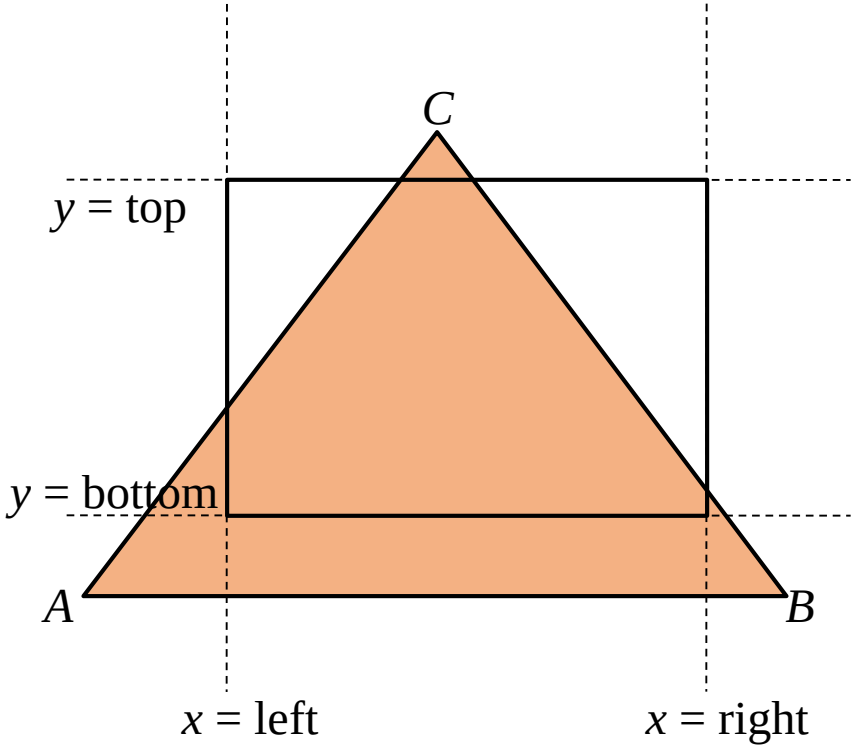
Clipping

CS418 Computer Graphics

John C. Hart

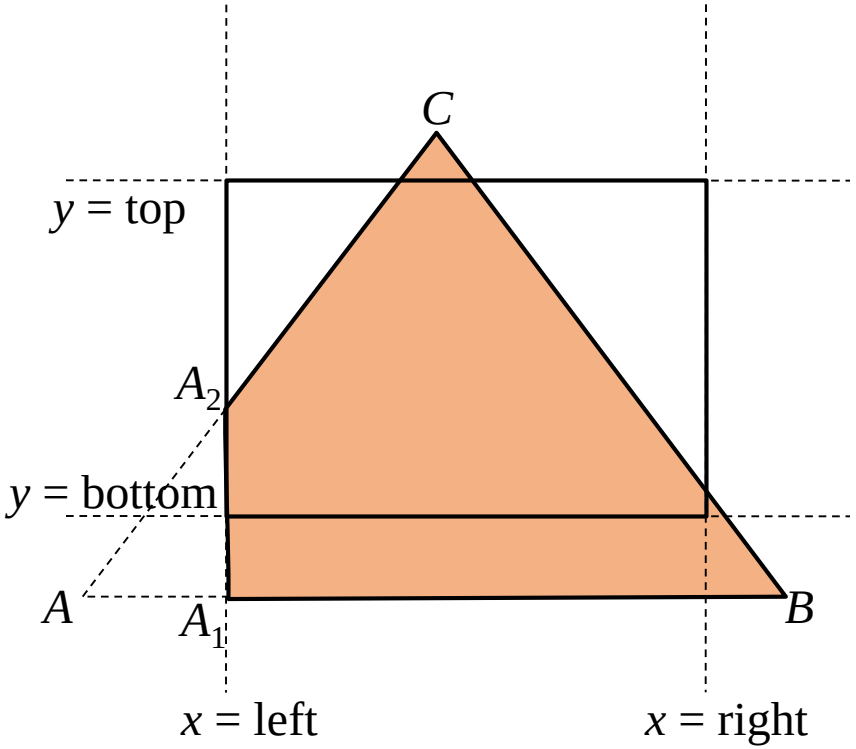
Polygon Clipping

- Sutherland-Hodgman
- Polygon *ABC*



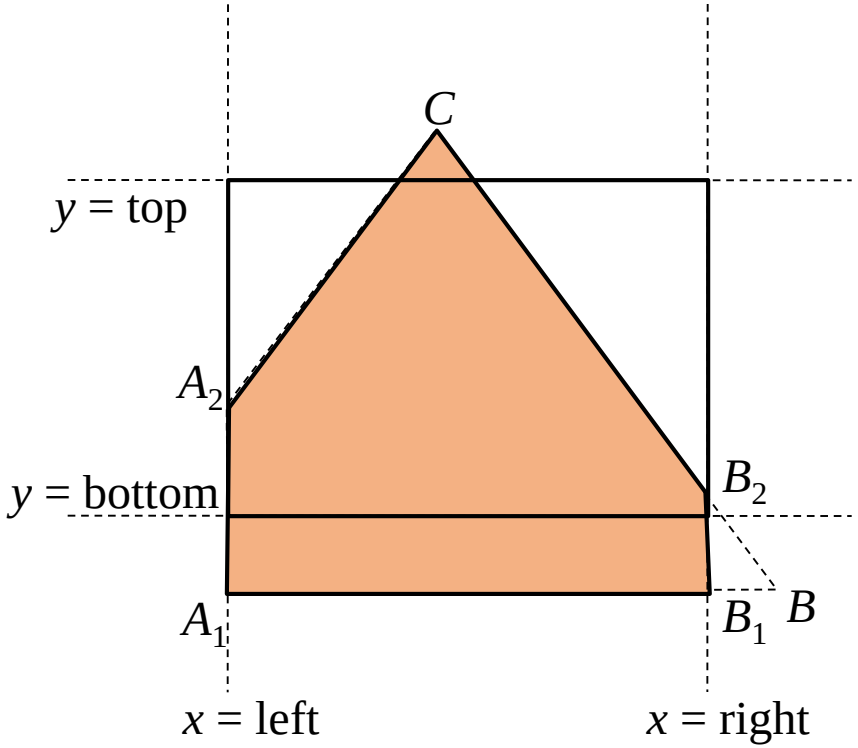
Polygon Clipping

- Sutherland-Hodgman
- Polygon *ABC*
- Clip left: A_1BCA_2



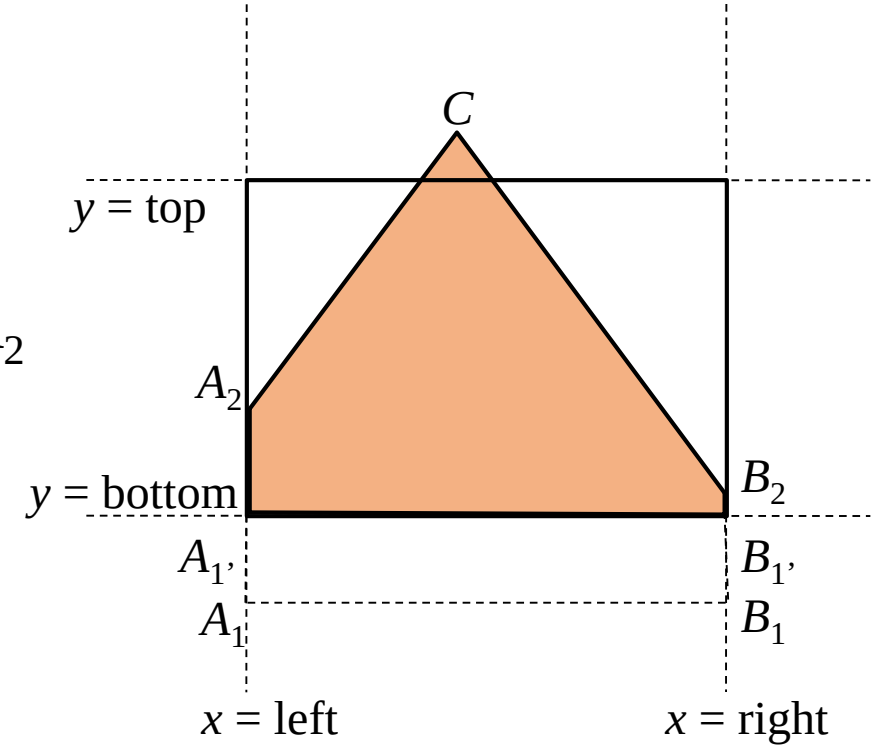
Polygon Clipping

- Sutherland-Hodgman
- Polygon ABC
- Clip left: A_1BCA_2
- Clip right: $A_1B_1B_2CA_2$



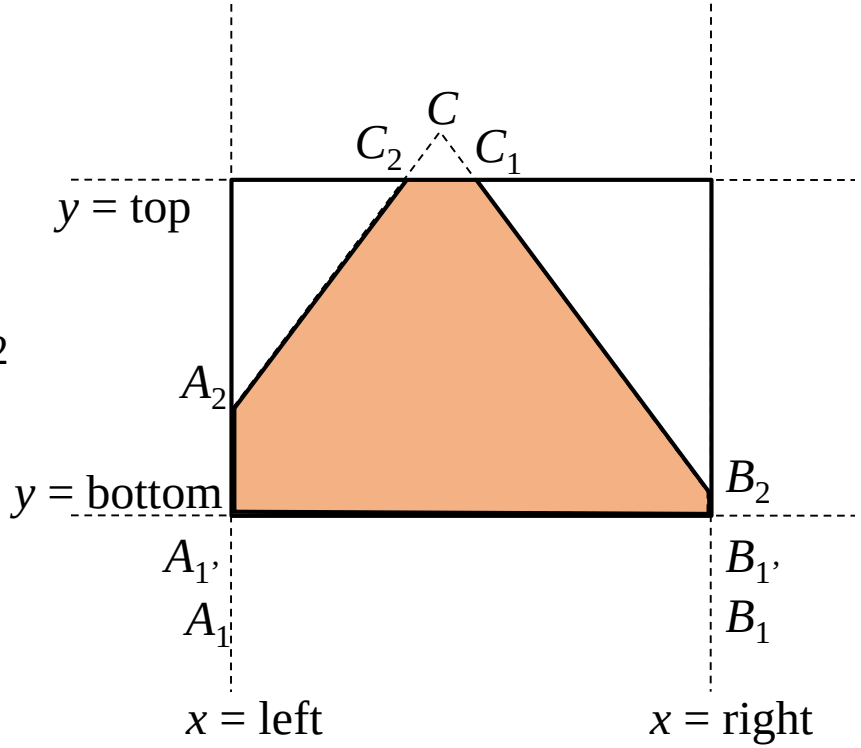
Polygon Clipping

- Sutherland-Hodgman
- Polygon ABC
- Clip left: A_1BCA_2
- Clip right: $A_1B_1B_2CA_2$
- Clip bottom: $A_1'B_1'B_2CA_2$



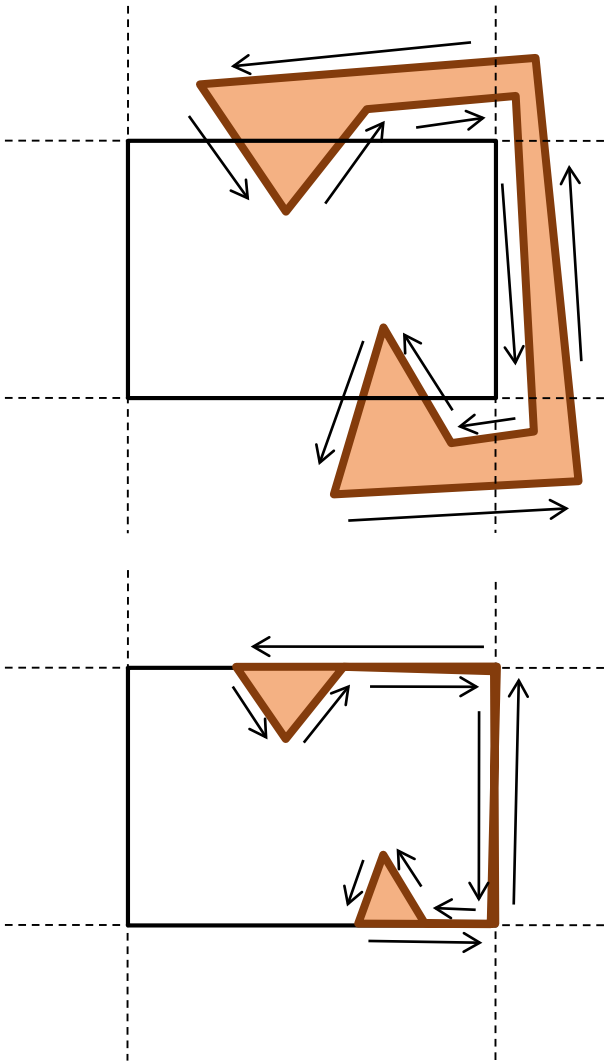
Polygon Clipping

- Sutherland-Hodgman
- Polygon ABC
- Clip left: A_1BCA_2
- Clip right: $A_1B_1B_2CA_2$
- Clip bottom: $A_1B_1{'}B_2{'}CA_2$
- Clip top: $A_1B_1{'}B_2{'}C_1C_2A_2$



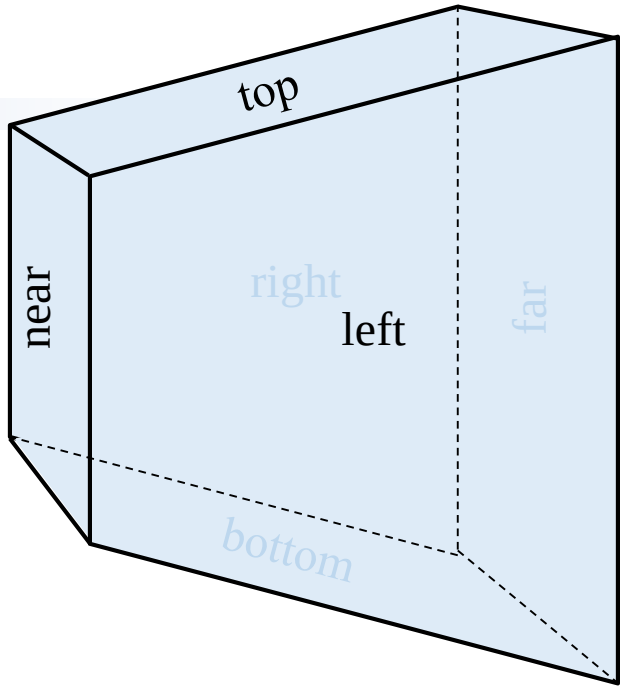
Concave Clipping

- Sutherland-Hodgman
- Clip segments even if they are trivially rejectible (rejectionable?)
- Outputs a single polygon that appears as multiple polygons
- Reversed edges don’t get filled



Clipping in 3-D (4-D)

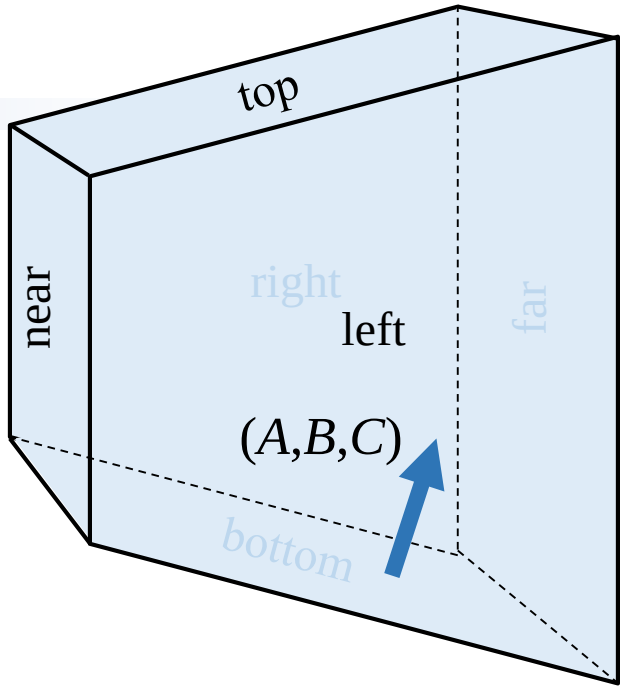
- Need to keep depth (z-coordinate) of geometry for visible surface detection
- Generalize oriented screen edge to oriented clipping plane $C = (A,B,C,D)$



Clipping in 3-D (4-D)

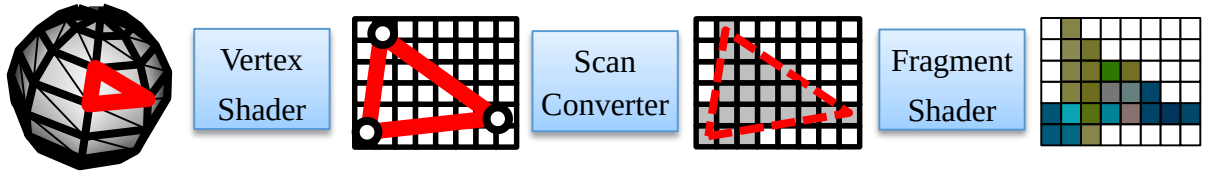
- Need to keep depth (z-coordinate) of geometry for visible surface detection
- Generalize oriented screen edge to oriented clipping plane $C = (A,B,C,D)$
- Then *any* homogeneous point $P = (x,y,z,w)^T$ classified as
  - "on" if $C\,P = 0$
  - "in" if $C\,P > 0$
  - "out" if $C\,P < 0$

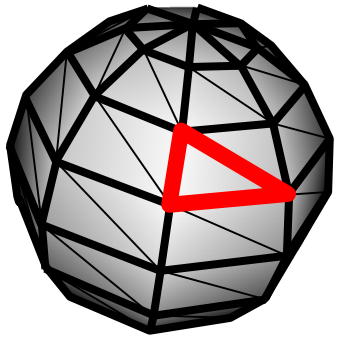
$$Ax + By + Cz + D = 0$$
$$\Updownarrow$$
$$wAx + wBy + wCz + wD = 0$$



$$\begin{bmatrix} A & B & C & D \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ w \end{bmatrix} = 0$$

Vertex Pipeline





Model Coords

Model Xform

World Coords

Viewing Xform

Viewing Coords

Projection

Clip Coords.

Clipping

Still Clip Coords.

Homogeneous Divide

Window Coordinates

Window to Viewport

Viewport Coordinates