Tile Rasterization

CS418 Computer Graphics

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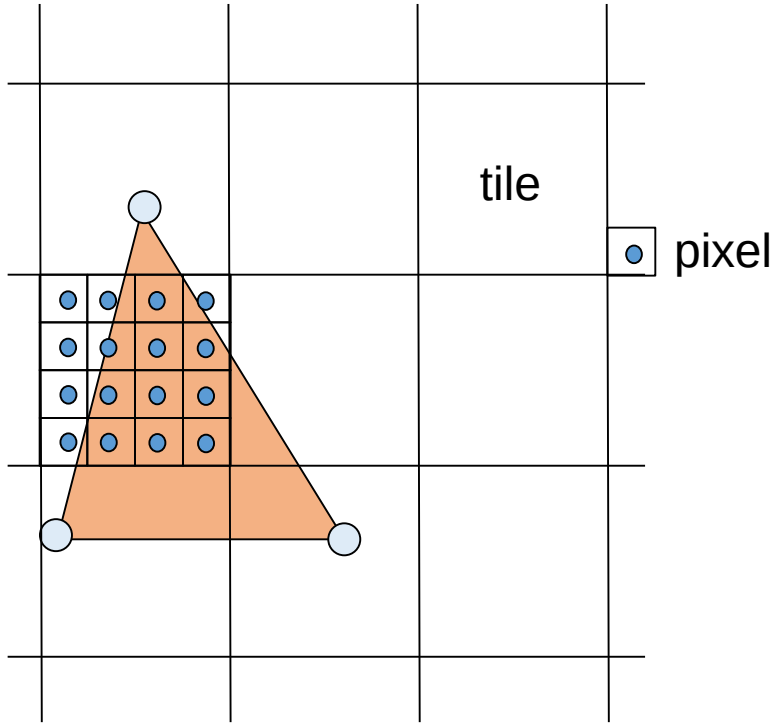
Triangle Rasterization

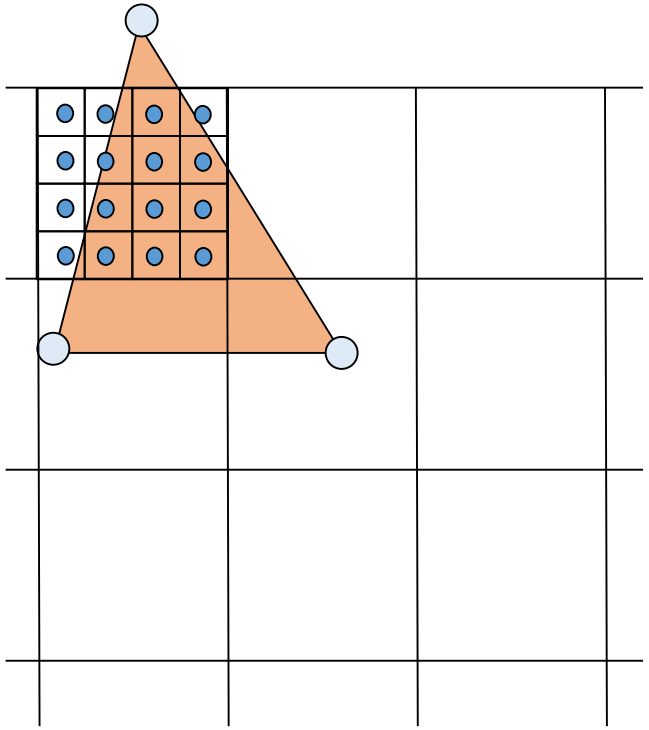
- Modern GPU's optimize triangles
  - Simplicial – least information for planar facet
  - Convex
- Modern GPU's often tile based
  - Spatial coherence
  - Memory coherence
- Modern GPU's parallel
  - Determine pixels independently
  - Determine pixels simultaneously



Who Needs Clipping?

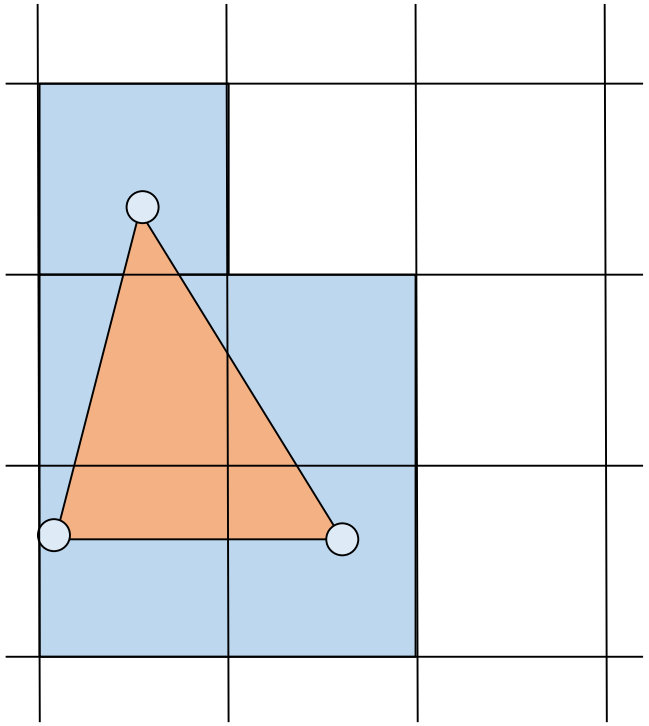
- Useful to cull (e.g. via Cohen-Sutherland outcodes) triangles that lie completely off the display viewport

- 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

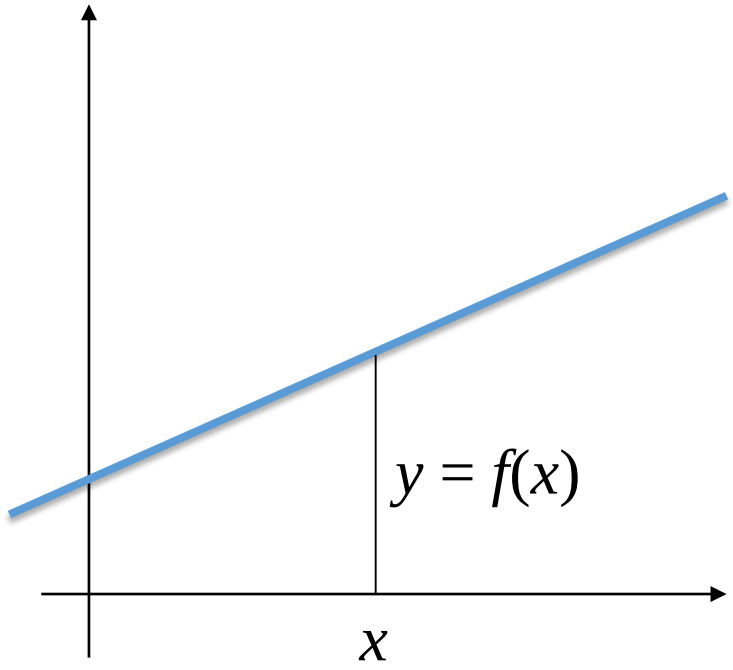
- Rasterize the tiles using e.g. a scan line algorithm on the tiles instead of the pixels
- Conservative rasterization: include any tile that contains any portion of triangle



Line Equation

- Explicit Line Equation

$$y = f(x) = mx + b$$



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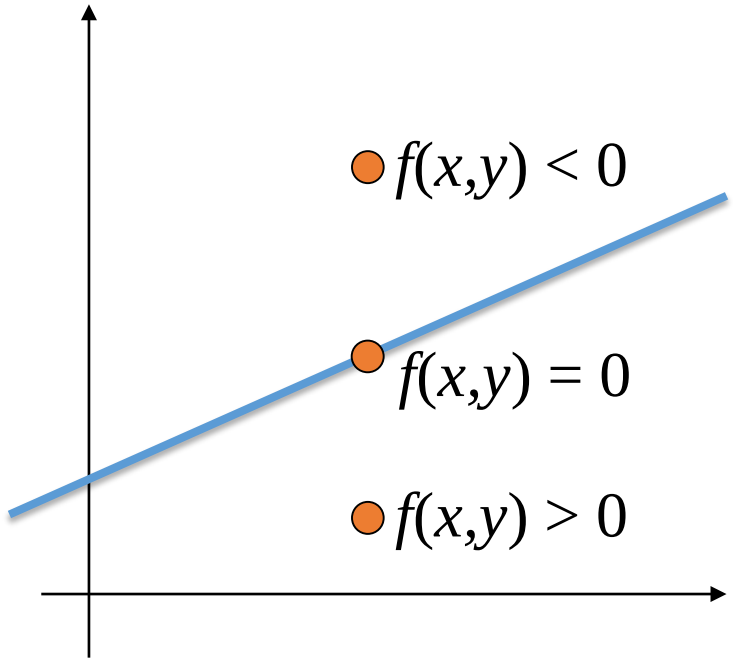
- Implicit Line Equation

$$f(x,y) = mx + b - y$$



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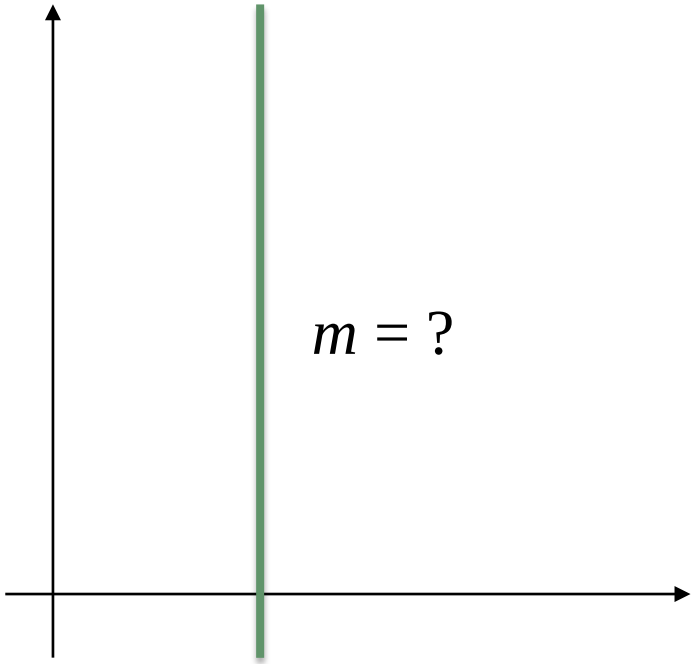
- But what about vertical lines?



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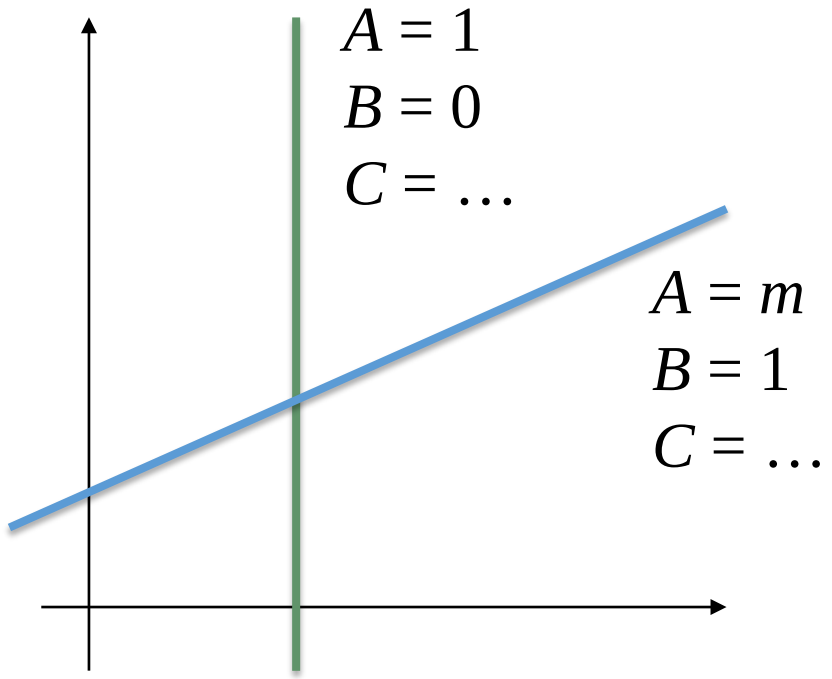
$$f(x,y) = Ax + By + C$$



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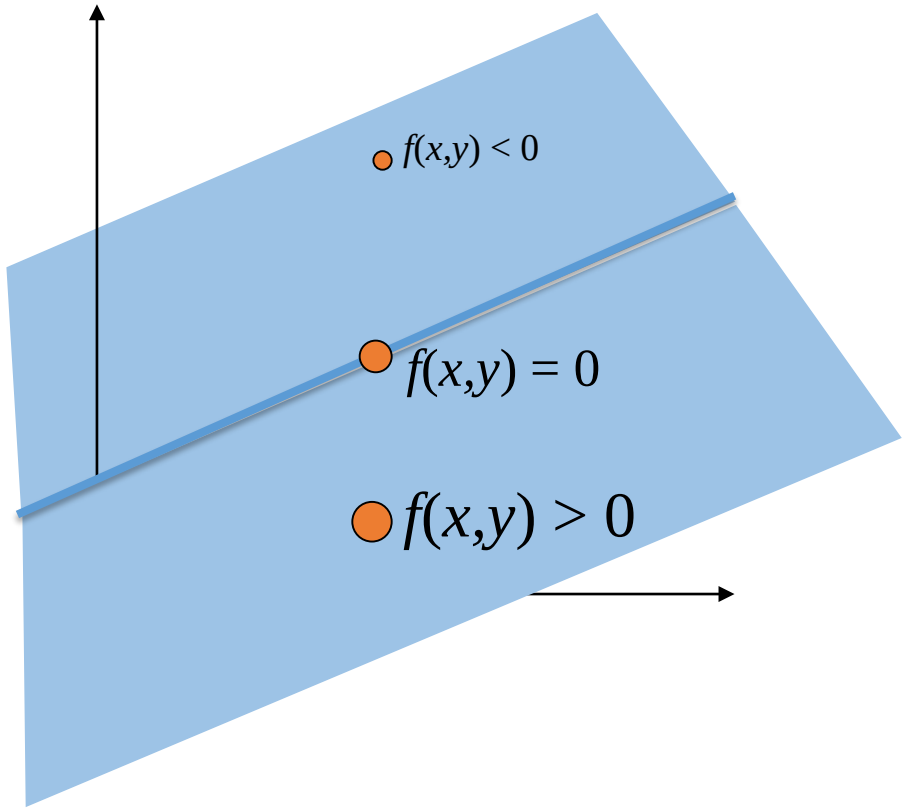
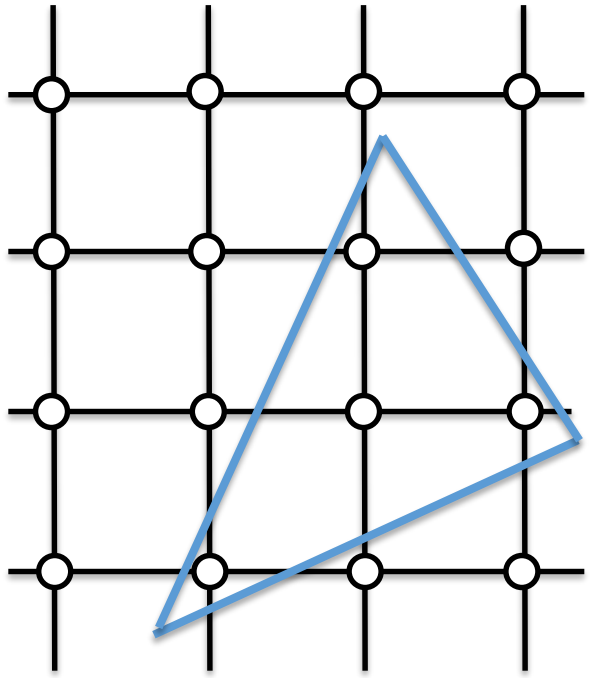
- Which is an Explicit Plane Equation

$$z = f(x,y) = Ax + By + C$$



Rasterizing a Triangle

- Figure out which pixel positions lie inside the triangle



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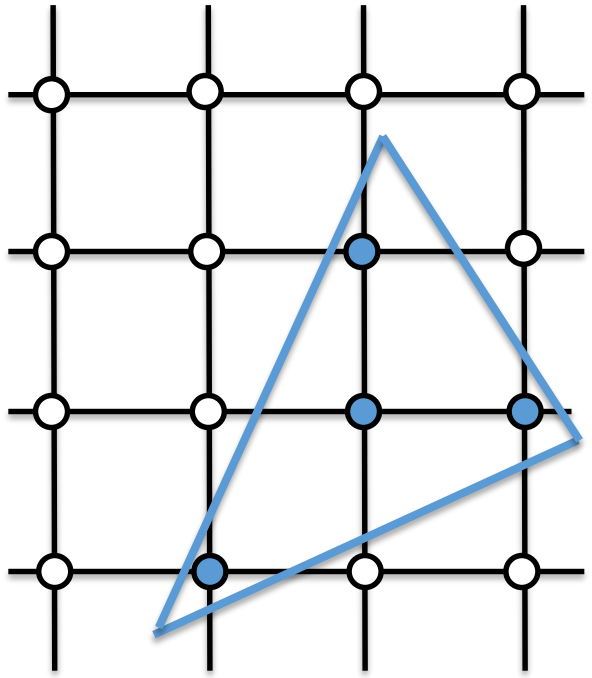
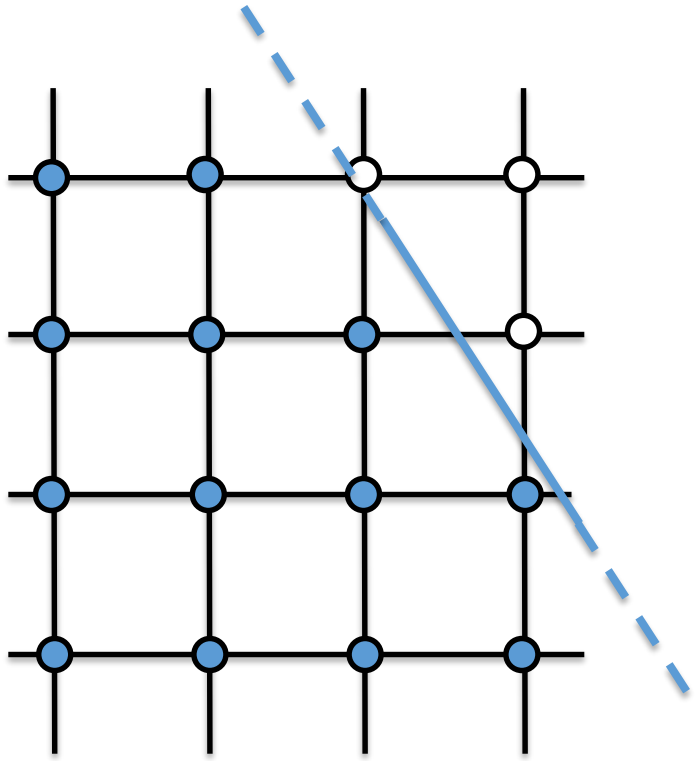


Rasterizing a Triangle

- Figure out which pixel positions lie inside the triangle
- Figure out which pixel positions lie on the positive side of each of three line equations



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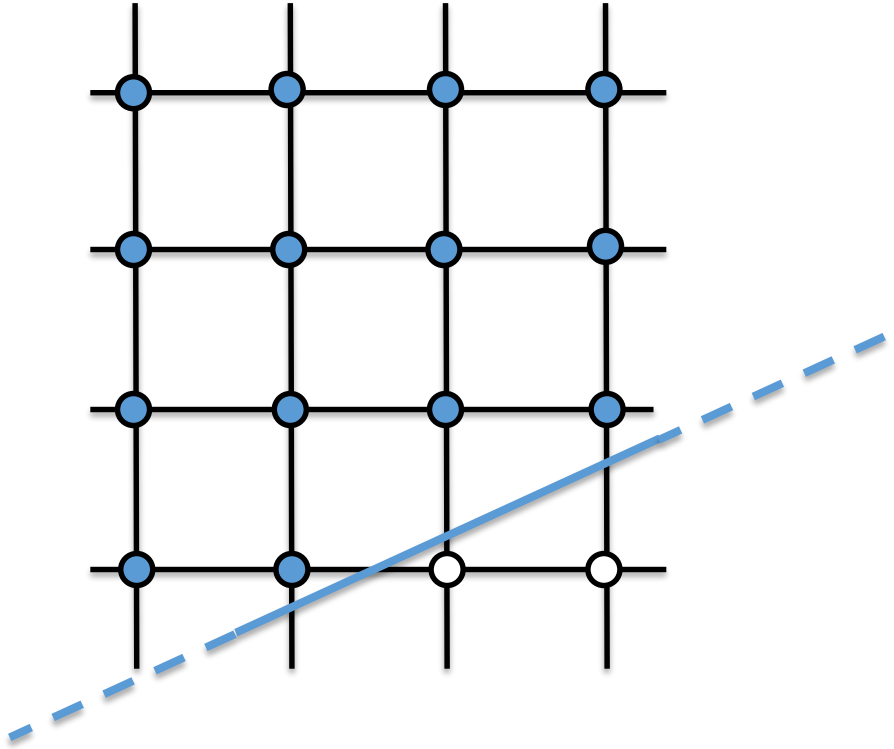

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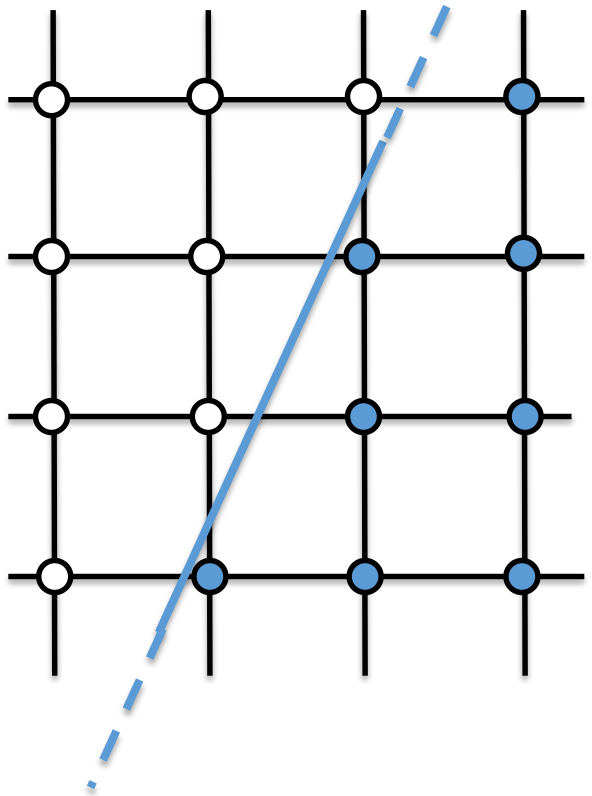
$$f(x,y) = Ax + By + C$$



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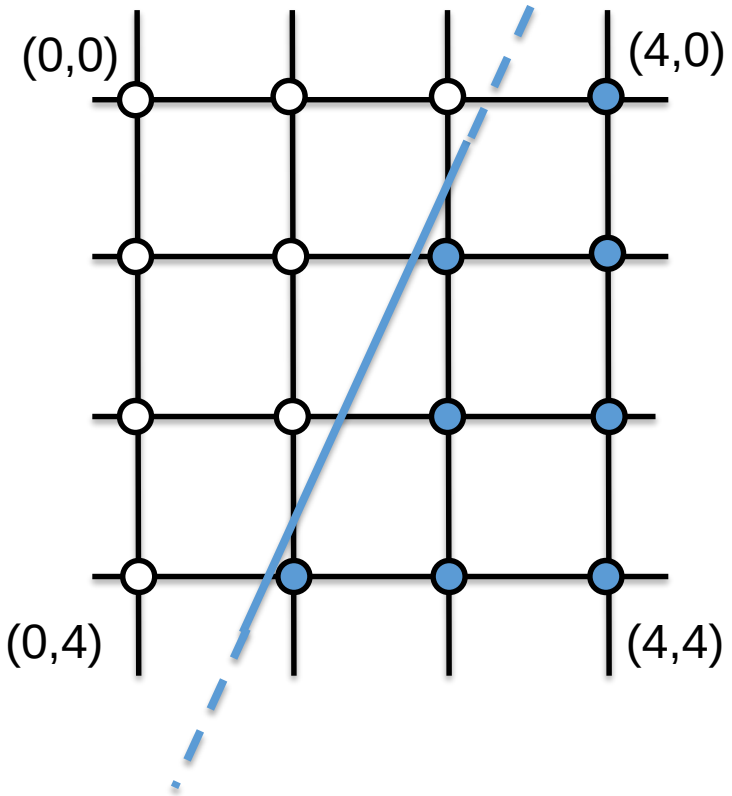
$$f(x,y) = 4x + 2y + -9$$



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