Clipping

Polygon Clipping

Polygon : Area primitive

Simple Polygon: Planar set of ordered points
No line crossings
No holes

Simple Polygon
Line Crossing
Hole
Clipping

Polygon Clipping
Polygon: Area primitive

Convex Polygon

Non-Convex Polygon
Clipping

Polygon Clipping

Sutherland-Hodgman

- Window must be convex
- Polygon to be clipped can be convex or non-convex
Clipping

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Sutherland-Hodgman

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Sutherland-Hodgman
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Sutherland-Hodgman

Approach

• Polygon to be clipped is given as $v_1$, $v_2$, ..., $v_n$
• Polygon edge is a pair $[v_i, v_{i+1}]$
• Process all polygon edges in succession against a window edge
  polygon $(v_1, v_2, ..., v_n) \rightarrow$ polygon $(w_1, w_2, ..., w_m)$
• Repeat on resulting polygon with next window edge
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Approach

Four Cases

• $s = v_i$ is the polygon edge starting vertex
• $p = v_{i+1}$ is the polygon edge ending vertex
• $i$ is a polygon-edge/window-edge intersection point
• $w_j$ is the next polygon vertex to be output
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Approach

Case 1: Polygon edge is entirely inside the window edge

- $p$ is next vertex of resulting polygon
- $p \rightarrow w_j$ and $j+1 \rightarrow j$
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Approach

Case 2: Polygon edge crosses window edge going out

- Intersection point $i$ is next vertex of resulting polygon
- $i \rightarrow w_j$ and $j+1 \rightarrow j$
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Approach

Case 3: Polygon edge is entirely outside the window edge

- No output
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Approach

Case 4: Polygon edge crosses window edge going in

- Intersection point $i$ and $p$ are next two vertices of resulting polygon
- $i \rightarrow w_j$ and $p \rightarrow w_{j+1}$ and $j+2 \rightarrow j$
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Example

Polygon

Window

s_1, s_2, s_3, s_4, s_5
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Example
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Polygon Clipping

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Example
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Example
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Example
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Example
Polygon Scan Conversion

Polygon Filling

Consider first triangle
Polygon Scan Conversion

Polygon Filling

Consider first triangle

Color all pixels inside triangle
Inside (containment) test
Polygon Scan Conversion

Polygon Filling

Triangle

Use horizontal spans. Process horizontal spans in scan-line order. For the next spans use edge slopes.
How do we decide what parts of the span should be filled?
Polygon Scan Conversion

Polygon Filling

Polygon

How do we decide what parts of the span should be filled?

Parity check
if odd fill
if even don’t fill
Polygon Scan Conversion

Polygon Filling

Polygon

What happens here?
Polygon Scan Conversion

Polygon Filling

Polygon

What happens here?
Polygon Scan Conversion

Polygon Filling

Polygon

Recursive seed filling