Tile Rasterization

CS418 Computer Graphics
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Triangle Rasterization

- Modern GPU’s optimize triangles
  - Simplicial – least information for planar facet
  - Convex
- Modern GPU’s often tile based
  - Spatial coherence
  - Memory coherence
- Modern GPU’s parallel
  - Determine pixels independently
  - Determine pixels simultaneously
Who Needs Clipping?

• Useful to cull (e.g. via Cohen-Sutherland outcodes) triangles that lie completely off the display viewport

• Don’t need to specifically clip triangles (e.g. via Liang-Barsky parametric clipping) that lie partially on and partially off the display viewport
Which Tiles in Triangle

- Rasterize the tiles using e.g. a scan line algorithm on the tiles instead of the pixels
- Conservative rasterization: include any tile that contains any portion of triangle
Line Equation

- Explicit Line Equation
  
  \[ y = f(x) = mx + b \]
Line Equation

- Explicit Line Equation
  \[ y = f(x) = mx + b \]

- Implicit Line Equation
  \[ f(x,y) = mx + b - y \]

\[ f(x,y) > 0 \]
\[ f(x,y) = 0 \]
\[ f(x,y) < 0 \]
Line Equation

- Explicit Line Equation
  \[ y = f(x) = mx + b \]
- Implicit Line Equation
  \[ f(x,y) = mx + b - y \]
- But what about vertical lines?

\[ m = ? \]
Line Equation

- Explicit Line Equation
  \[ y = f(x) = mx + b \]
- Implicit Line Equation
  \[ f(x,y) = mx + b - y \]
- But what about vertical lines?
- Implicit Line Equation
  \[ f(x,y) = Ax + By + C \]
Line Equation

- Explicit Line Equation
  $$y = f(x) = mx + b$$
- Implicit Line Equation
  $$f(x,y) = mx + b - y$$
- But what about vertical lines?
- Implicit Line Equation
  $$f(x,y) = Ax + By + C$$
- Which is an Explicit Plane Equation
  $$z = f(x,y) = Ax + By + C$$
Rasterizing a Triangle

- Figure out which pixel positions lie inside the triangle
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- Figure out which pixel positions lie on the positive side of each of three line equations
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\[ f(x, y) = 4x + 2y - 9 \]
Tile Test

• Does tile contain edge?
• Just check corners
  – If all corners outside then tile is empty
  – If all corners inside then tile is inside
  – Otherwise edge passes through tile
• Perform for all three edges