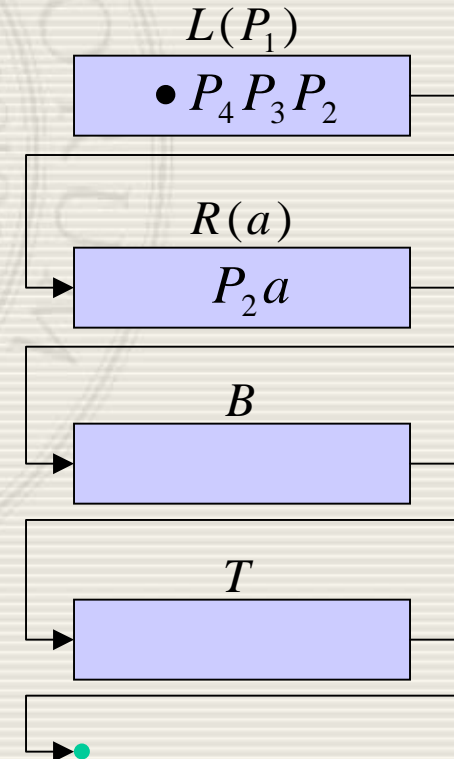
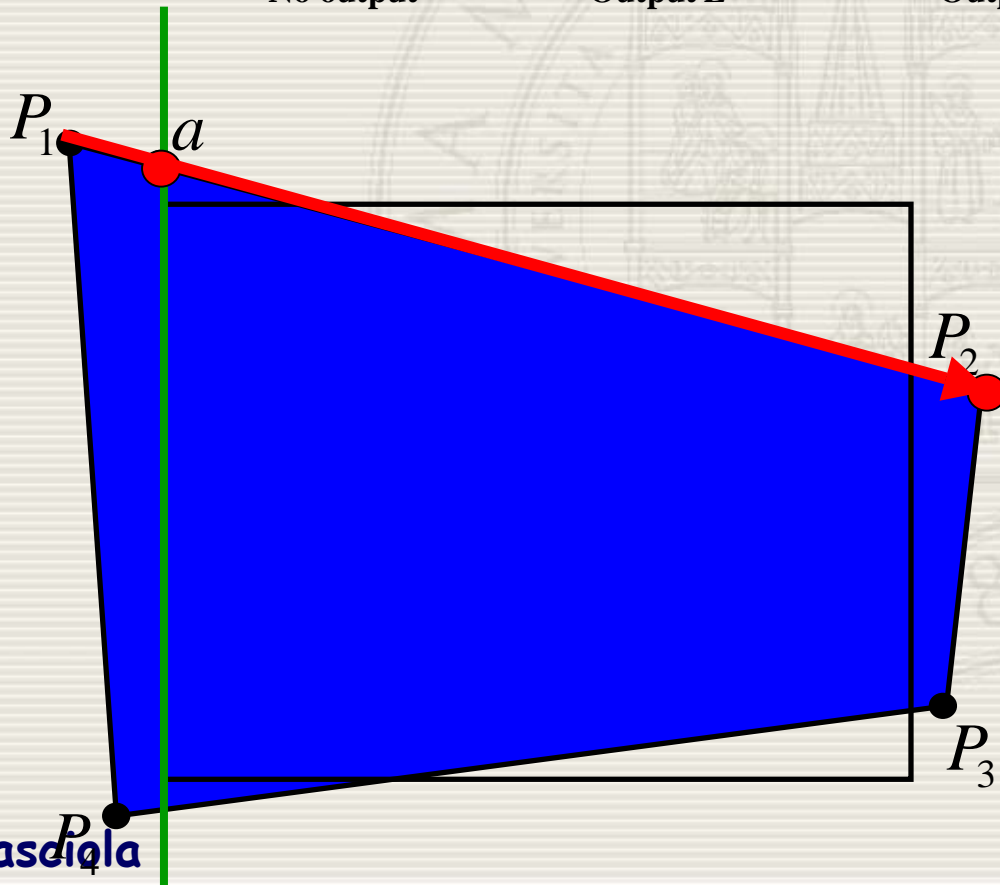
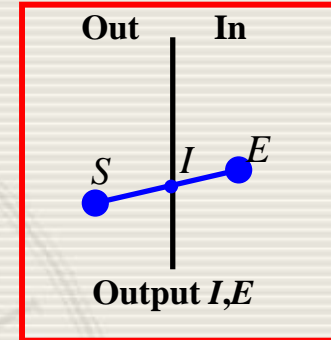
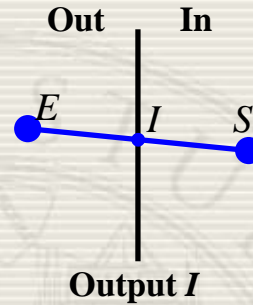
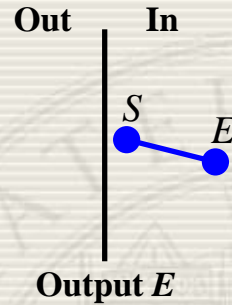
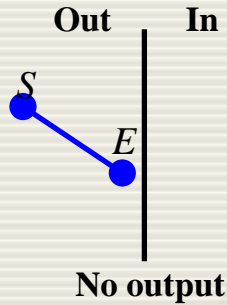
# Algoritmo di Sutherland-Hodgman



# Algoritmo di Sutherland-Hodgman

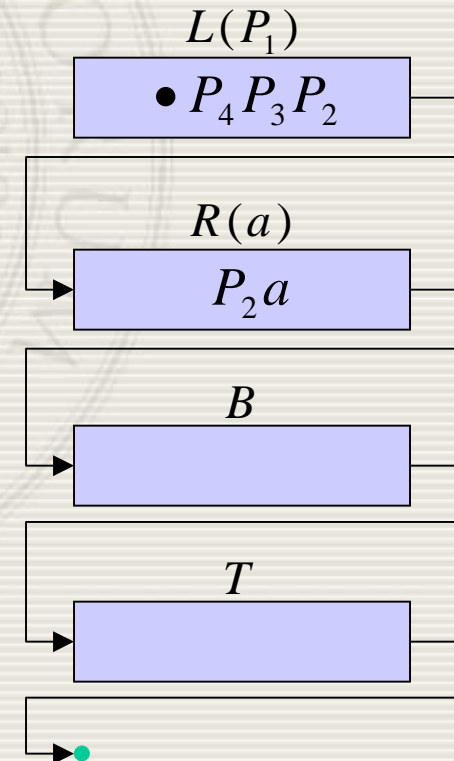
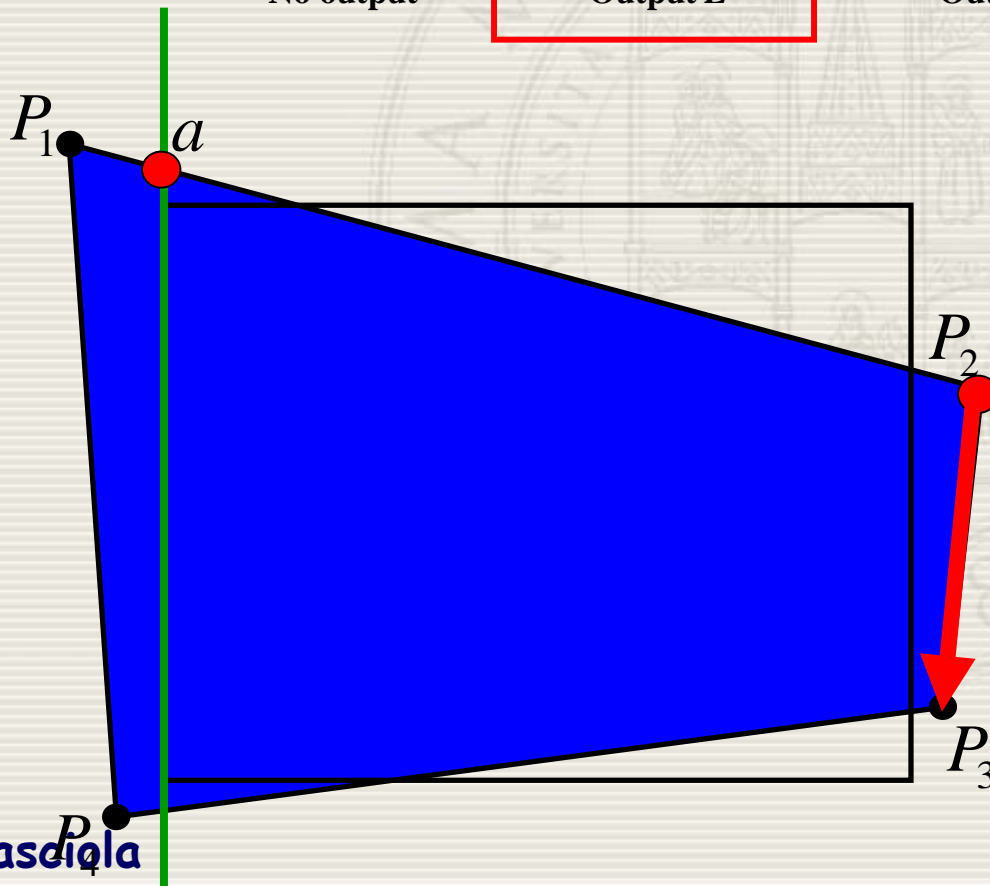
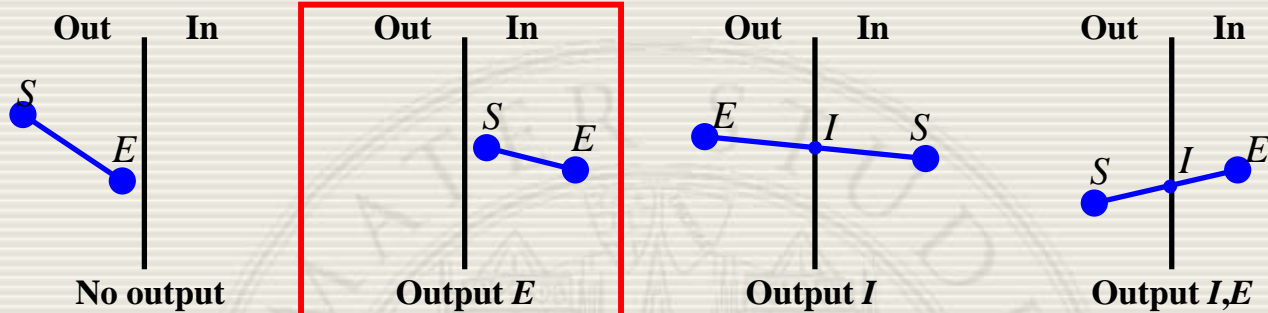


# Algoritmo di Sutherland-Hodgman

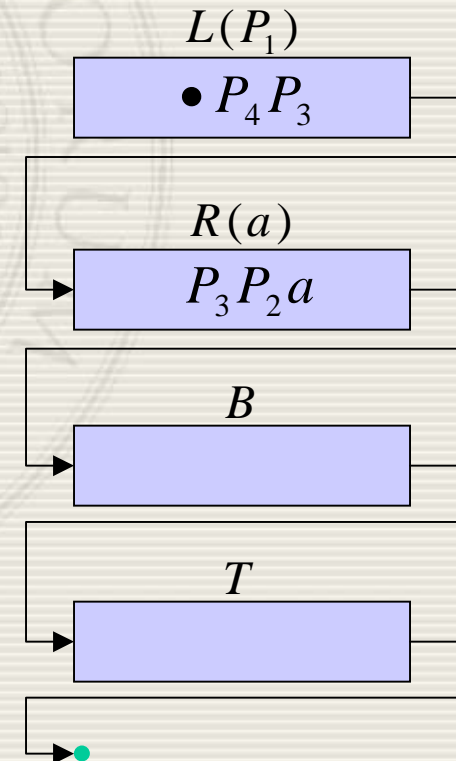
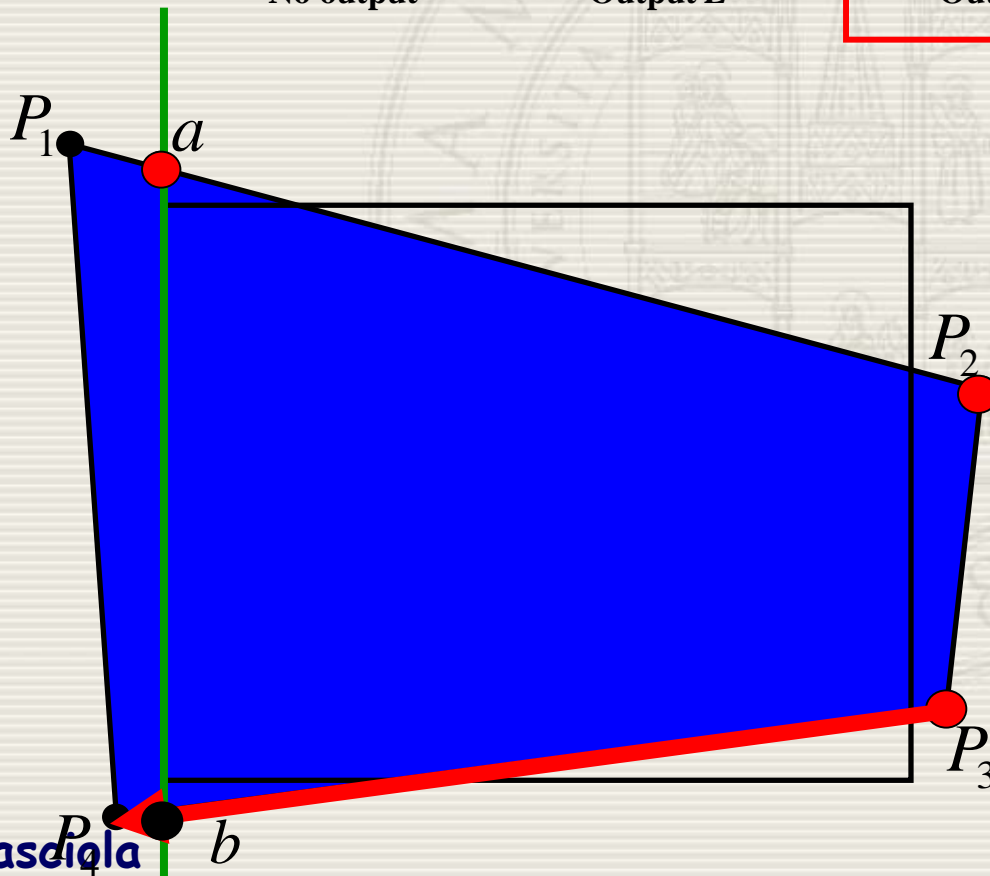
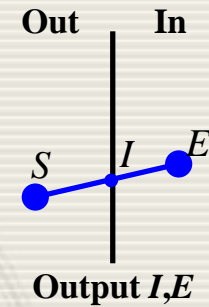
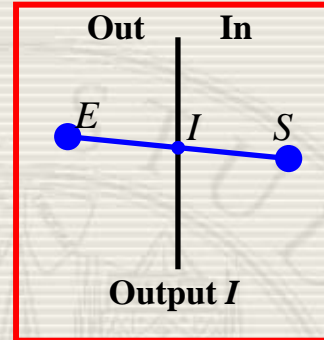
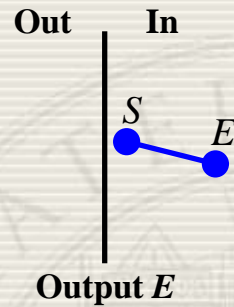
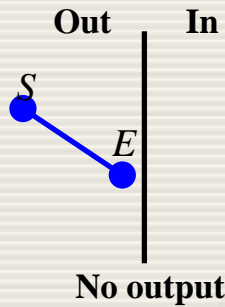




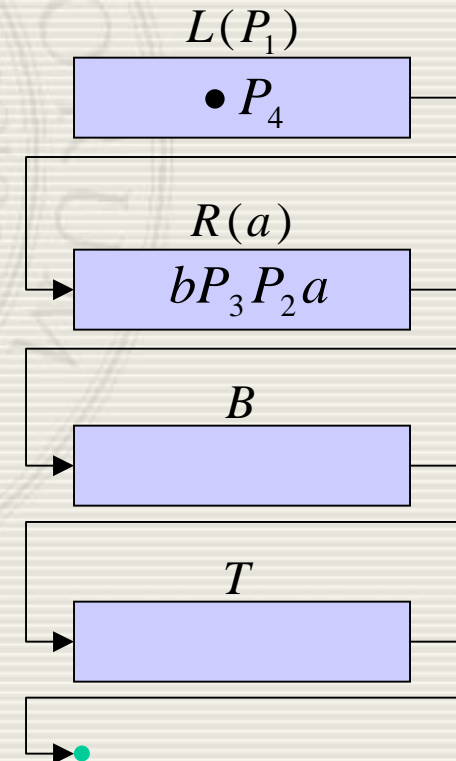
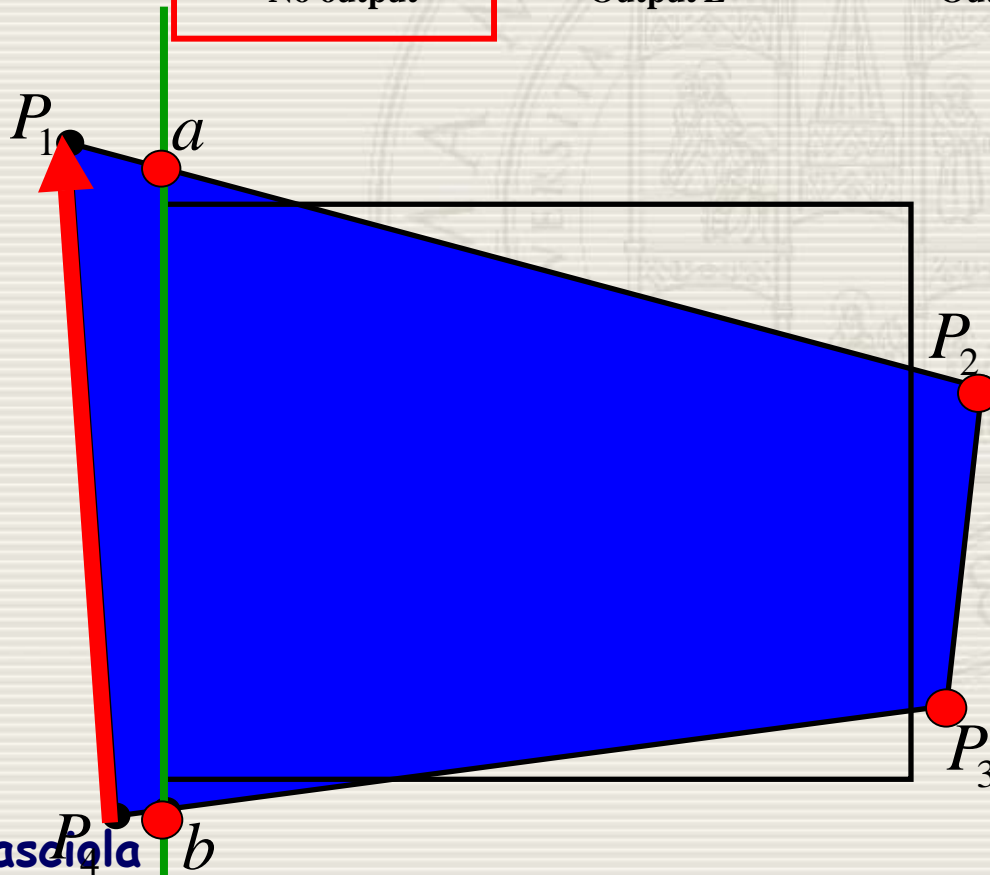
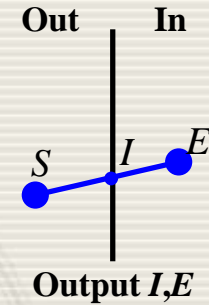
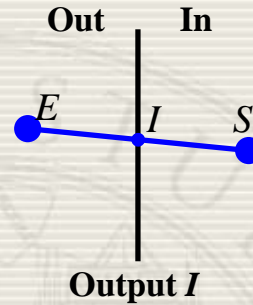
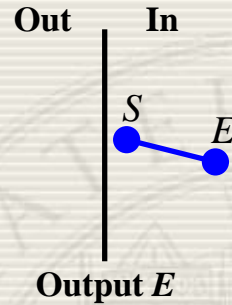
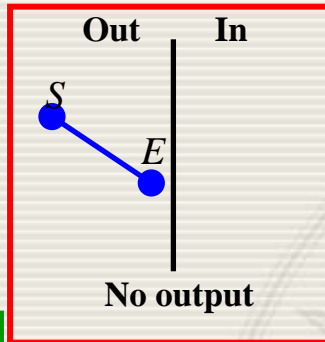
# Algoritmo di Sutherland-Hodgman



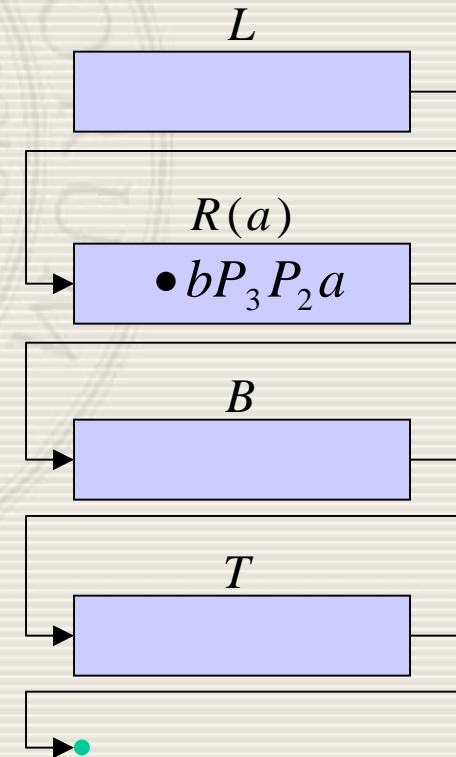
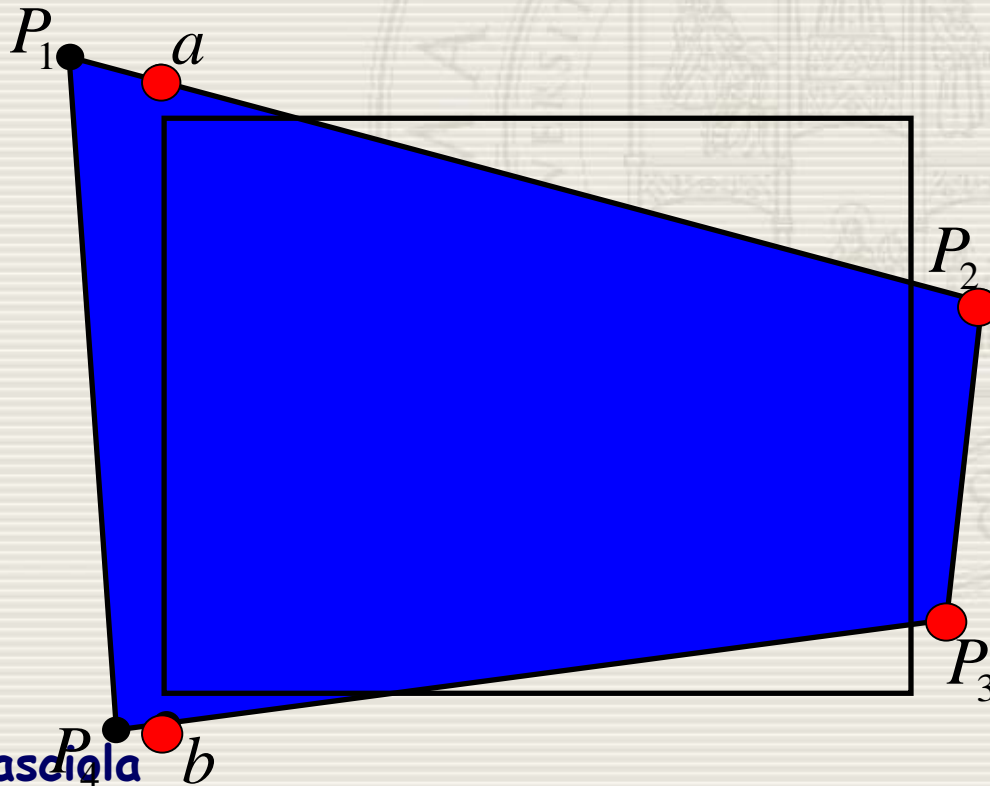
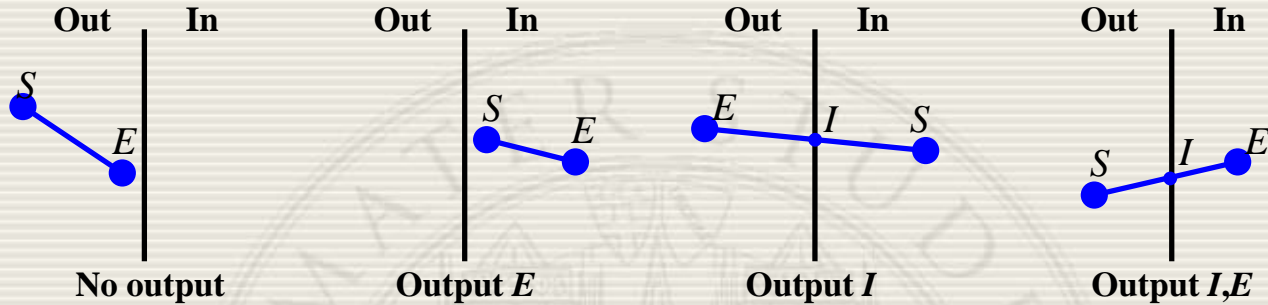
# Algoritmo di Sutherland-Hodgman



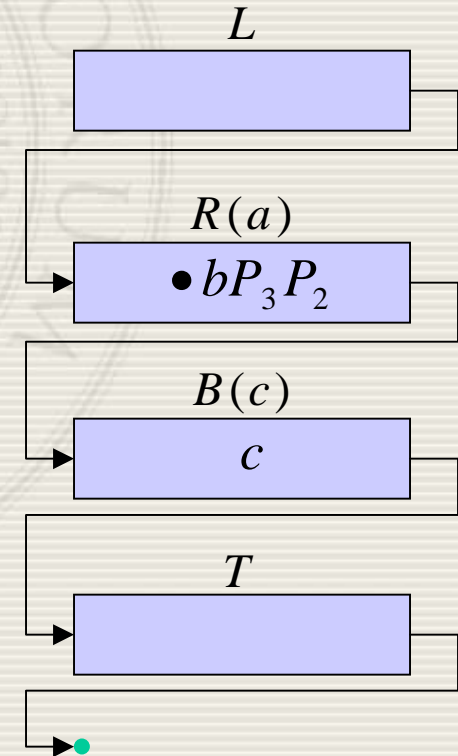
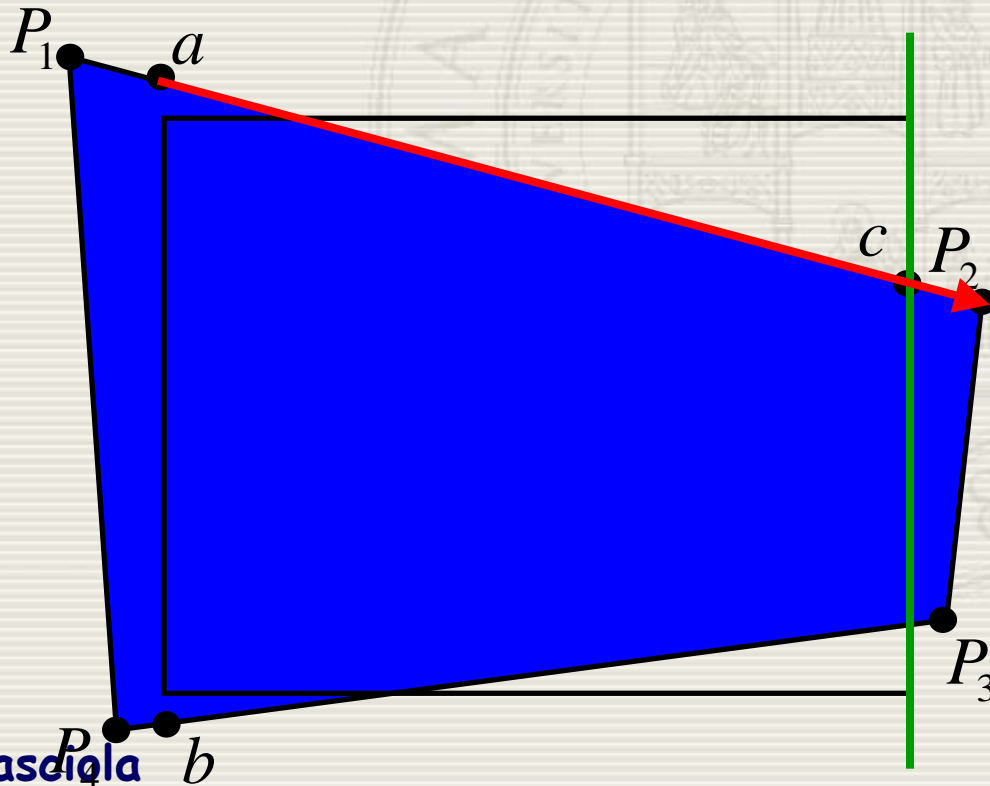
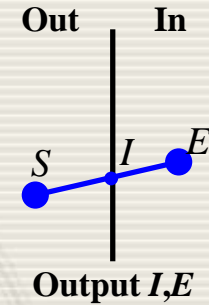
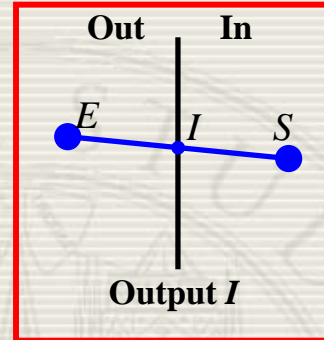
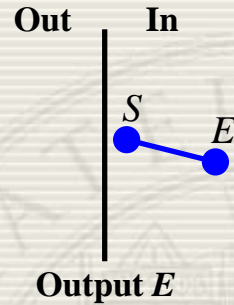
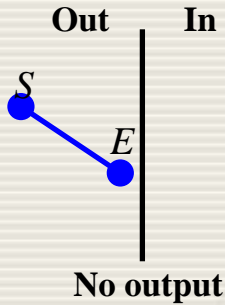
# Algoritmo di Sutherland-Hodgman



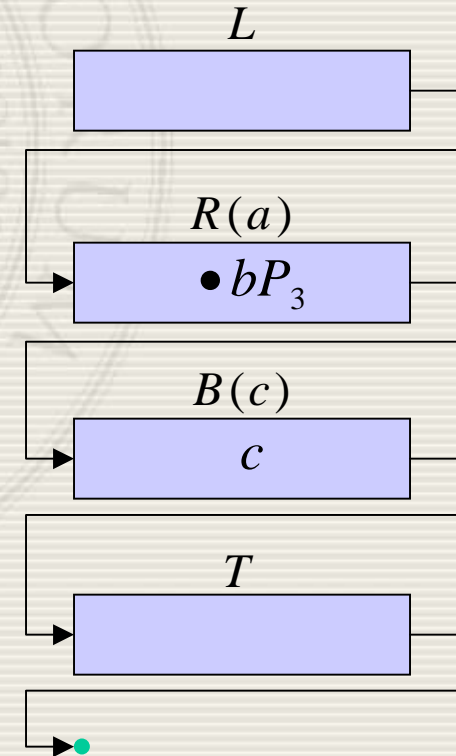
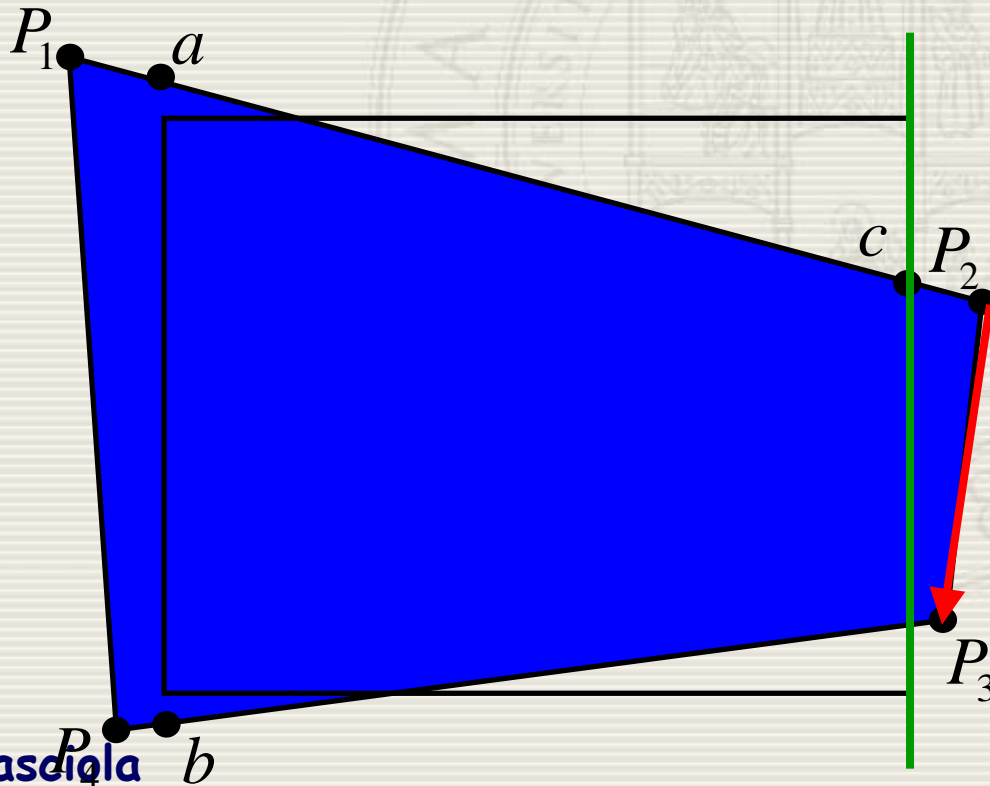
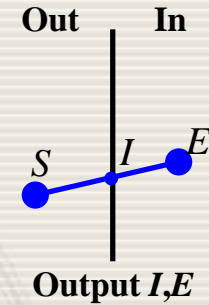
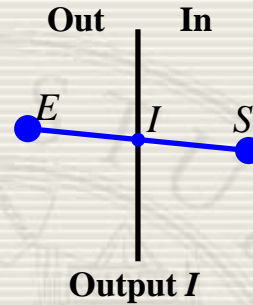
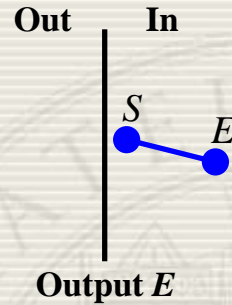
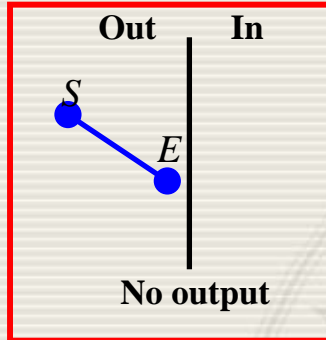
# Algoritmo di Sutherland-Hodgman



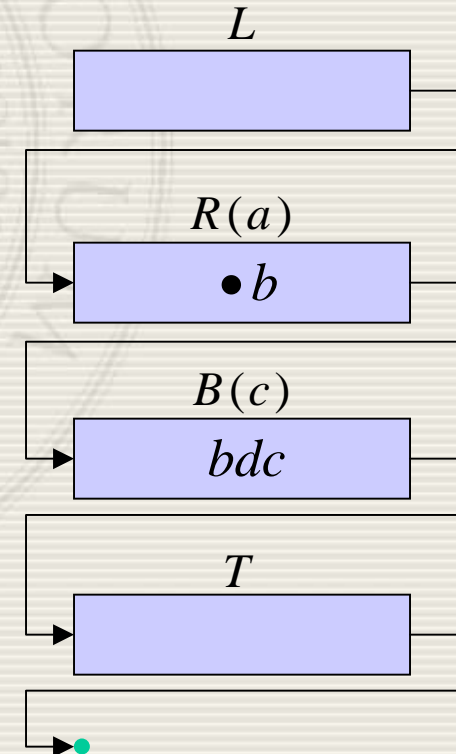
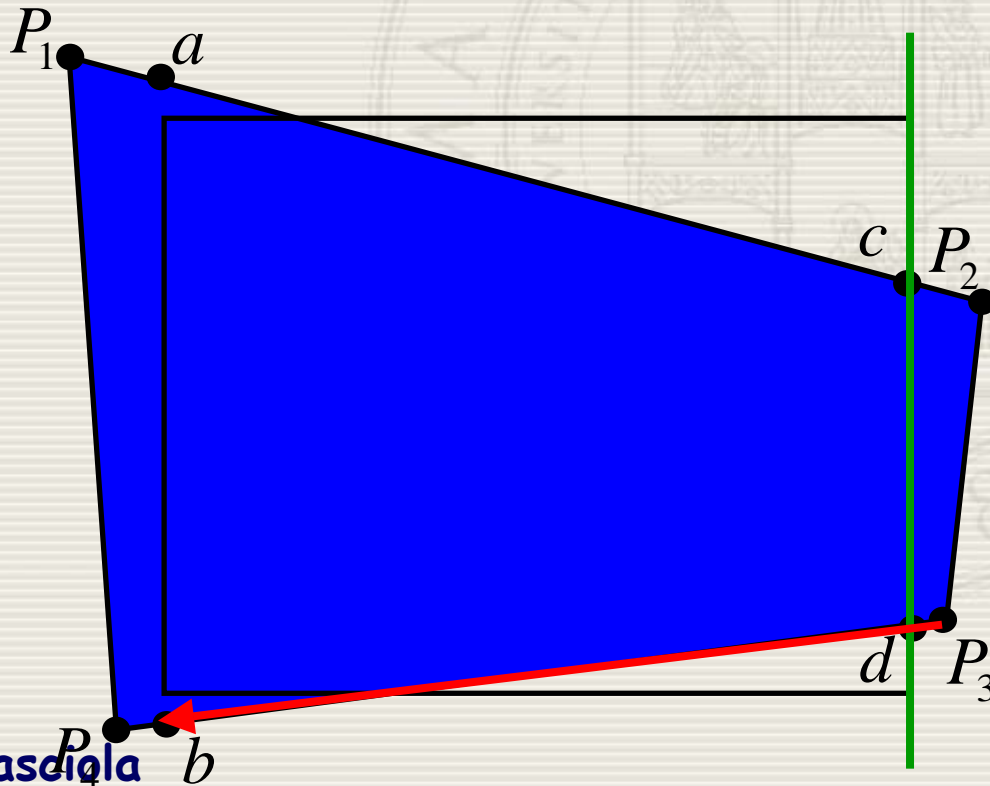
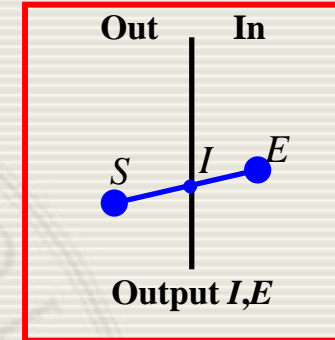
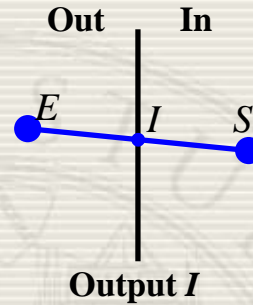
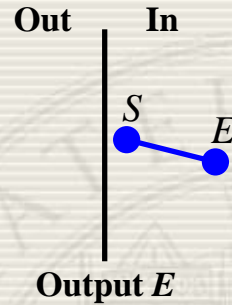
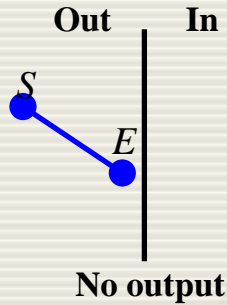
# Algoritmo di Sutherland-Hodgman



# Algoritmo di Sutherland-Hodgman

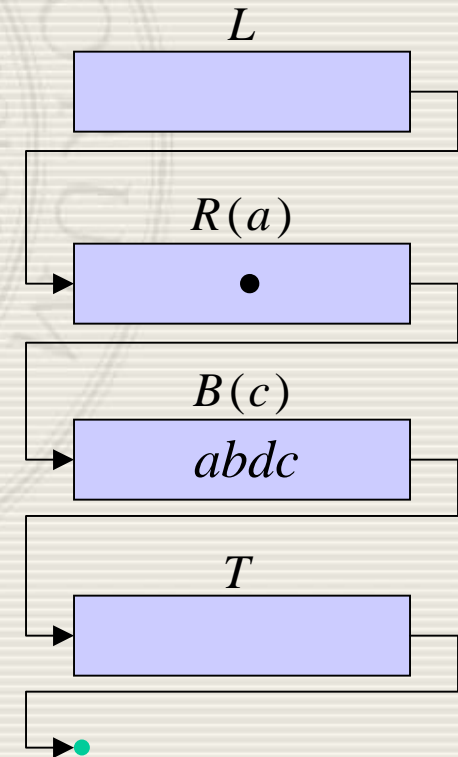
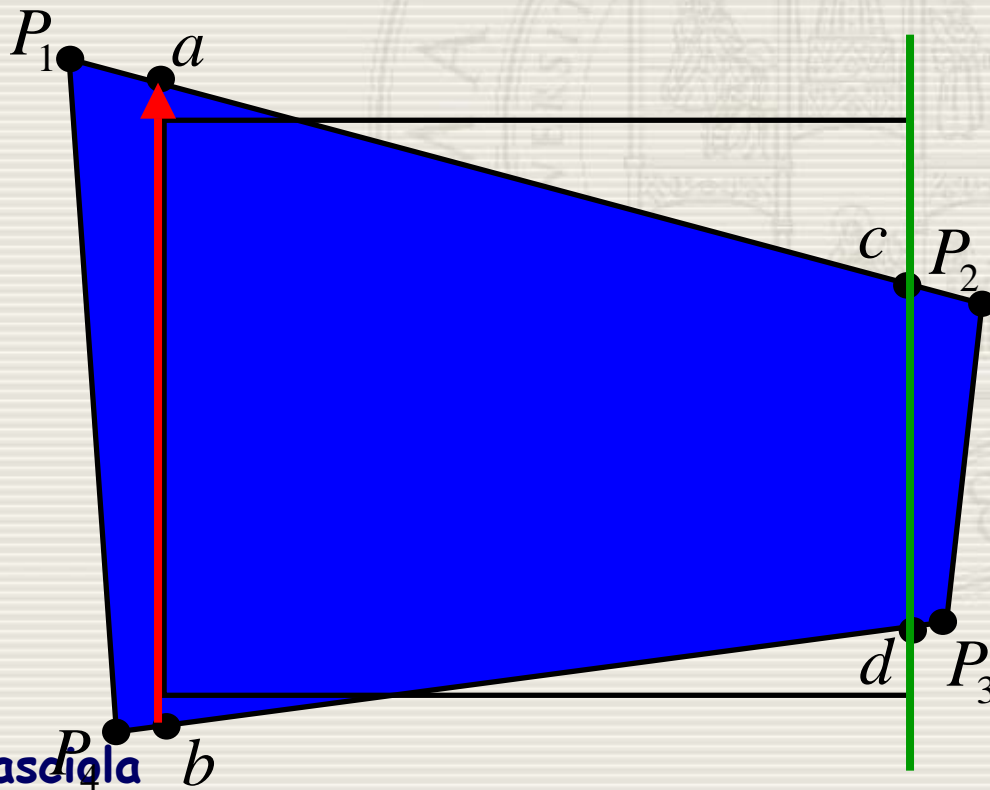
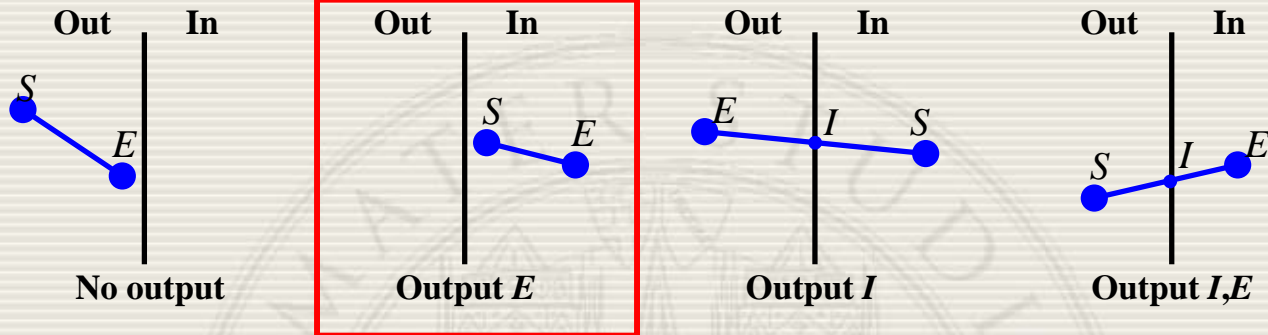


# Algoritmo di Sutherland-Hodgman

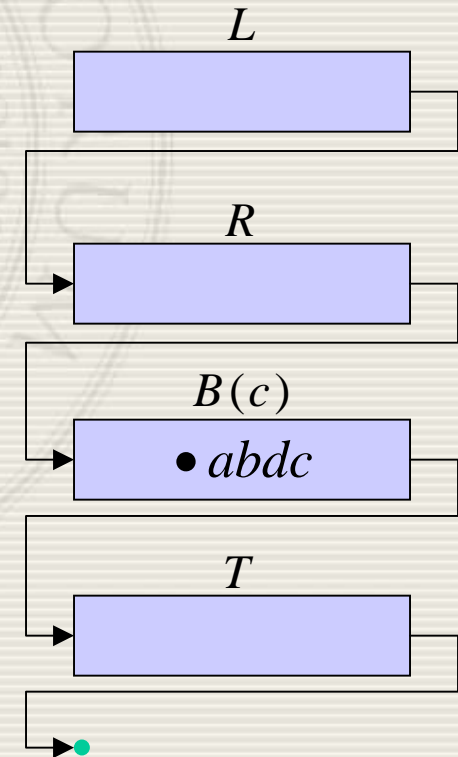
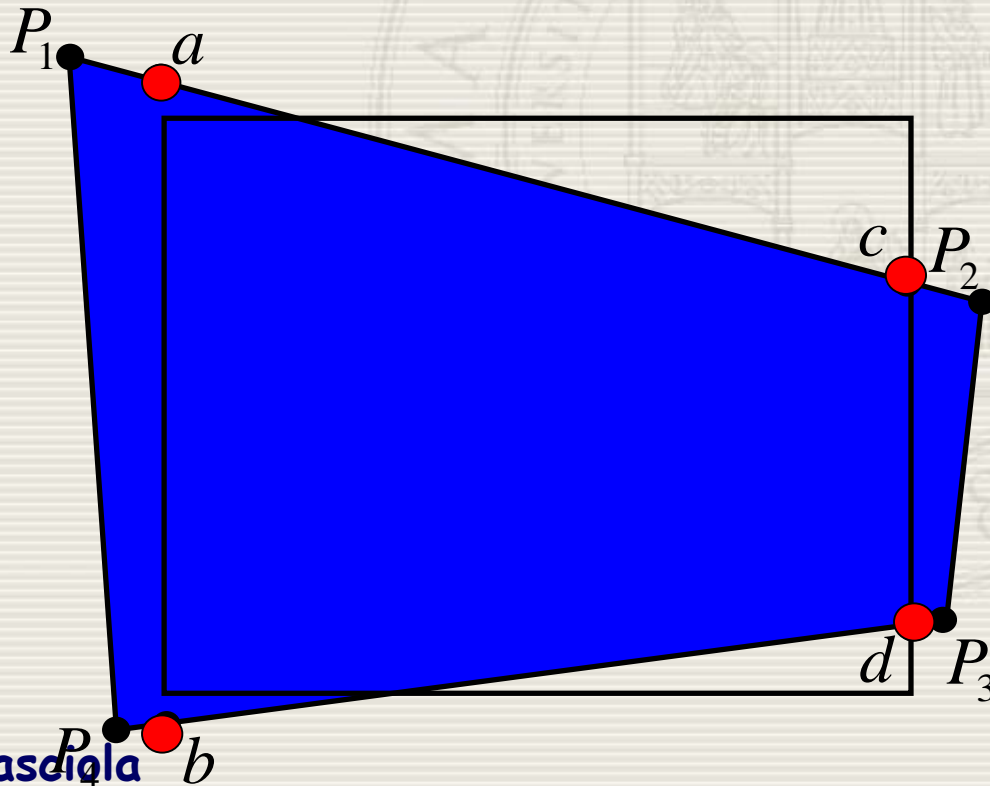
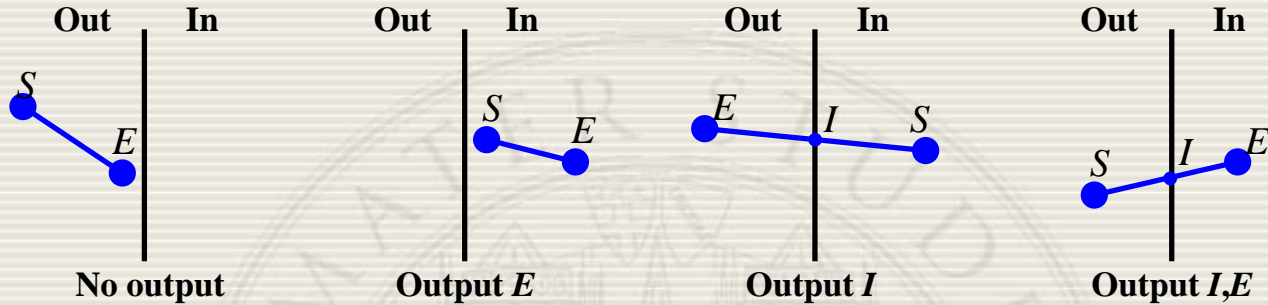




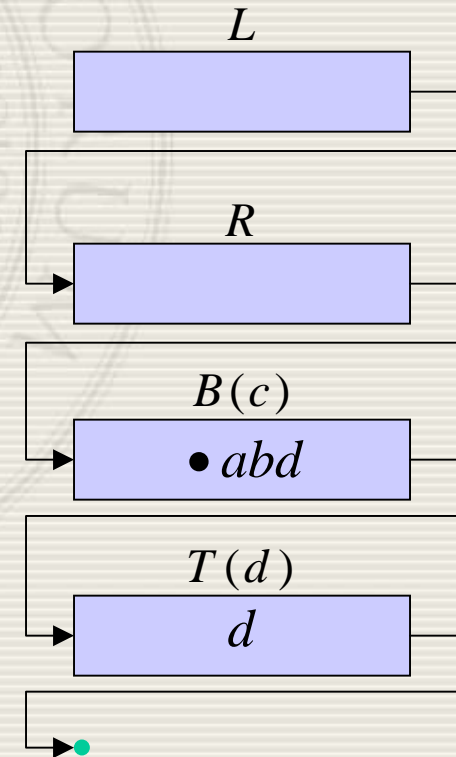
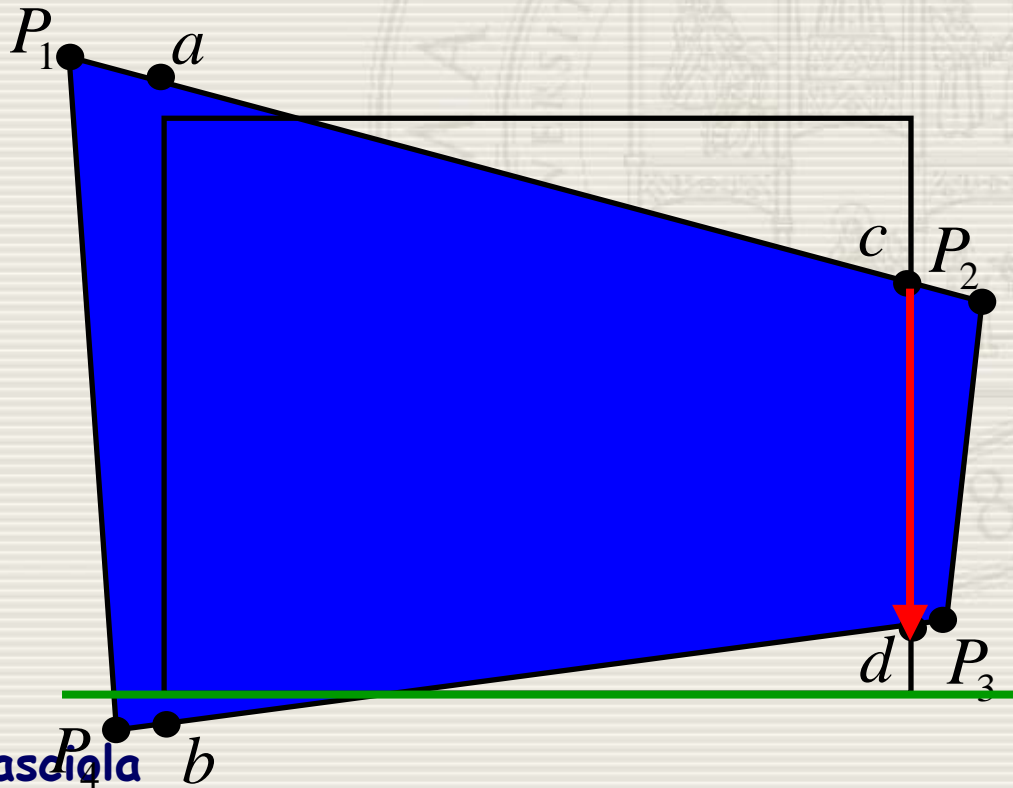
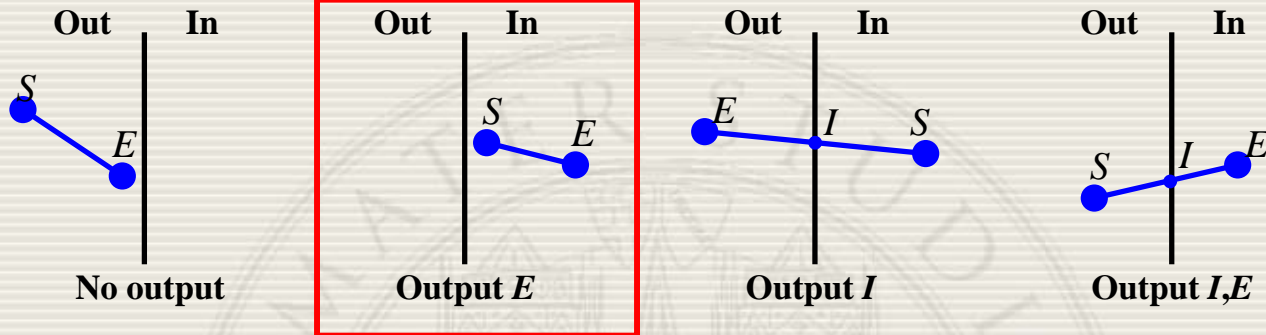
# Algoritmo di Sutherland-Hodgman



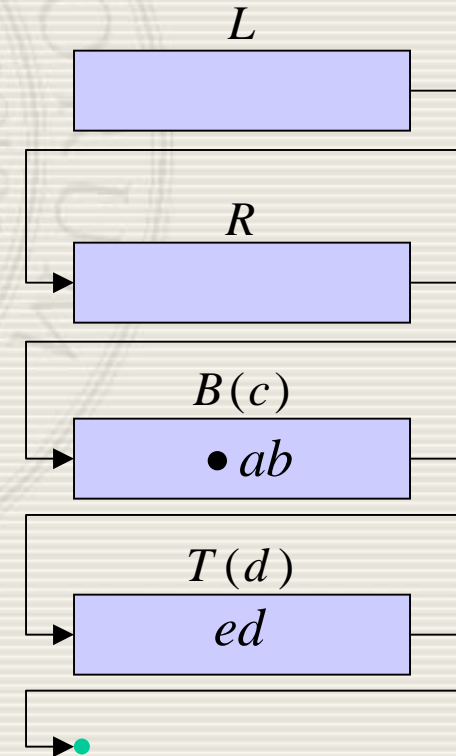
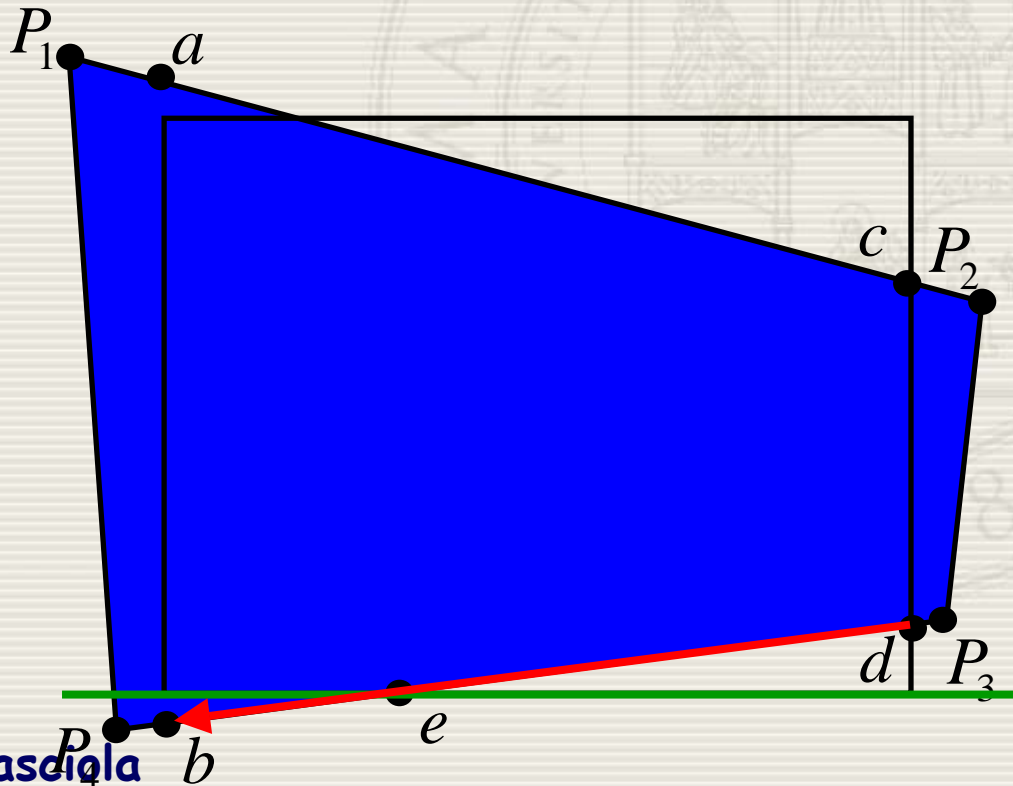
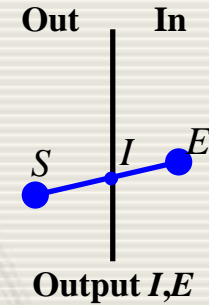
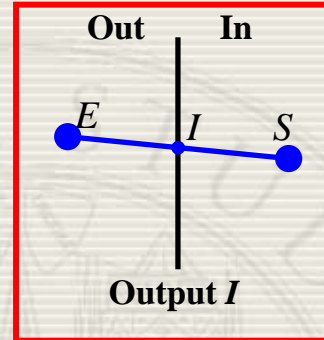
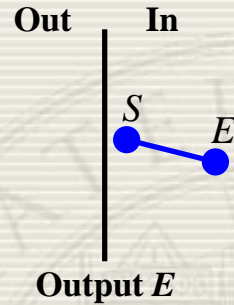
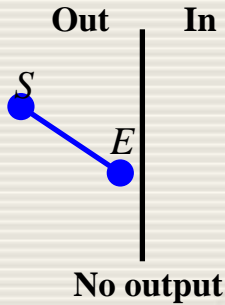
# Algoritmo di Sutherland-Hodgman



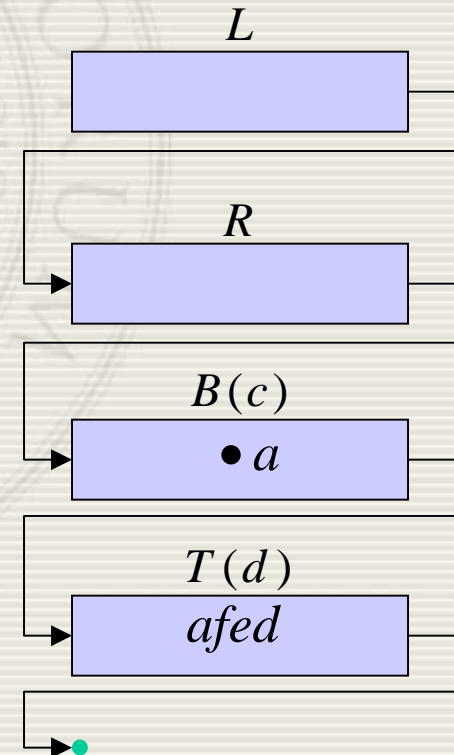
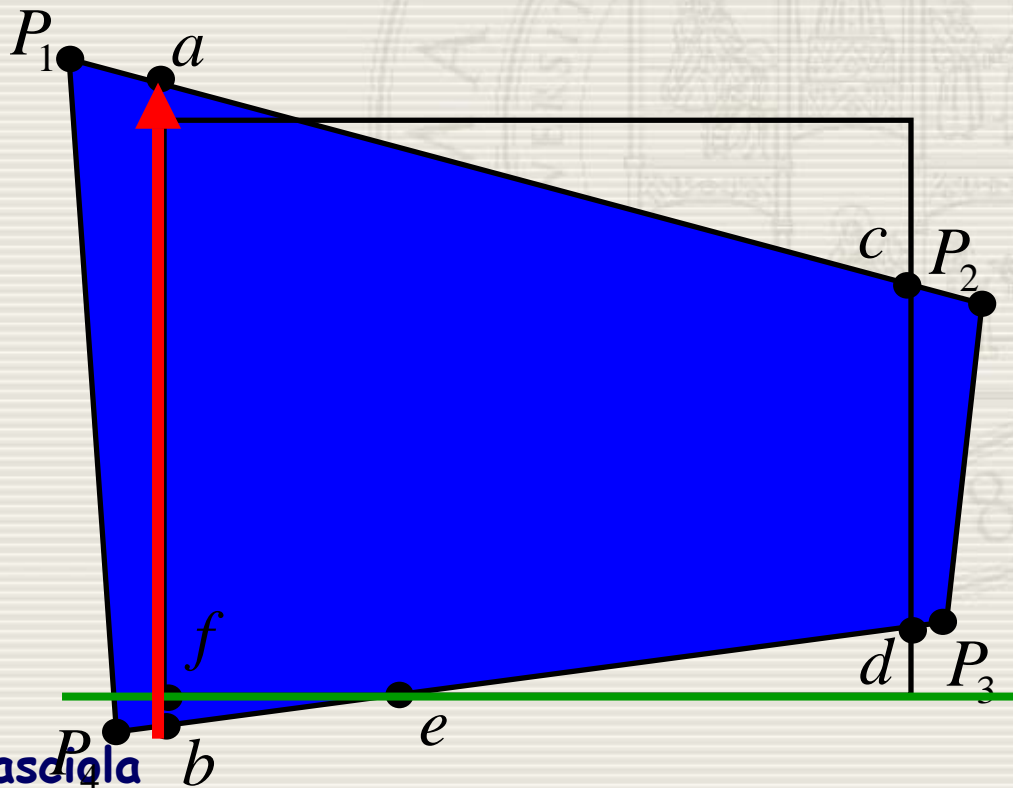
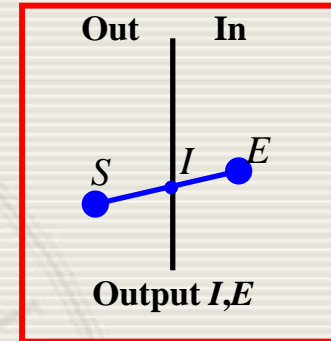
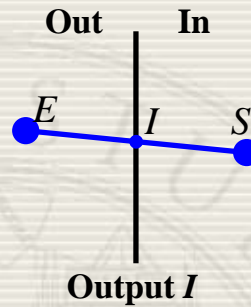
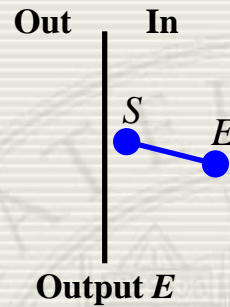
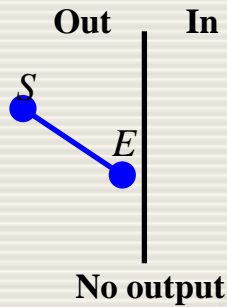
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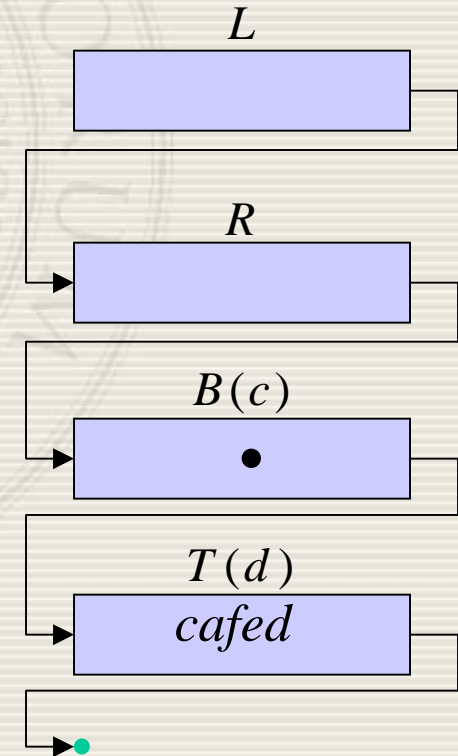
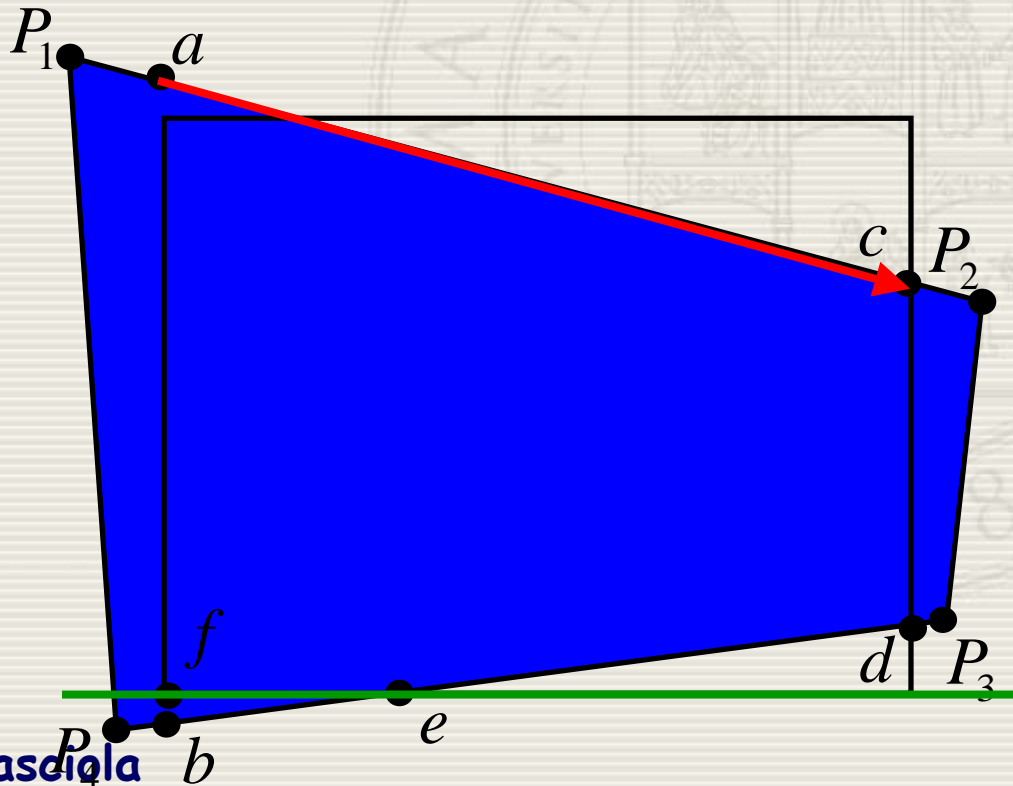
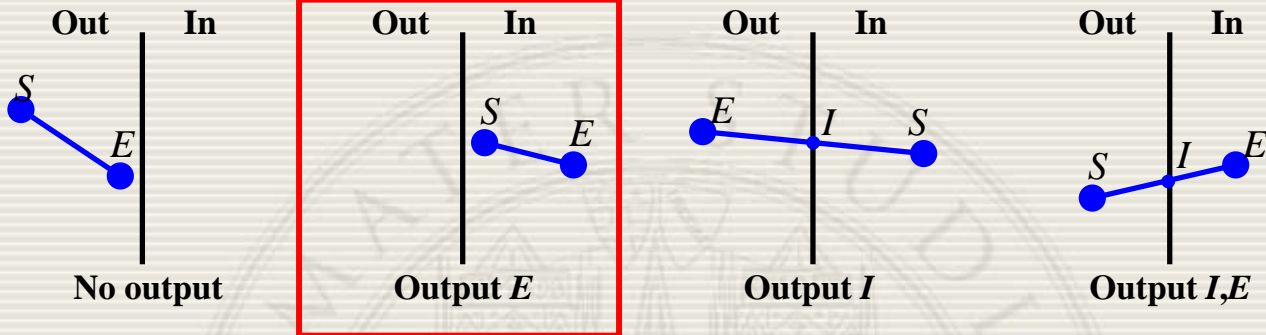
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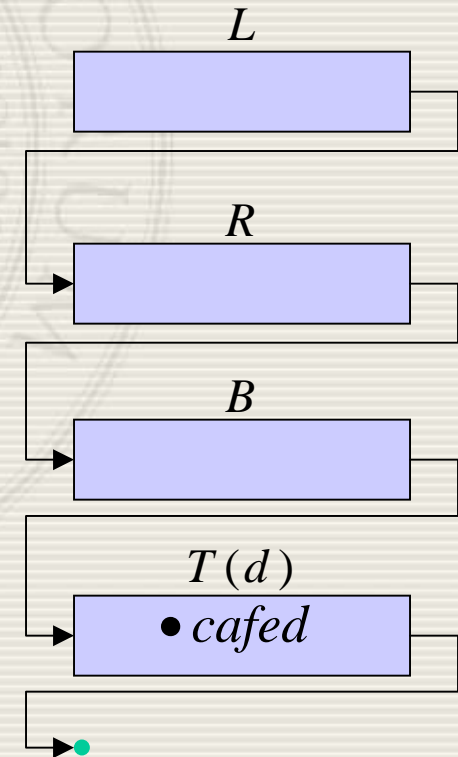
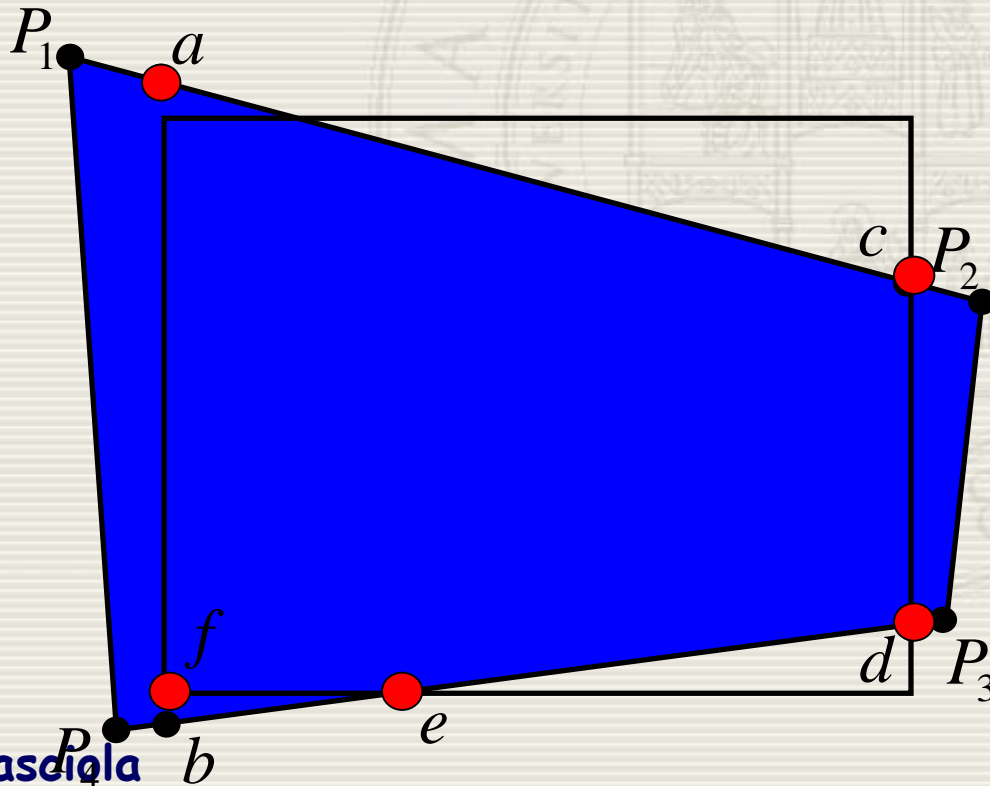
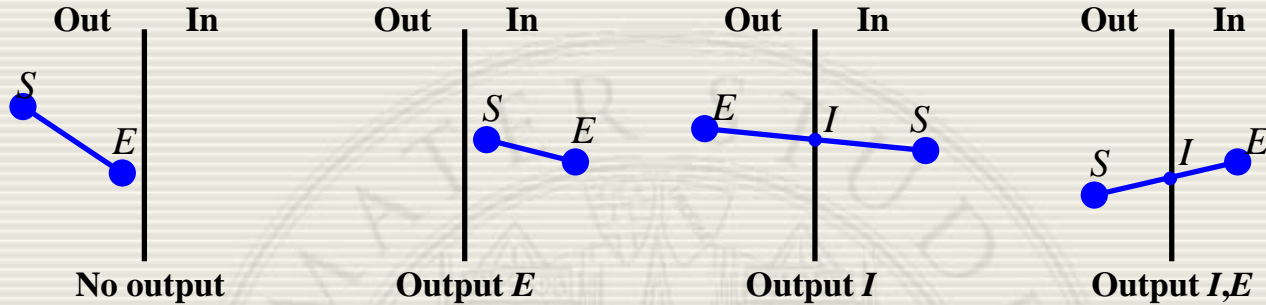
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# Algoritmo di Sutherland-Hodgman

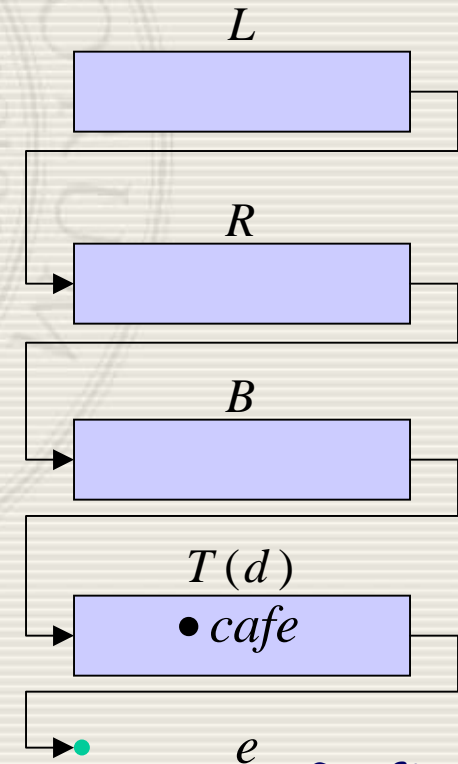
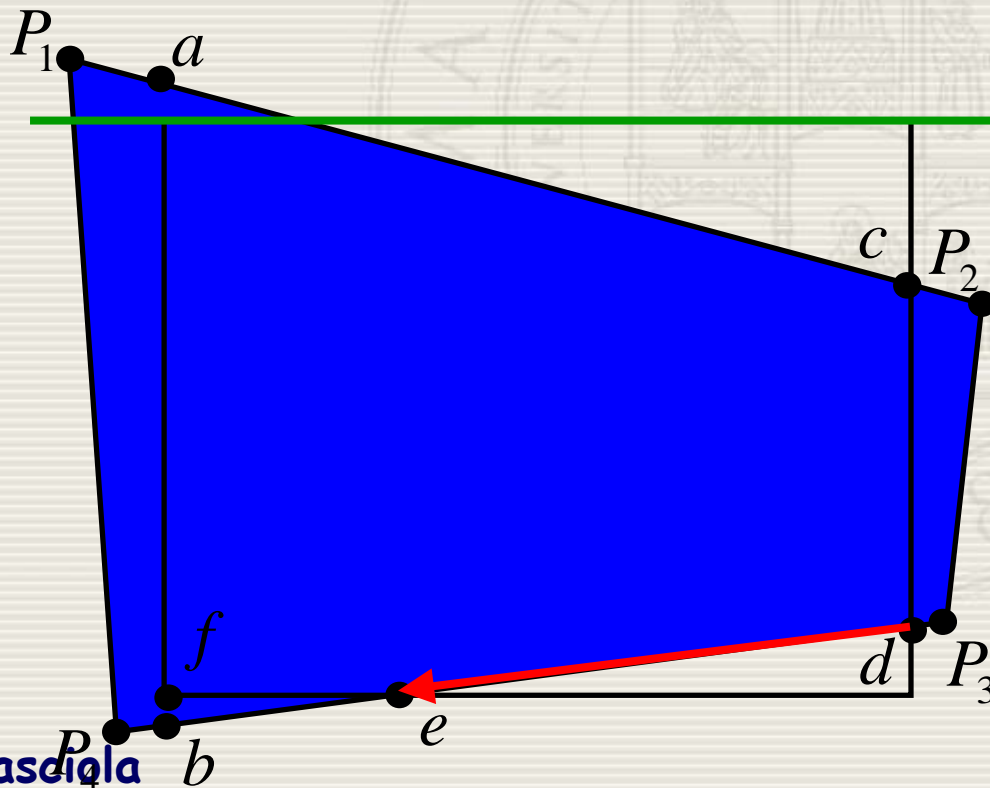
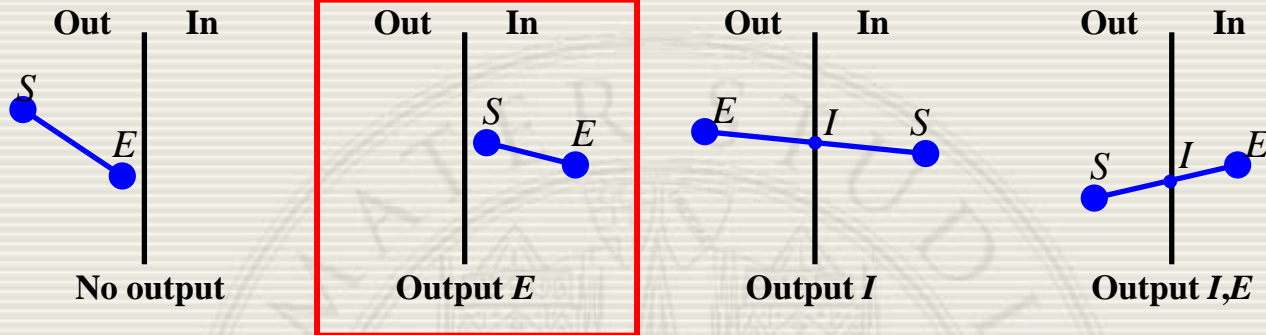


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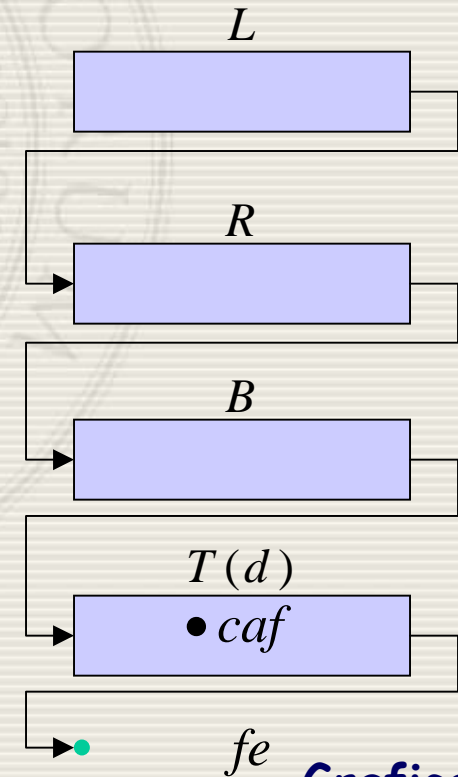
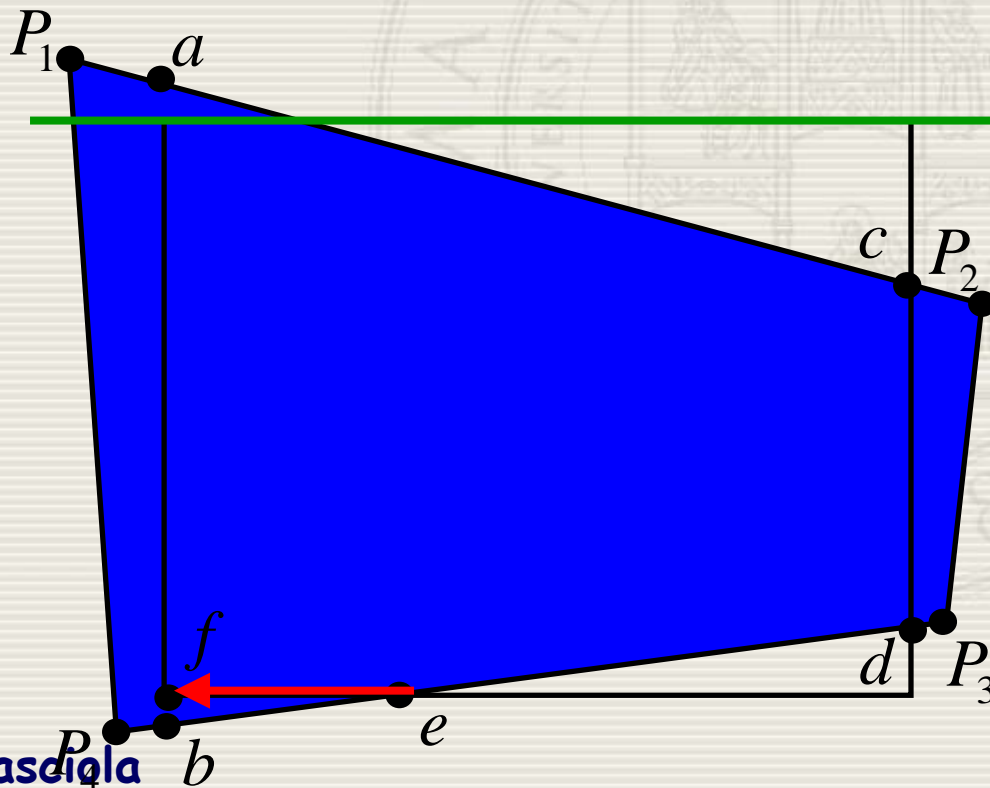
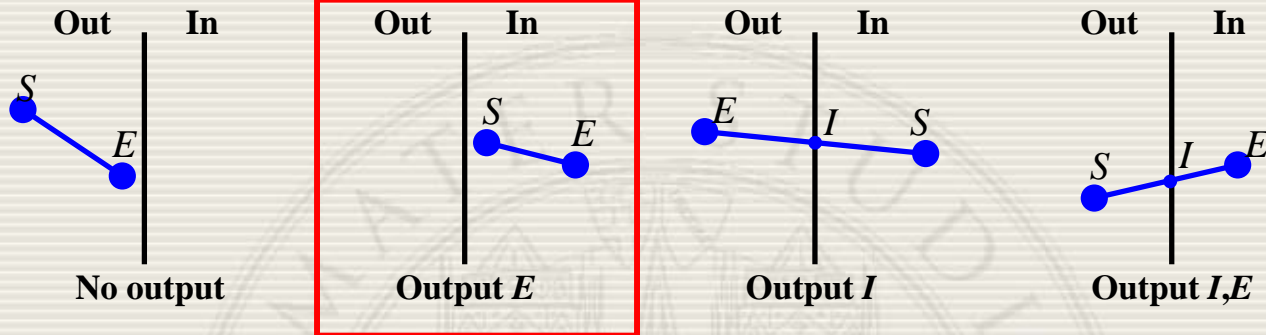




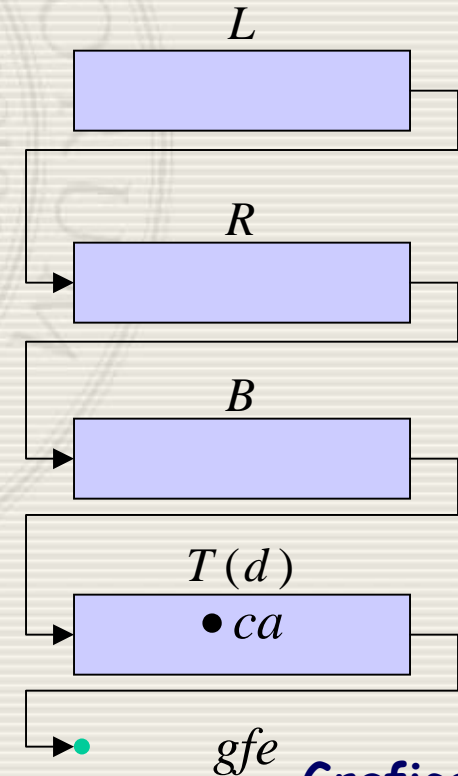
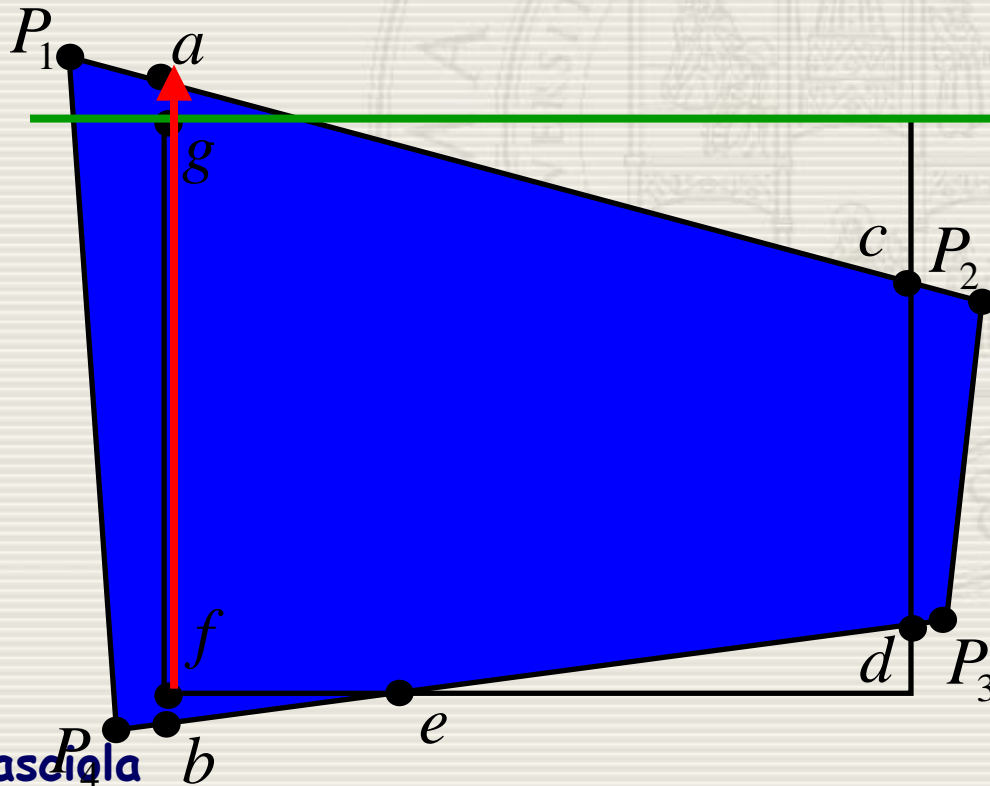
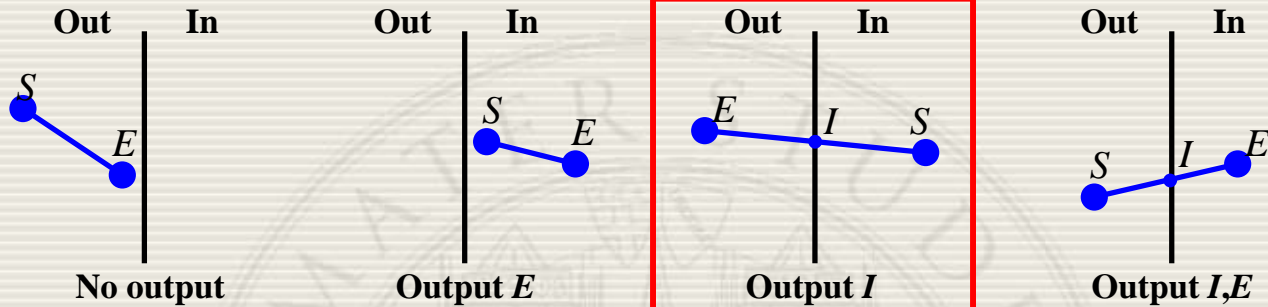
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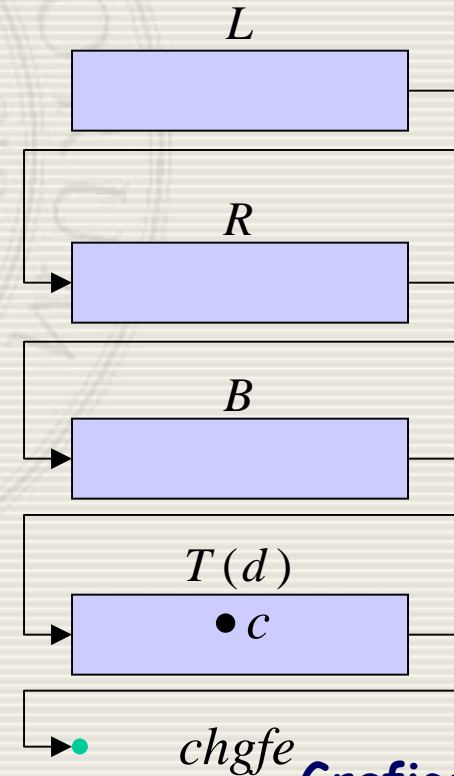
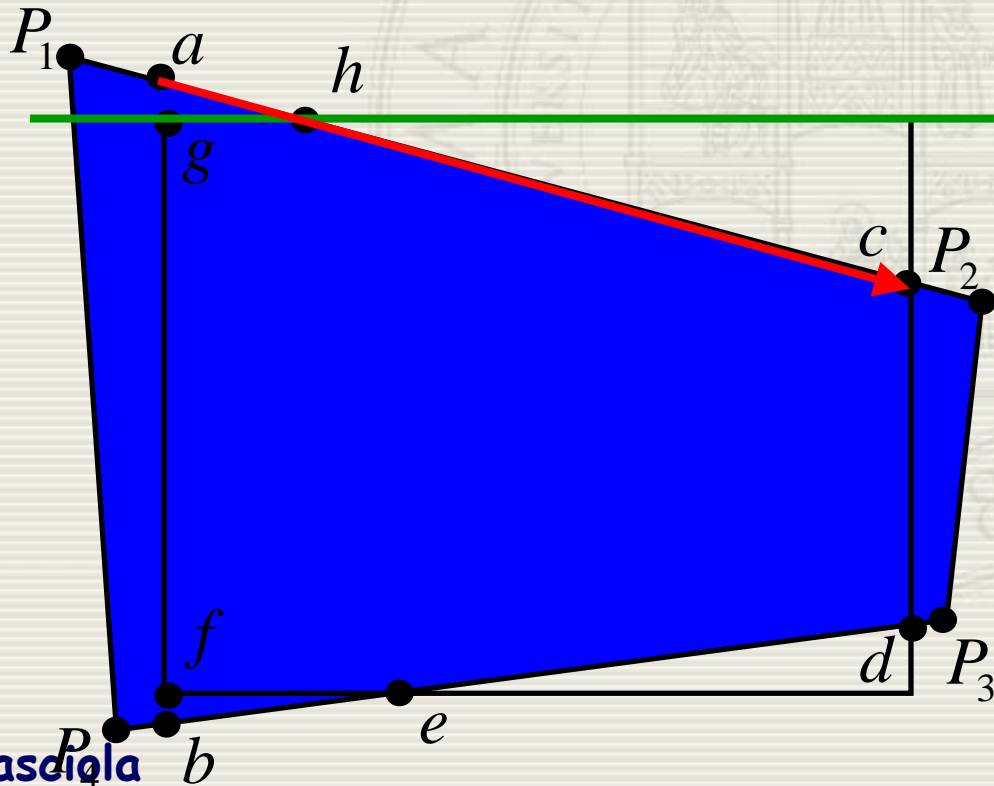
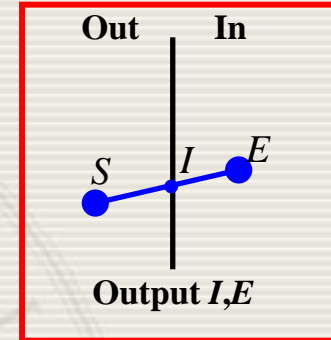
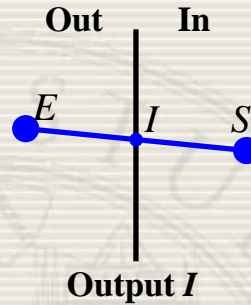
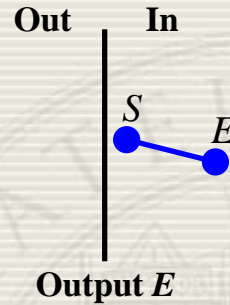
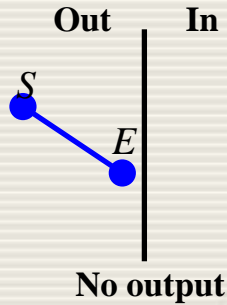
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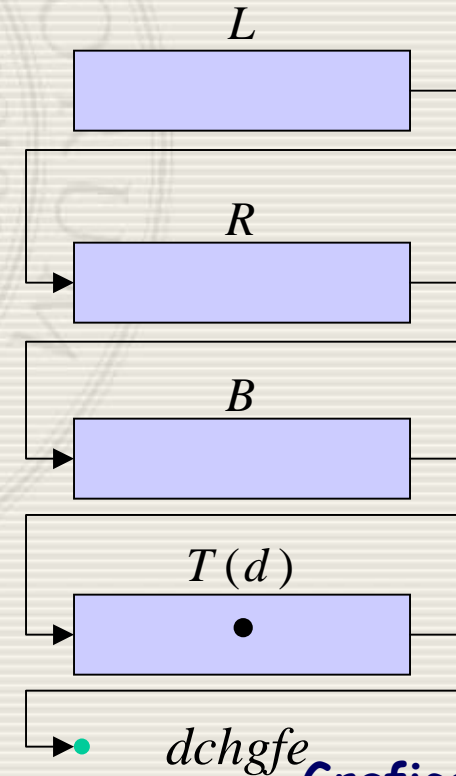
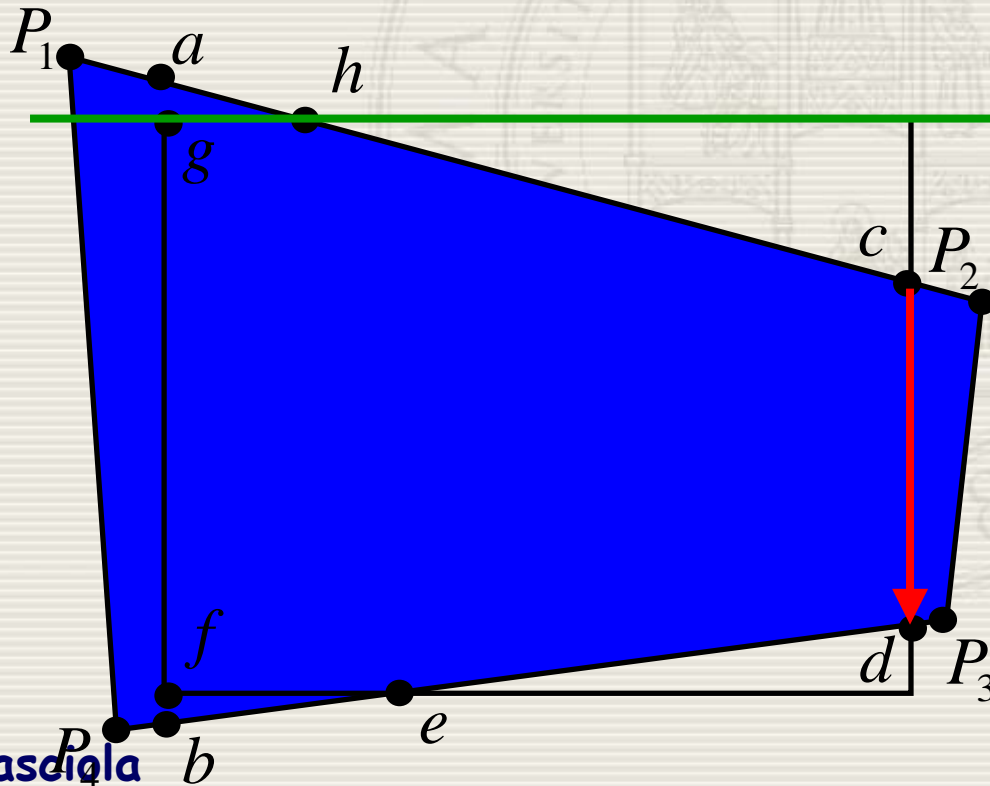
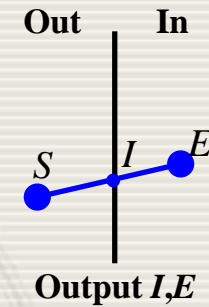
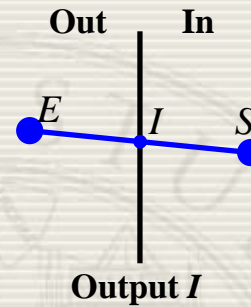
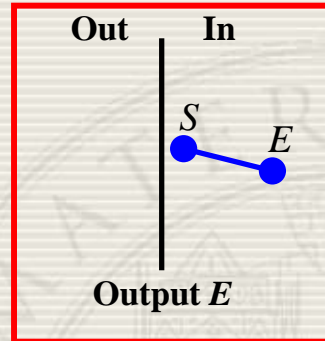
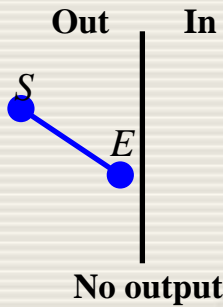
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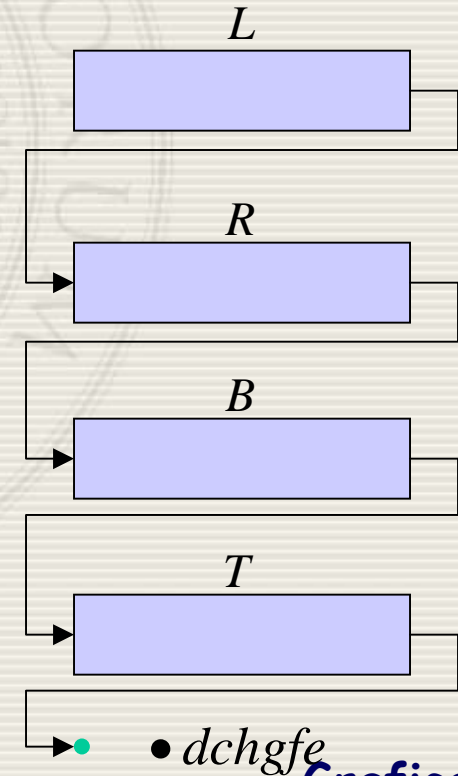
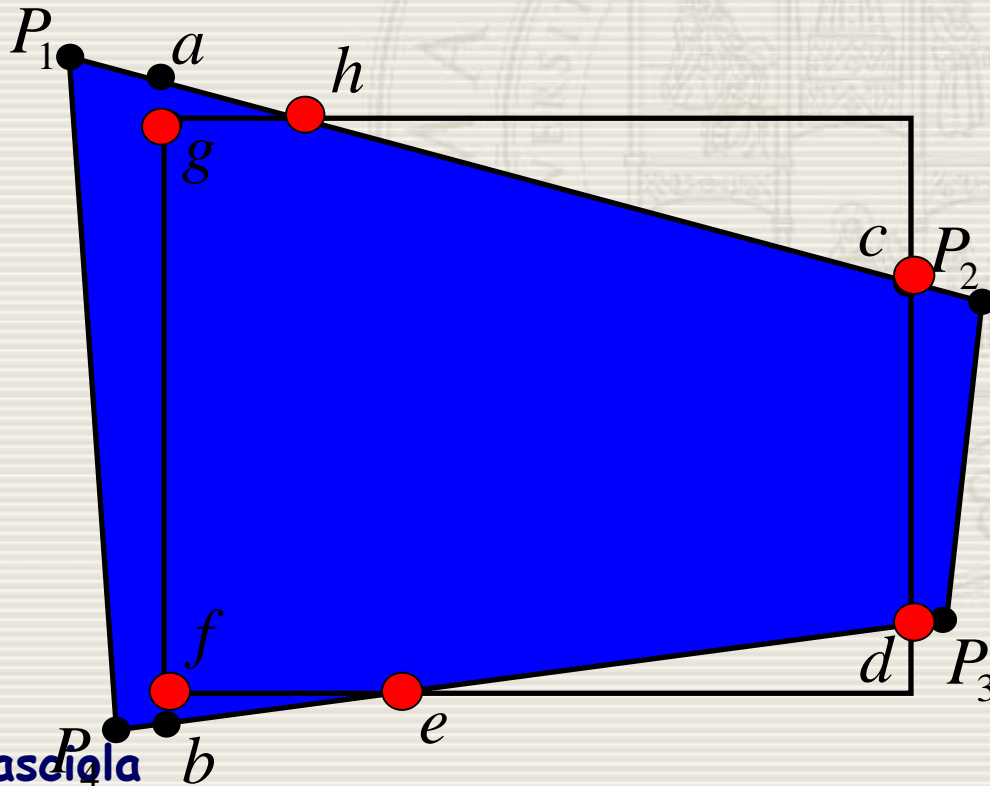
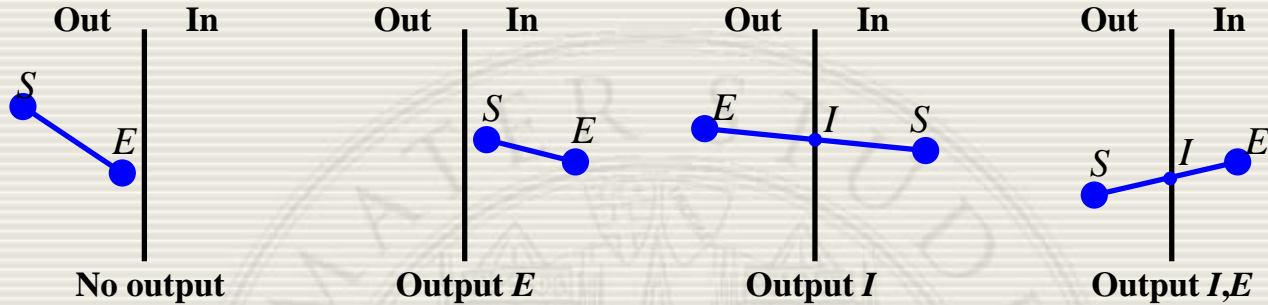
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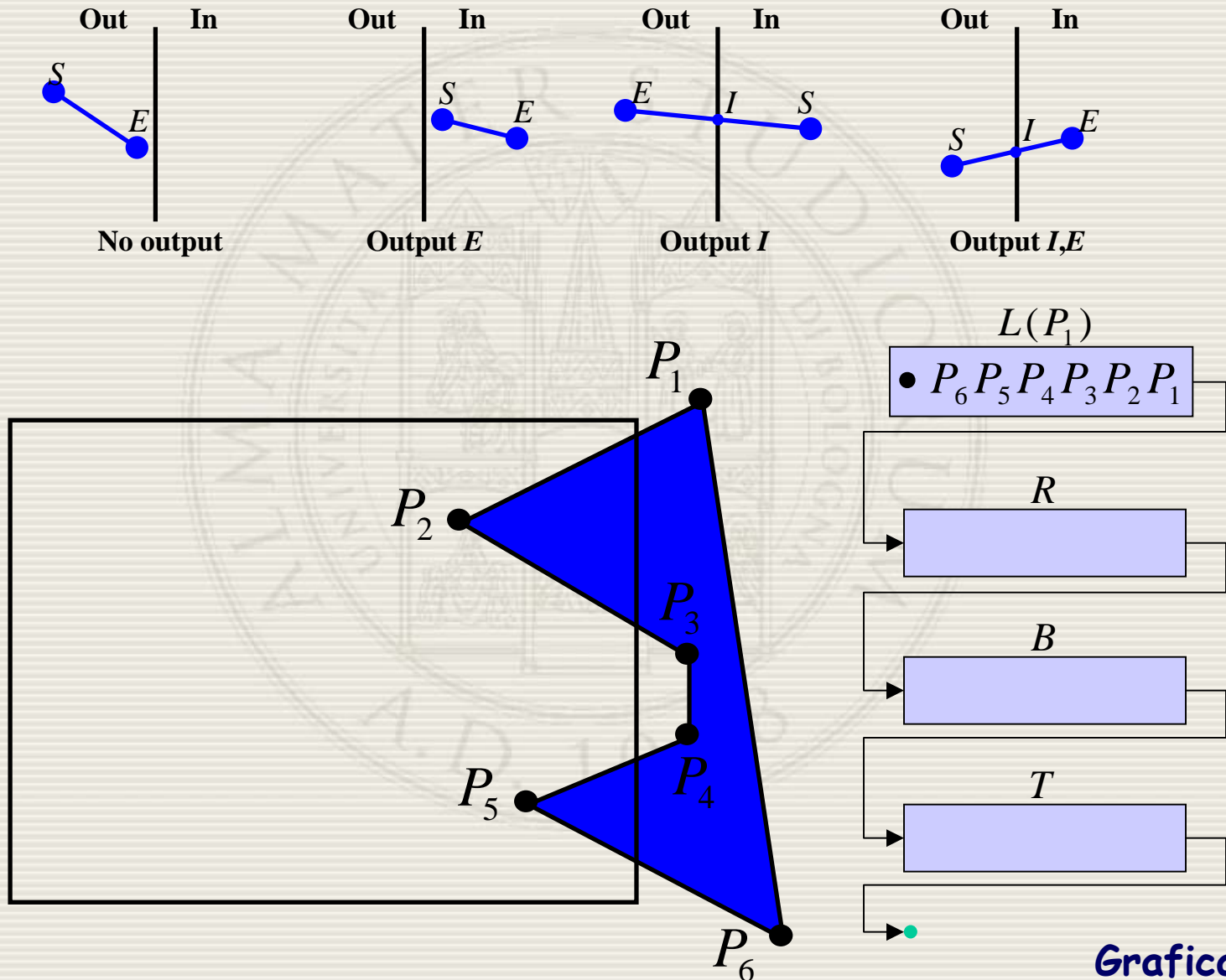
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# Algoritmo di Sutherland-Hodgman

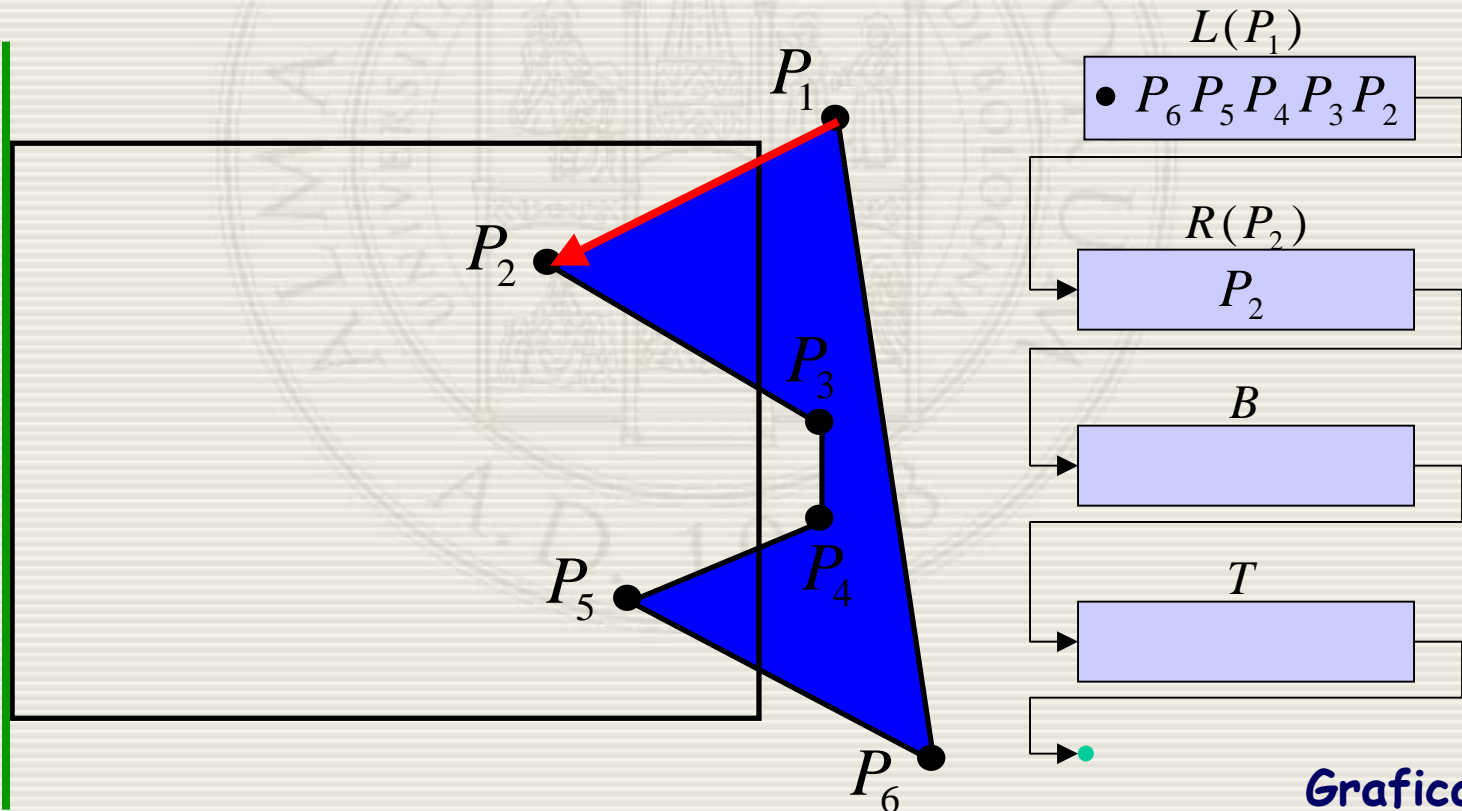
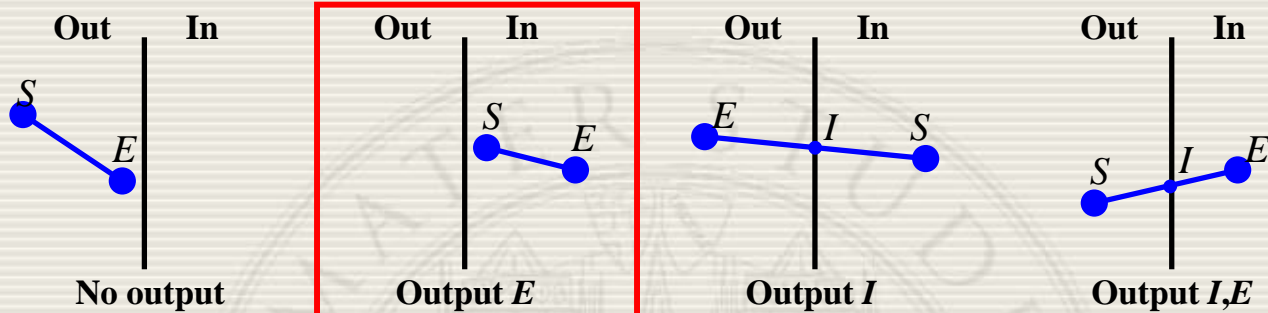


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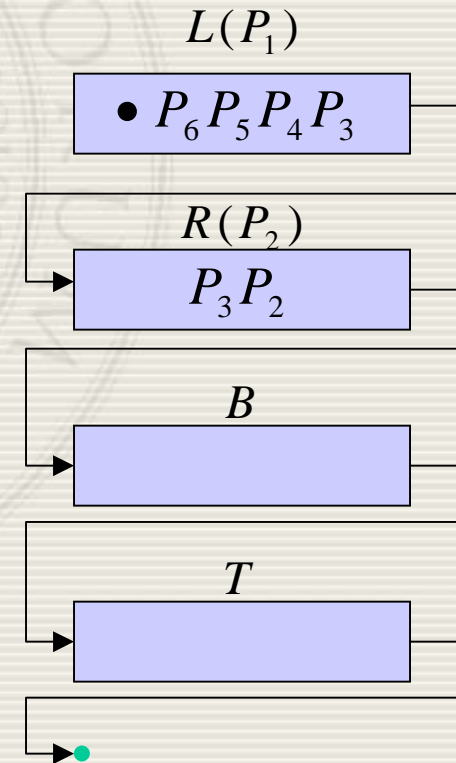
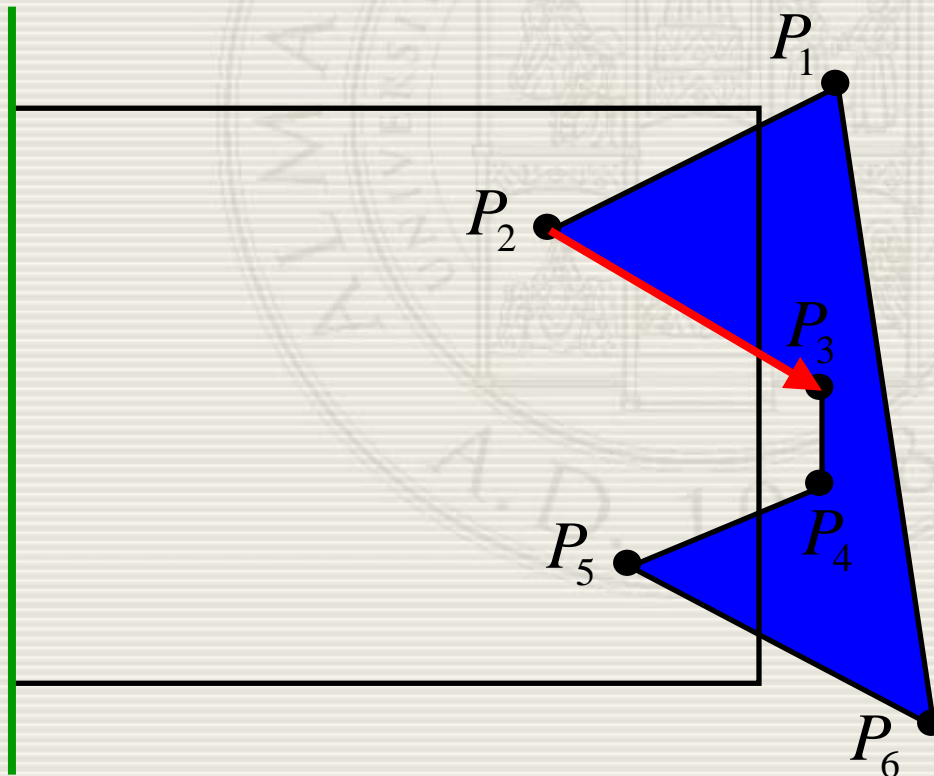
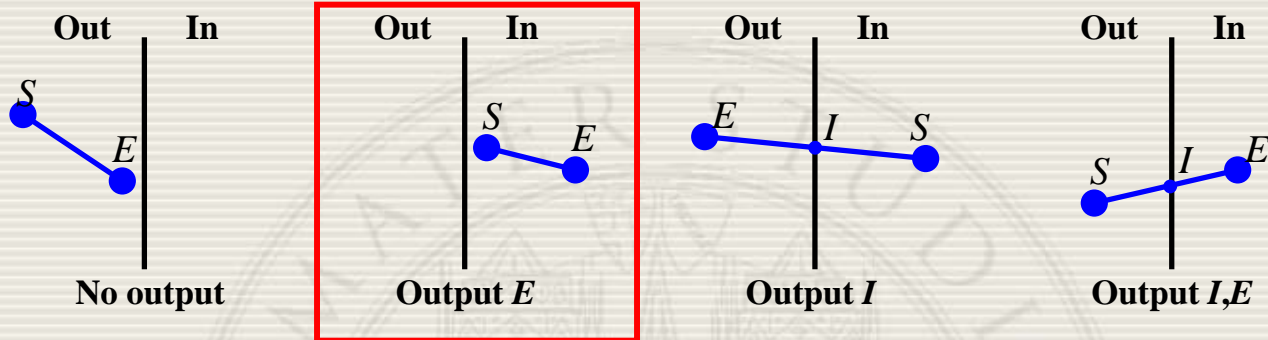




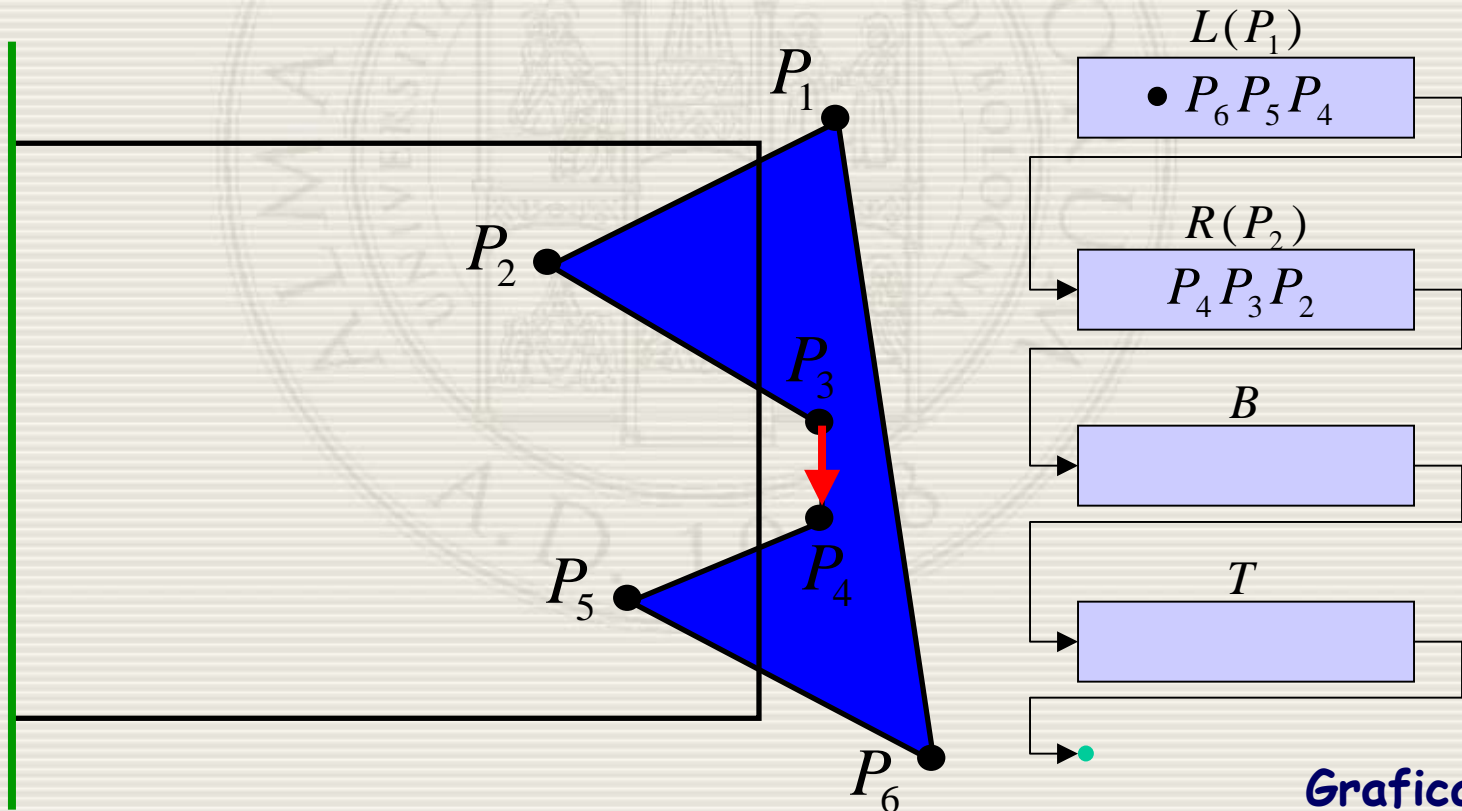
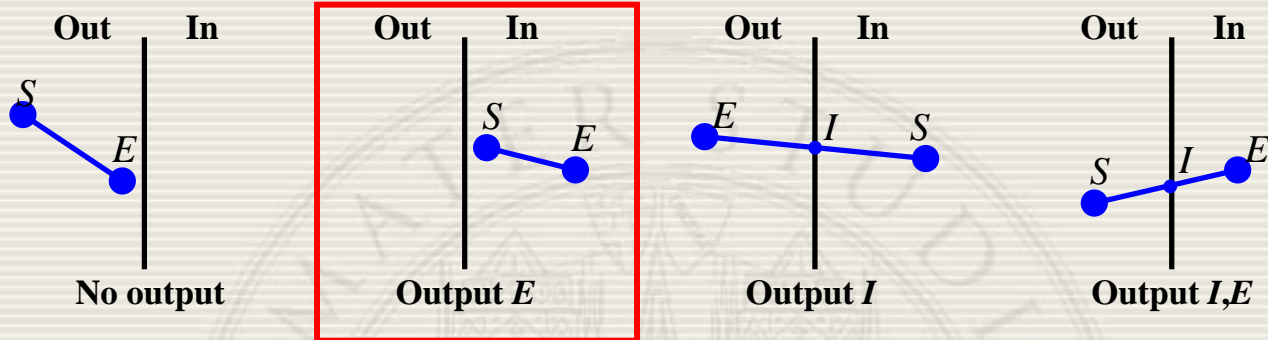
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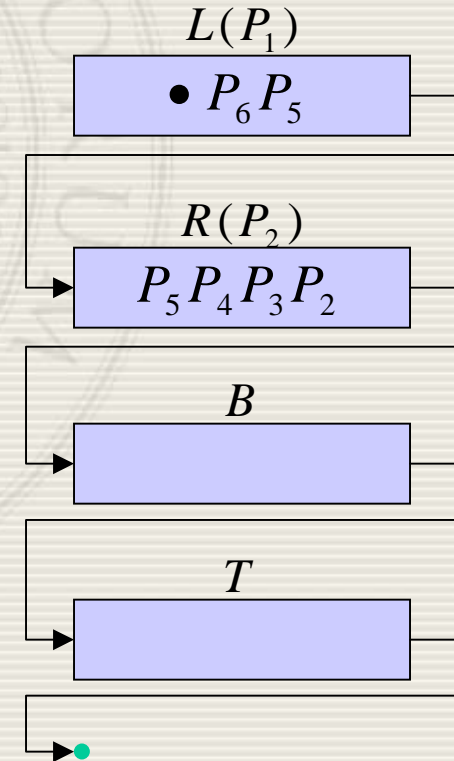
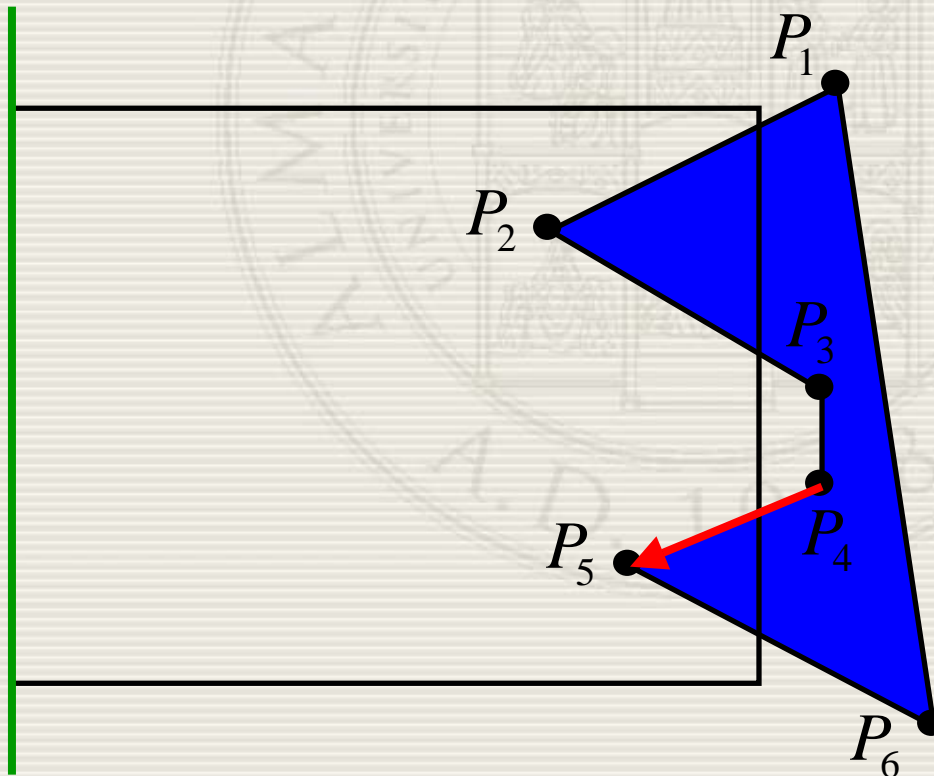
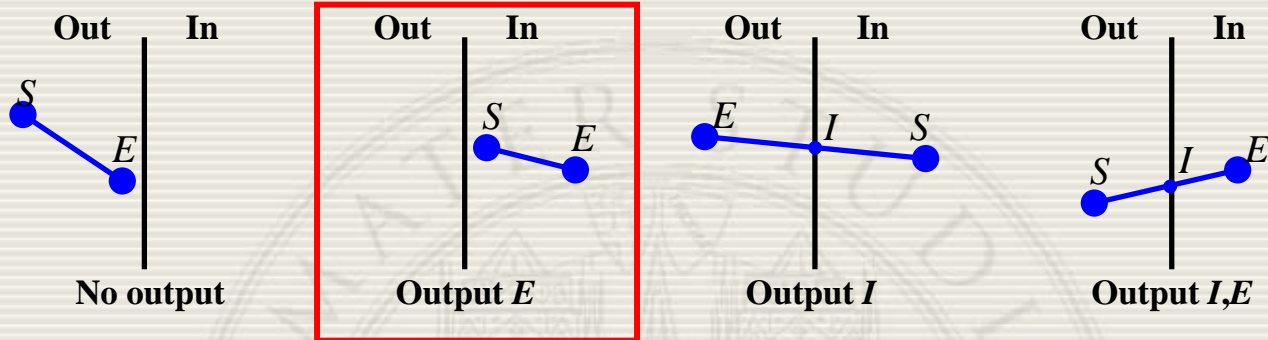
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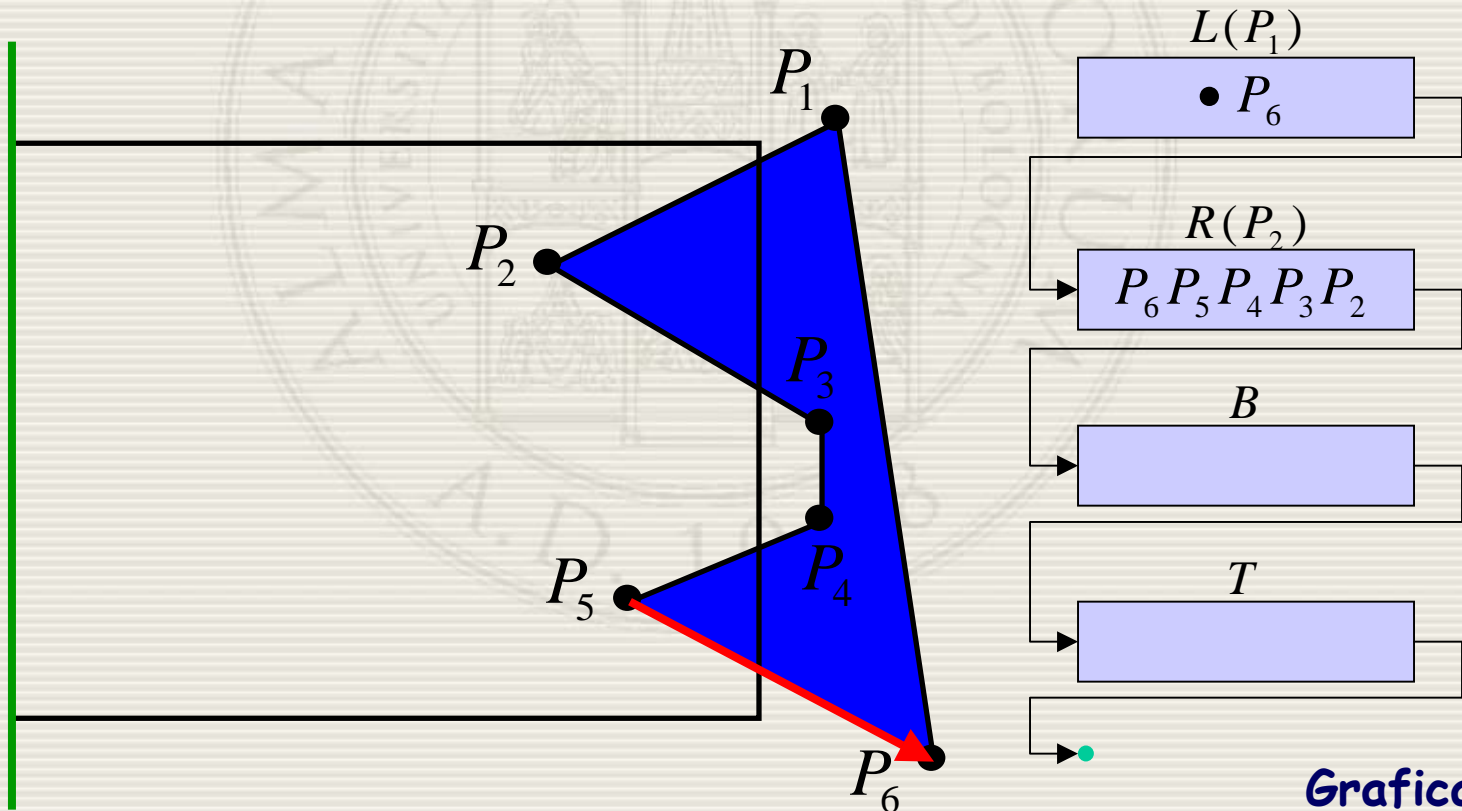
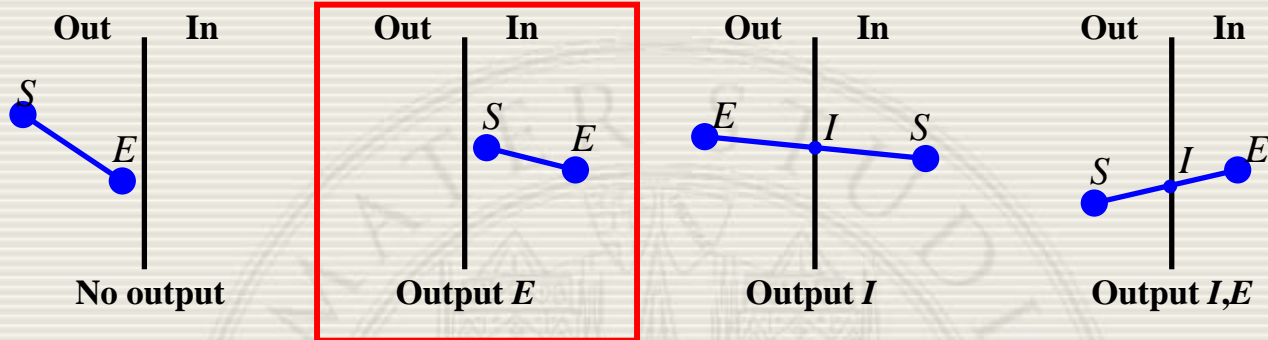
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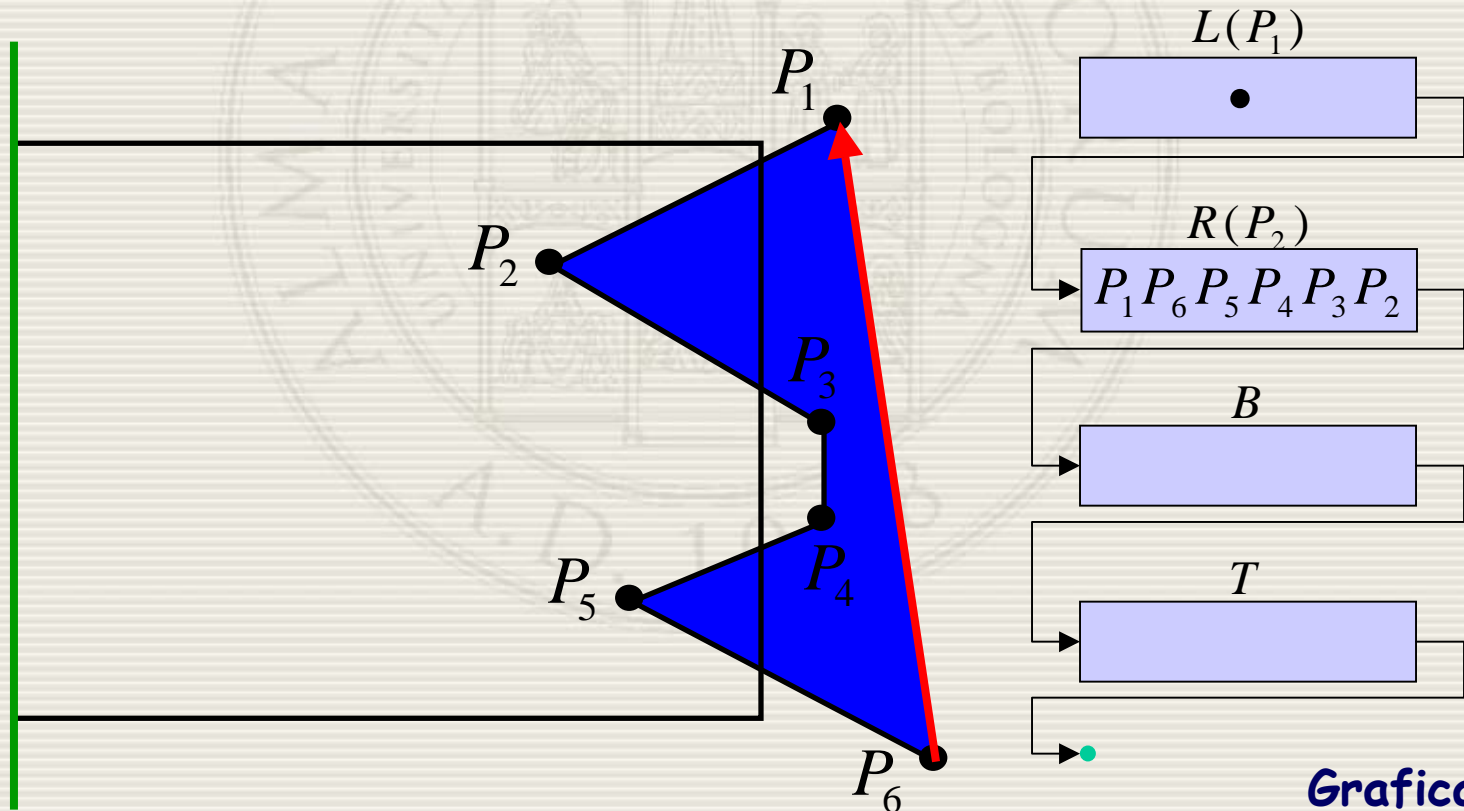
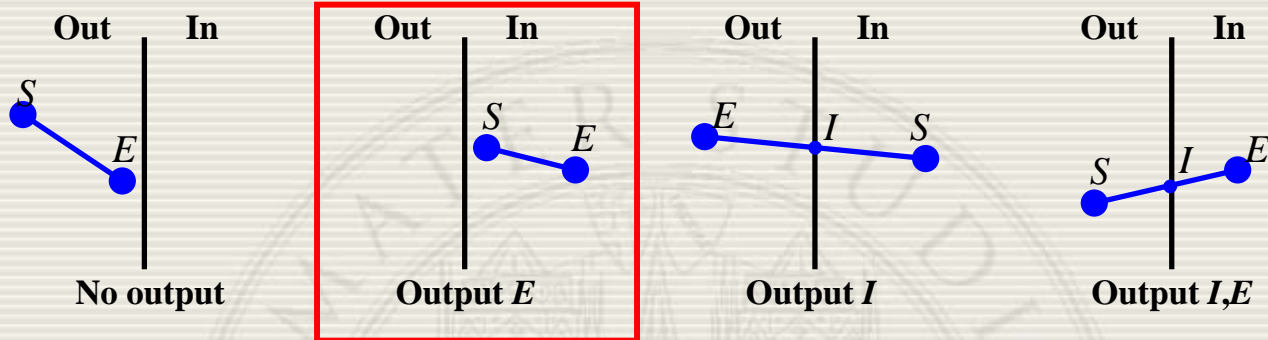
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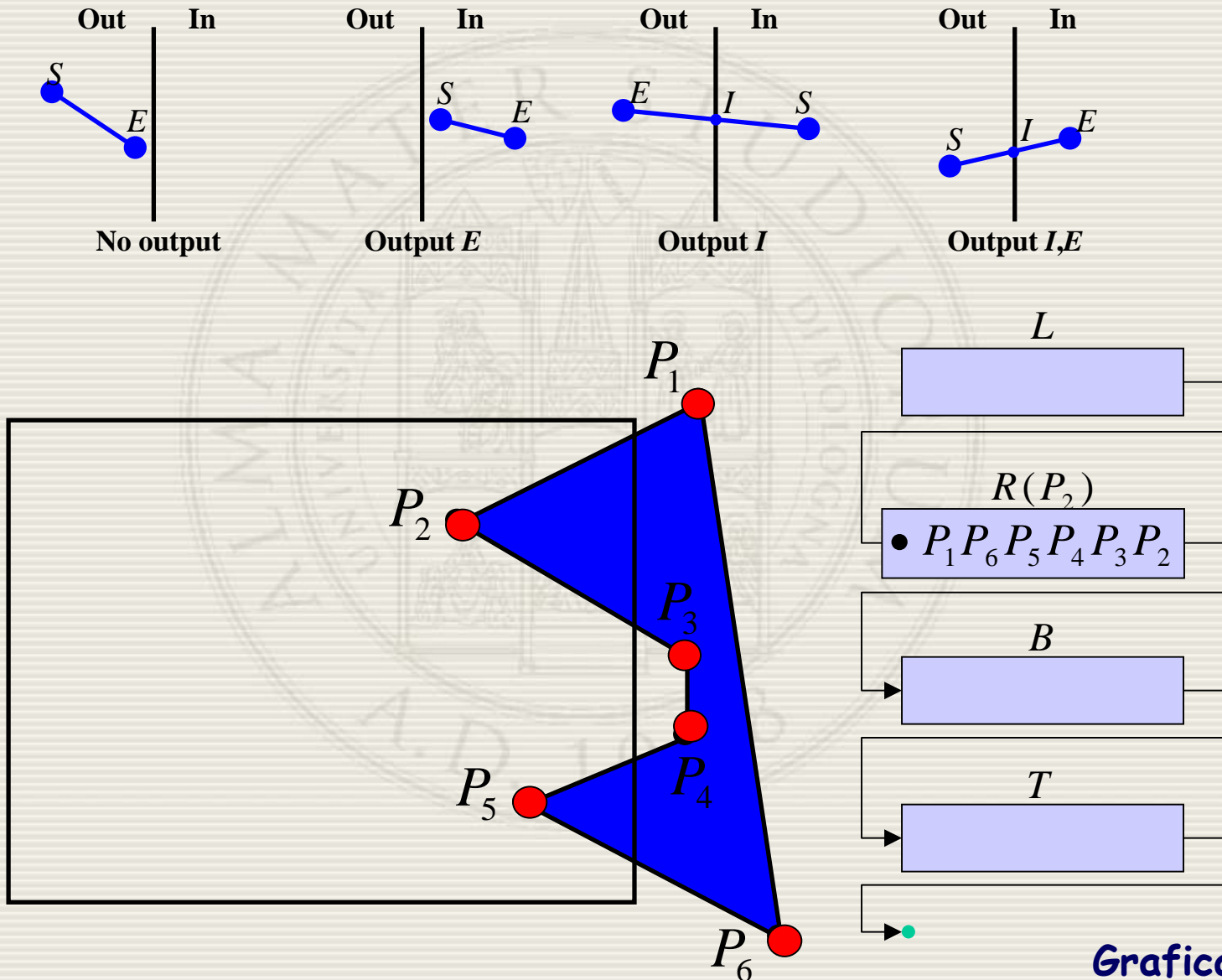
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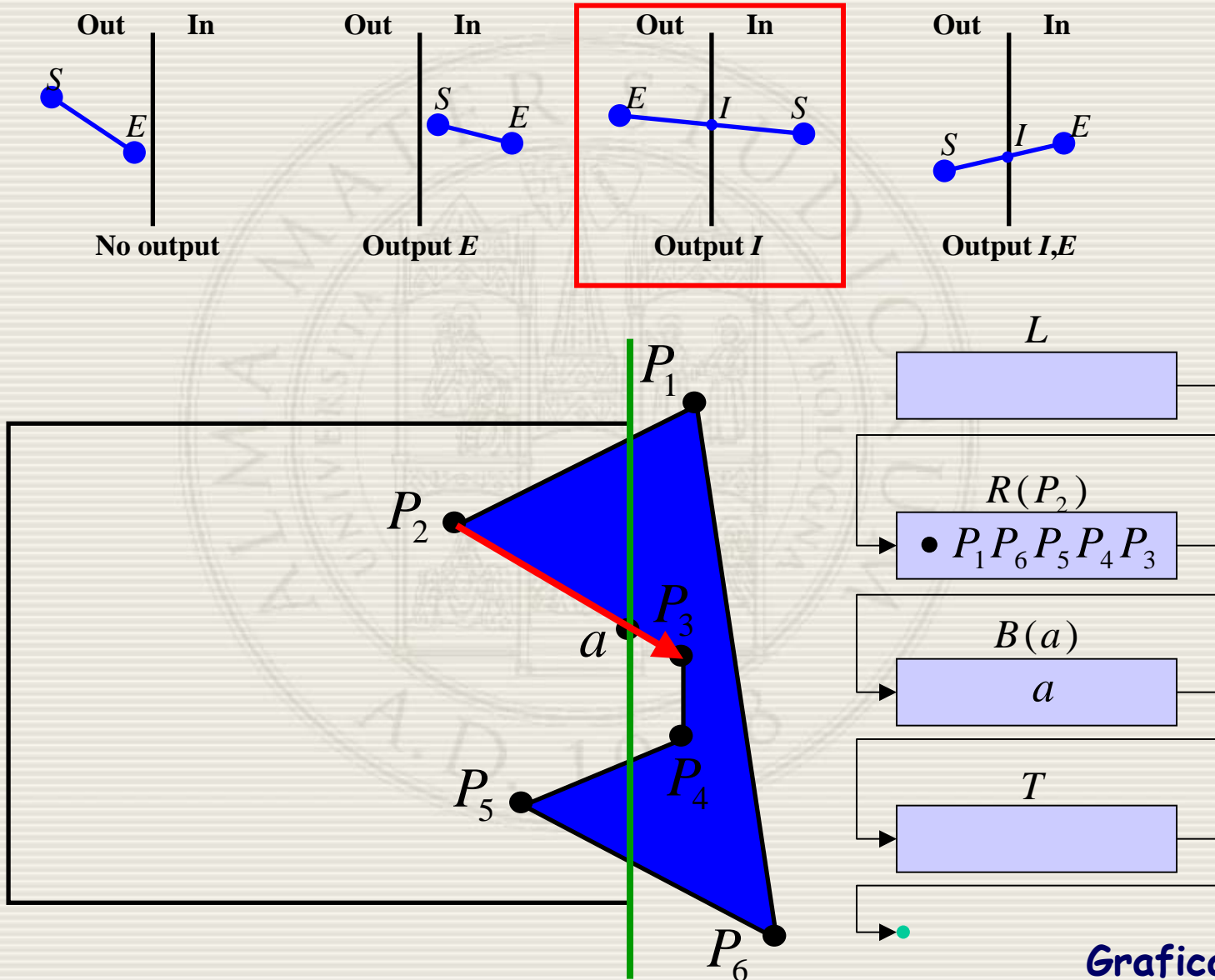
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# Algoritmo di Sutherland-Hodgman

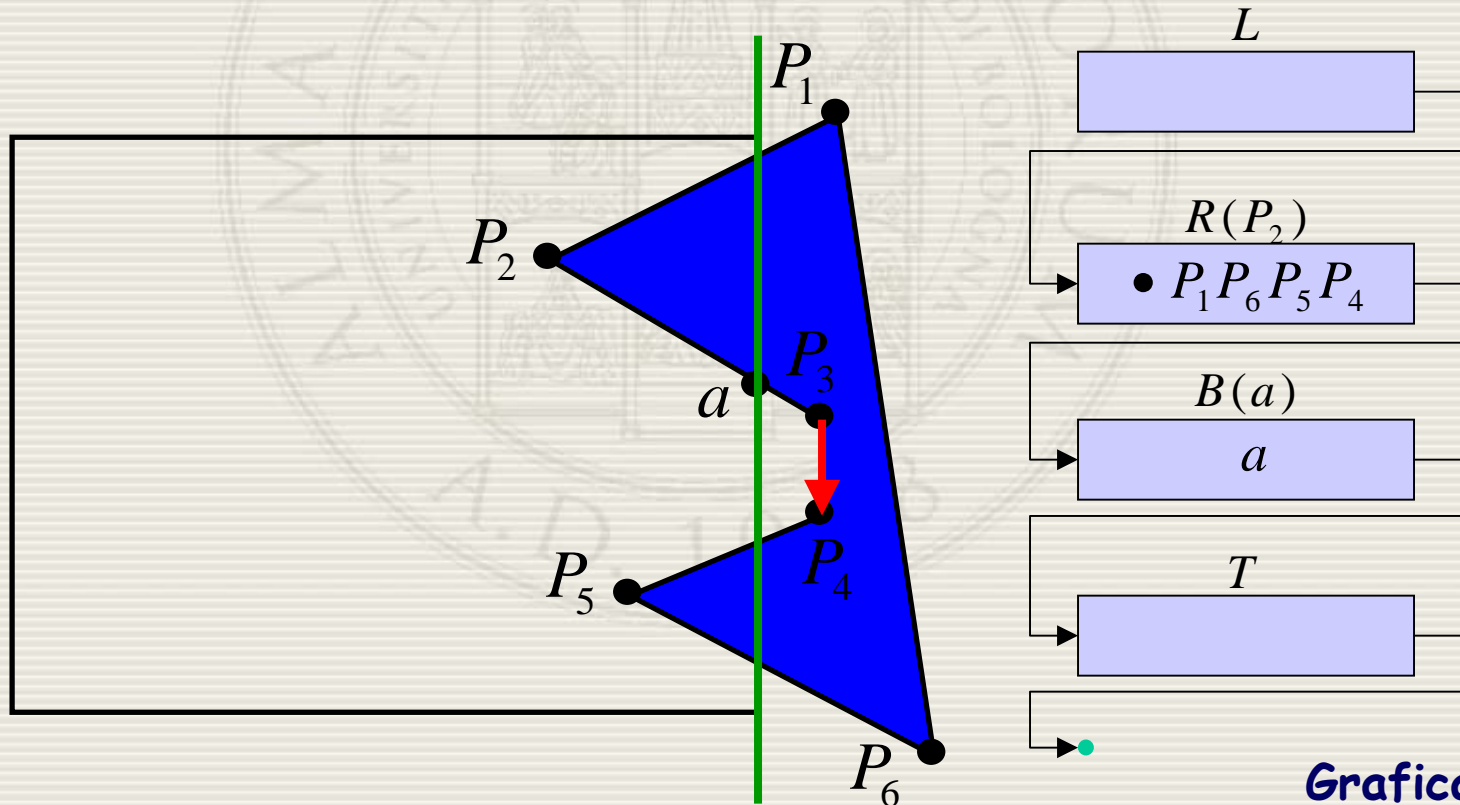
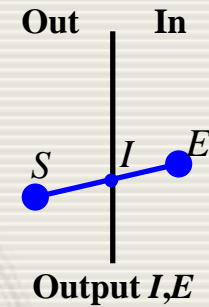
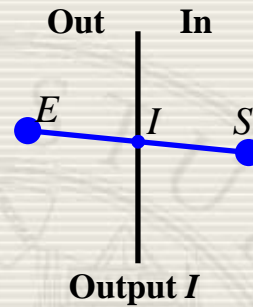
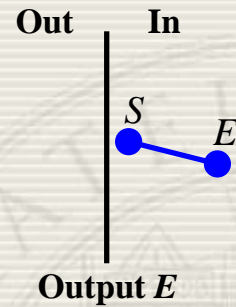
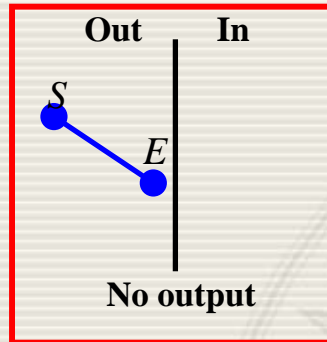


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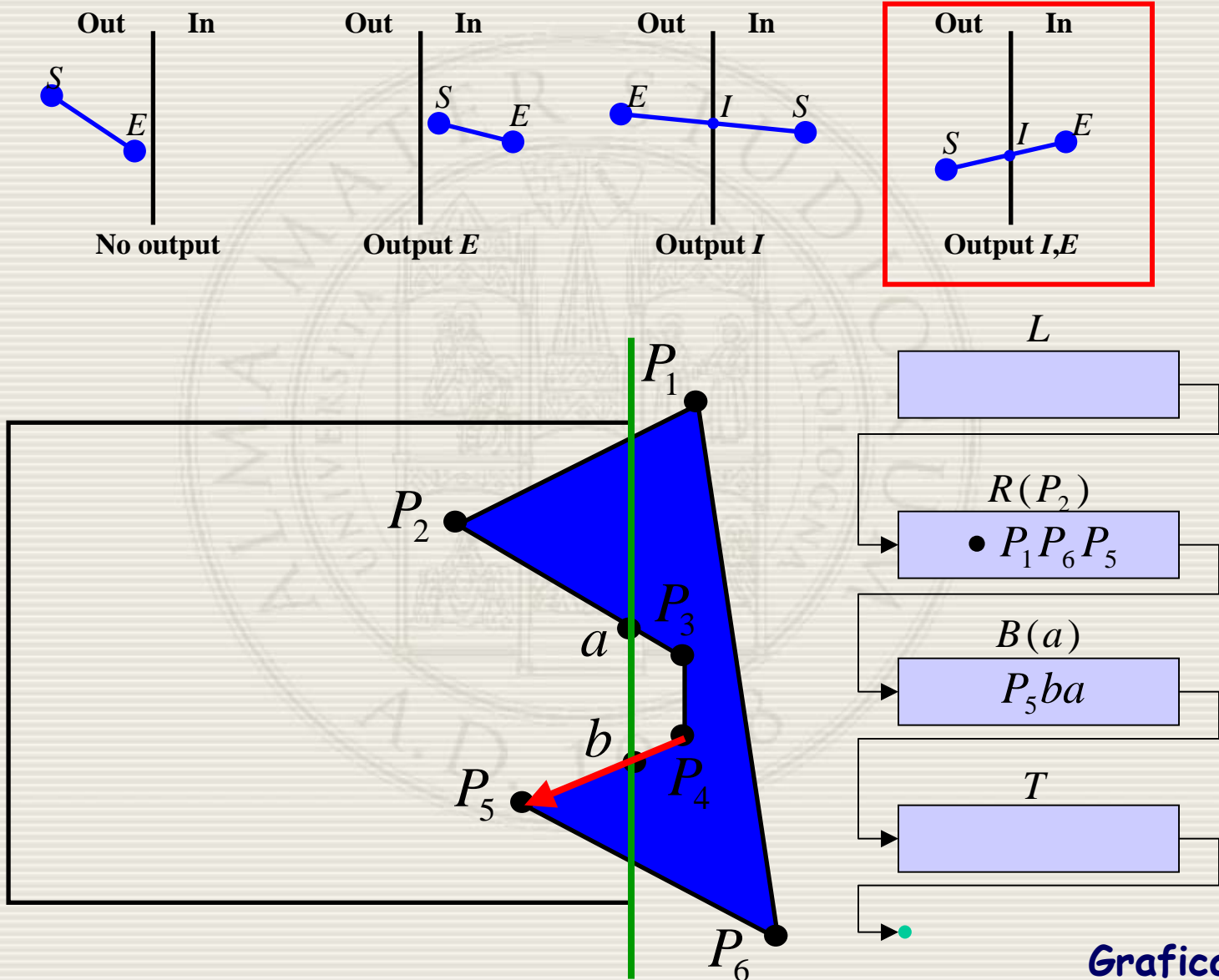




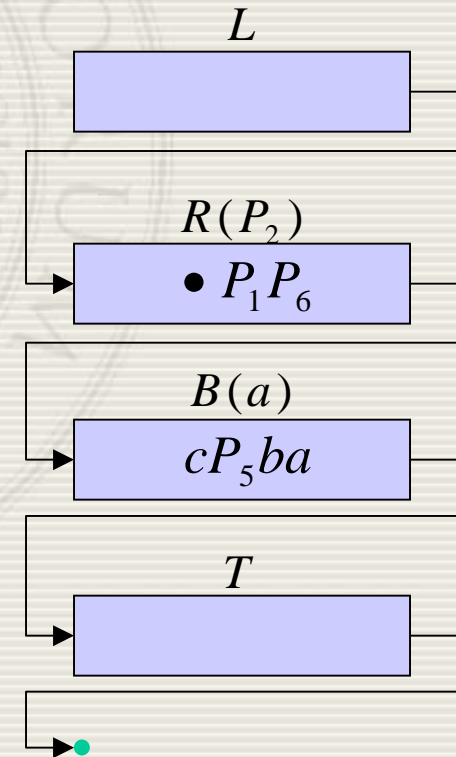
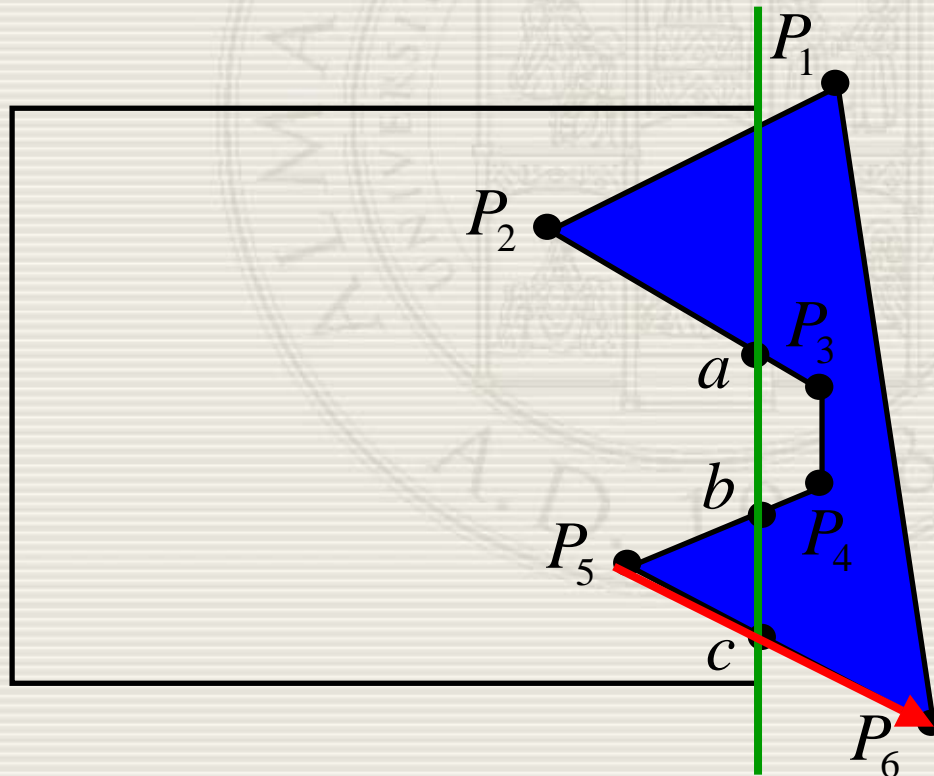
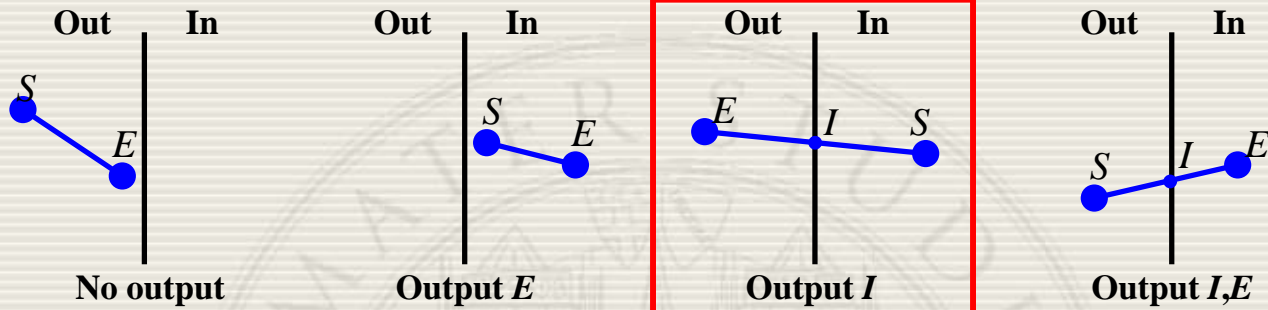
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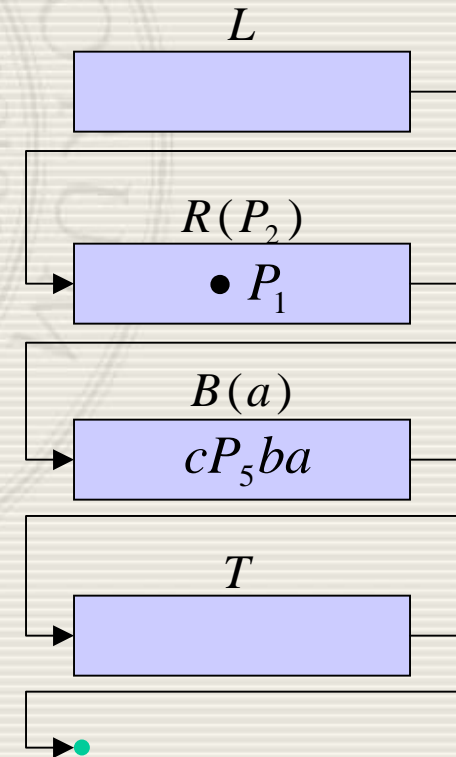
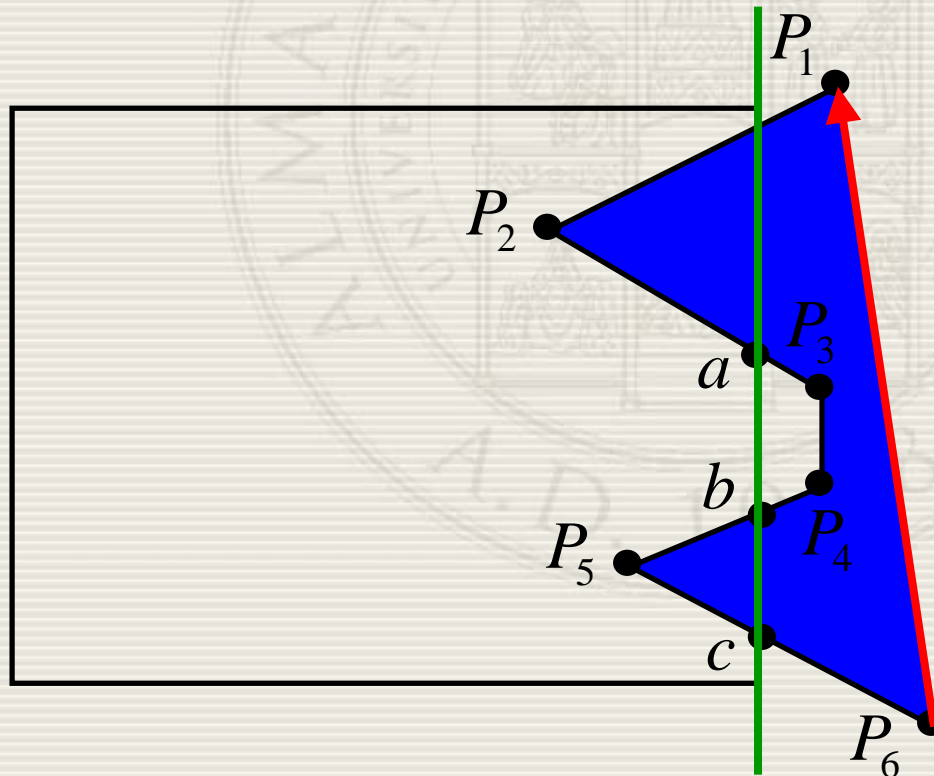
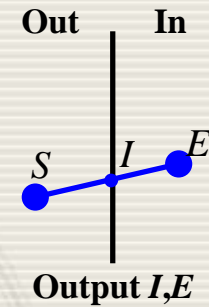
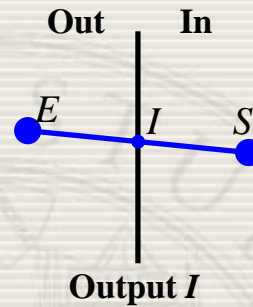
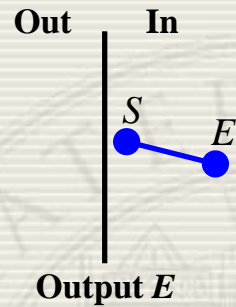
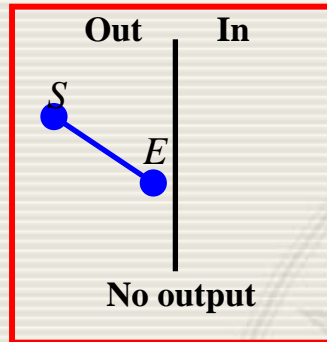
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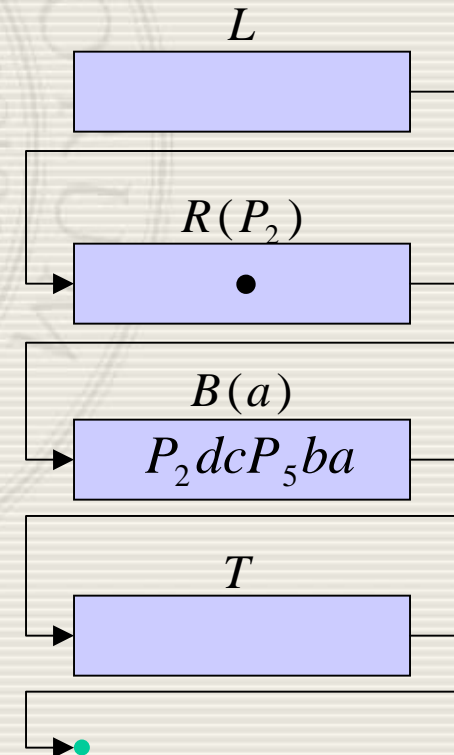
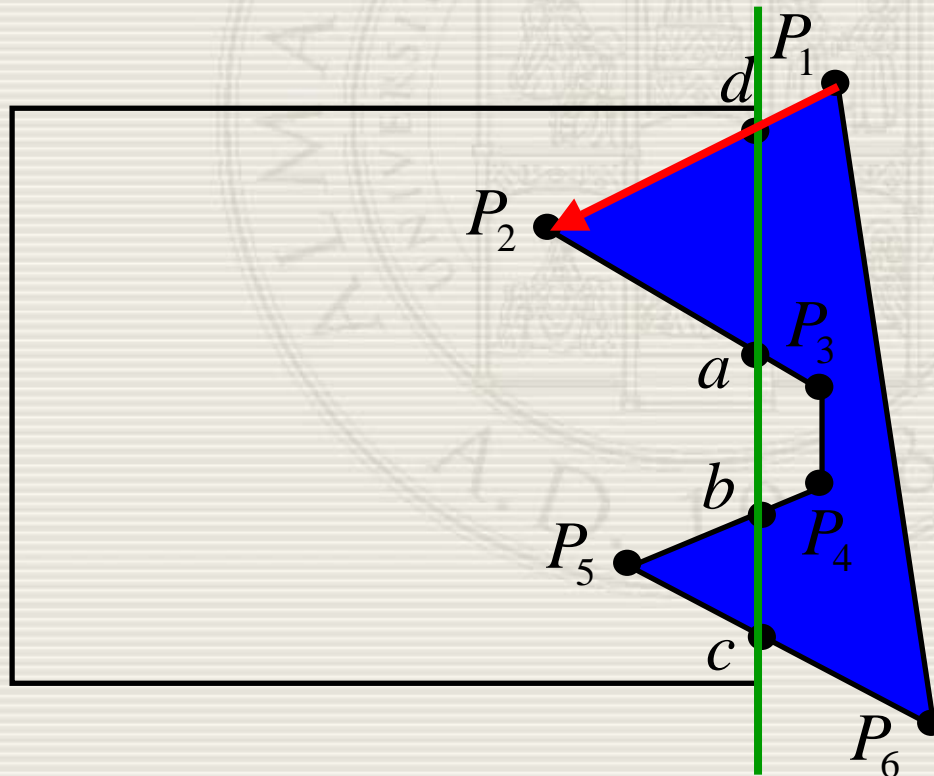
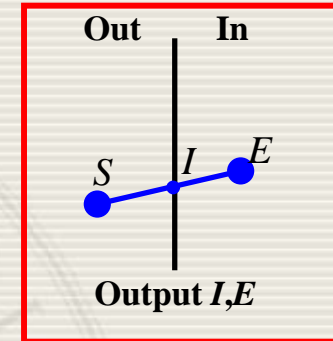
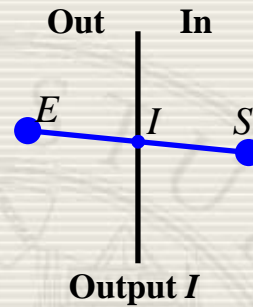
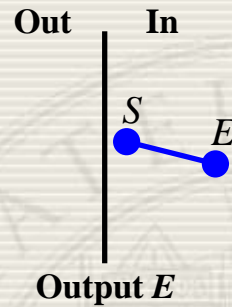
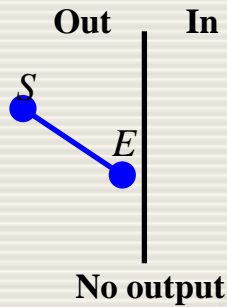
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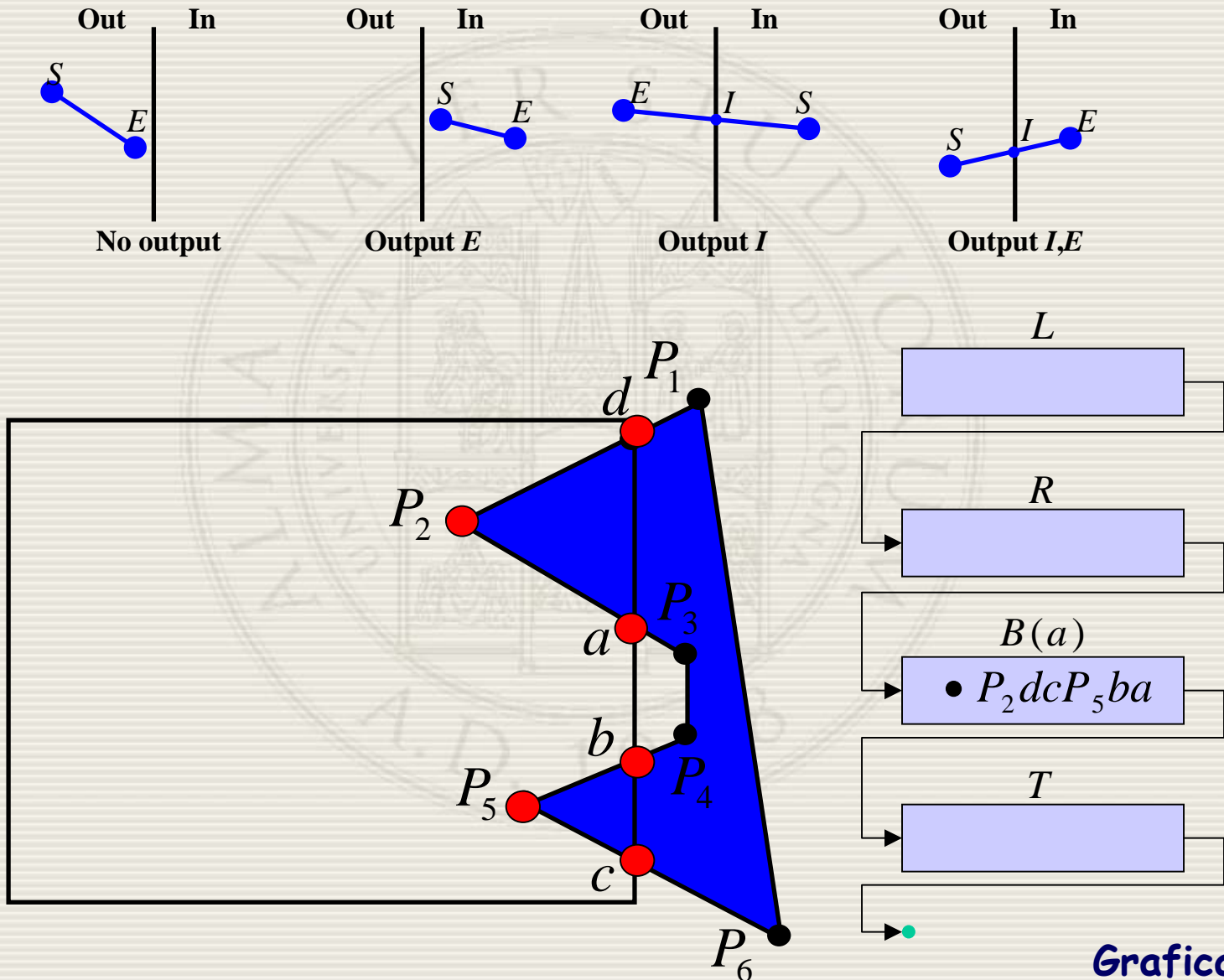
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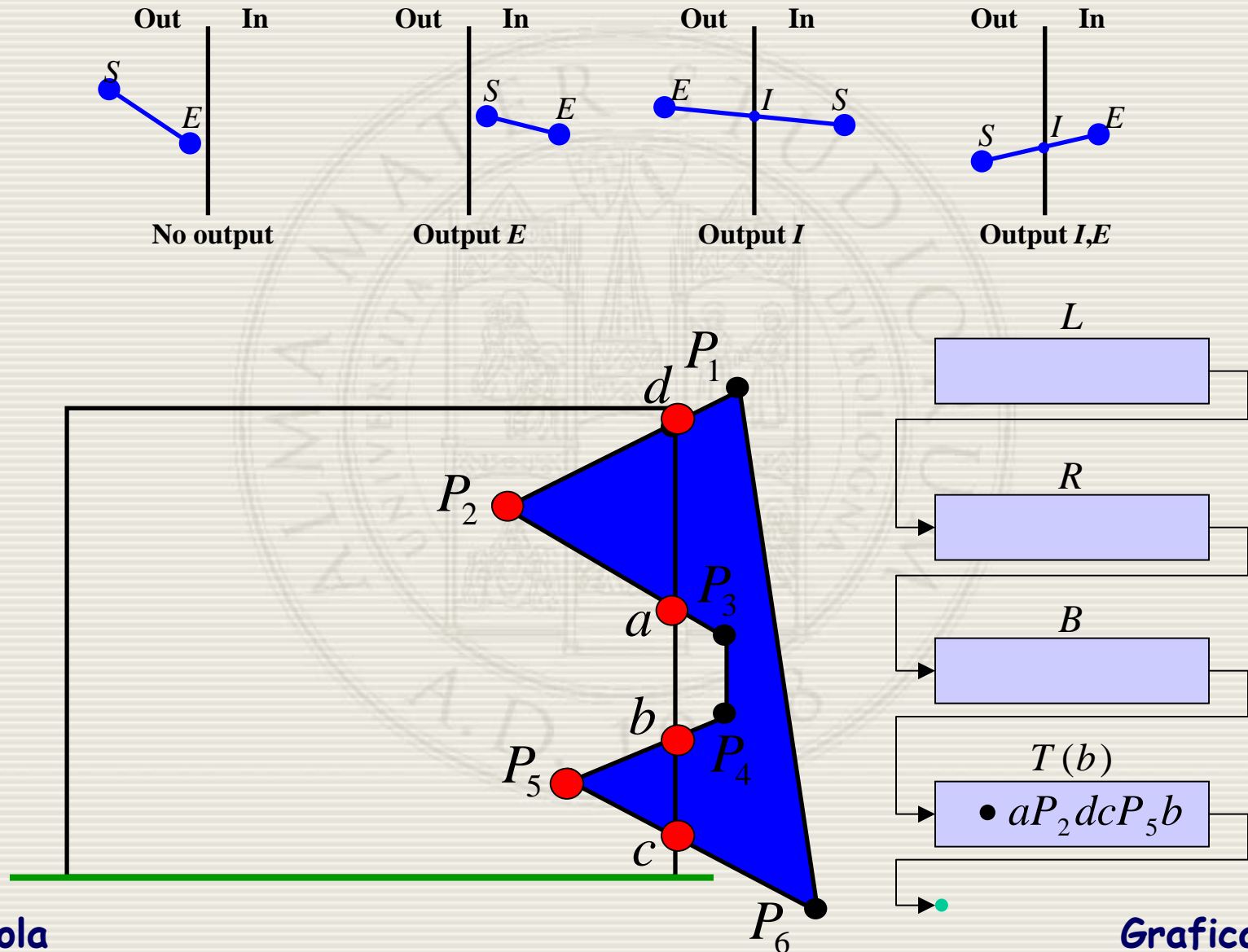
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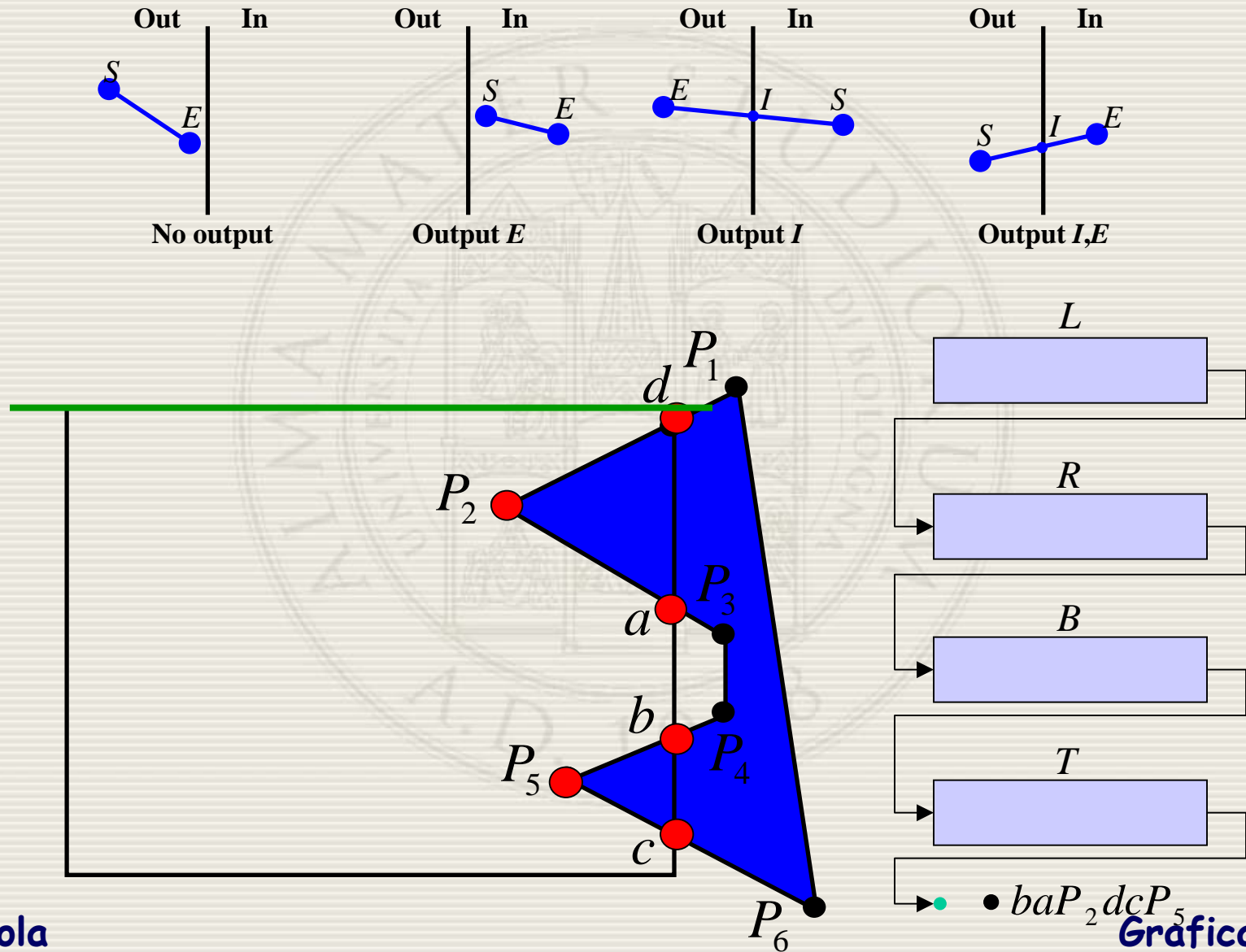
# Algoritmo di Sutherland-Hodgman



# Algoritmo di Sutherland-Hodgman

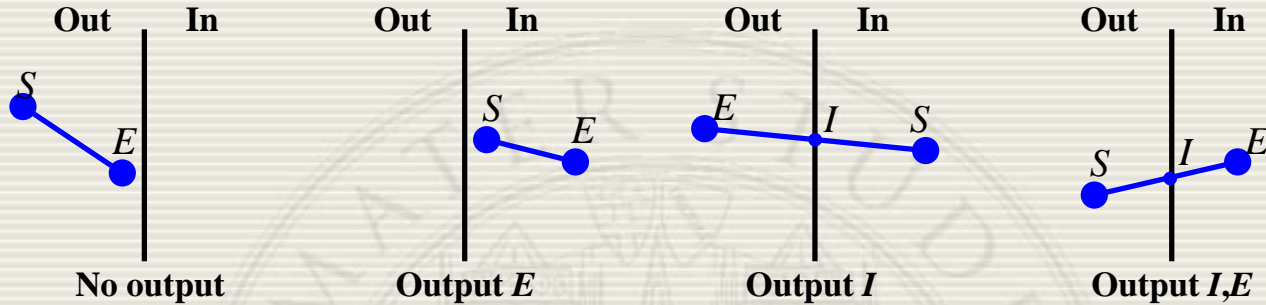


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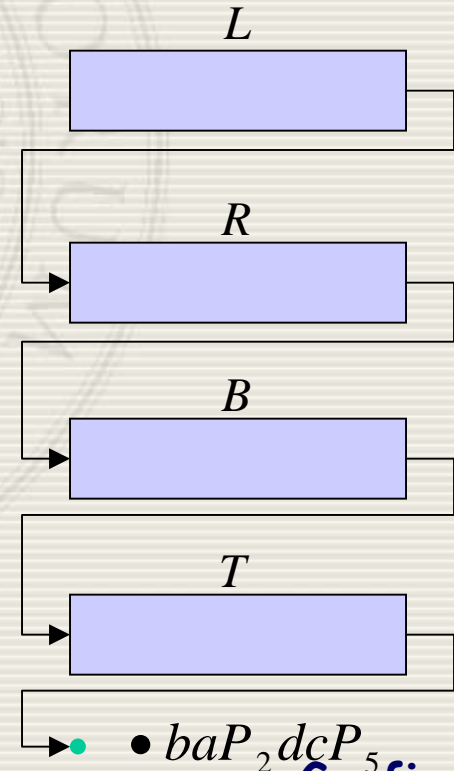
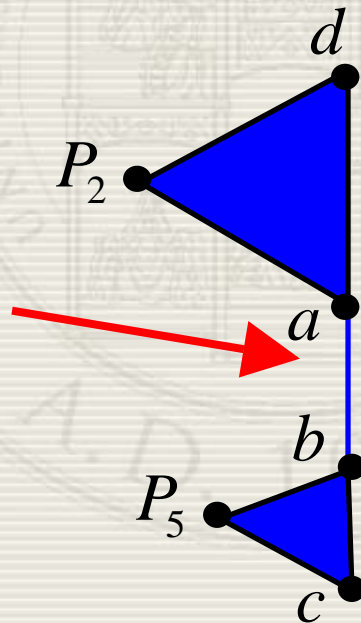




# Algoritmo di Sutherland-Hodgman



Possibile errore nel caso di poligoni non convessi

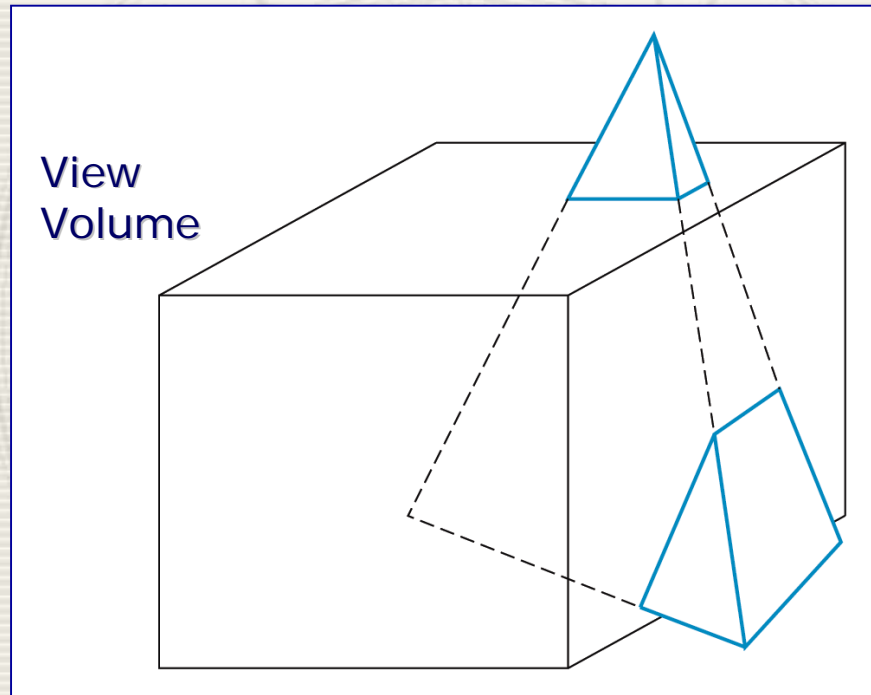


# Algoritmo di Sutherland-Hodgman

- Ideale per l'elaborazione in pipe-line.  
Il clipping di un lato del poligono non è necessario che sia terminato per cominciare con il lato successivo
- Ideale per l'elaborazione in fasi successive.  
Si può operare il clipping solo su due lati e portare a termine il procedimento in una seconda fase
- Porta a sostanziali miglioramenti delle prestazioni

# Algoritmo di Sutherland-Hodgman 3D

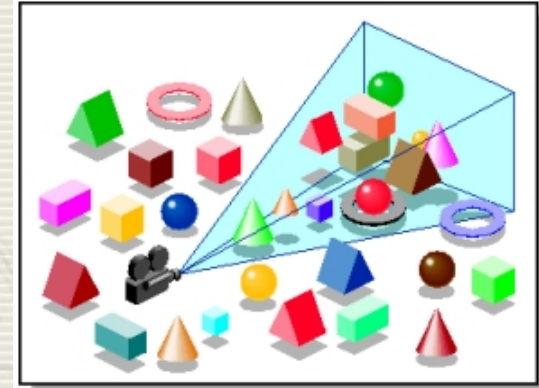
L'algoritmo di Sutherland-Hodgman può essere generalizzato rispetto ad un View Volume 3D.



Il caso più comune di clipping 3D è quello di oggetti mesh con facce poligonali ed in particolare triangolari.

# Algoritmo di Sutherland-Hodgman 3D

Prima di applicare l'algoritmo si controlla se l'oggetto è esterno al Frustum utilizzando un bounding volume o completamente interno;



Poi si esegue il clipping sui singoli poligoni utilizzando l'algoritmo di Sutherland-Hodgman visto;

I poligoni risultanti, se non sono triangoli, devono essere opportunamente suddivisi.