559 General Polygons

Mike Gleicher

Fall 2006 (taken from Fall 2005)

Notes for lecture – not shown in class

Triangles?

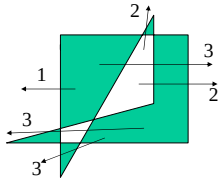
- Old way: Scan conversion
  - Start at top
  - Brezenham's algorithm gives left/right sides
  - Draw horizontal scans
- New Way: point in triangle tests
  - Generate sets of points that might be in triangle
  - Do half-plane tests to see if inside
- Tricky part: edges
  - Need to decide which triangle draws shared edges

General Polygons?

- Inside / Outside not obvious for general polygons
- Usually require simple polygons
  - Convex (easy to break into triangles)
- For general case, three common rules:
  - Non-exterior rule: A point is inside if every ray to infinity intersects the polygon
  - Non-zero winding number rule: trace around the polygon, count the number of times the point is circled (+1 for clockwise, -1 for counter clockwise). Odd winding counts = inside (note: I got this wrong in class)
  - Parity rule: Draw a ray to infinity and count the number or edges that cross it. If even, the point is outside, if odd, it's inside (ray can't go through a vertex)

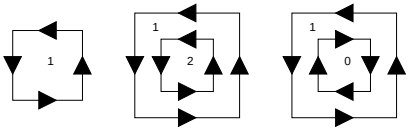
Parity

- Any point, take any ray (that doesn't go through a vertex)
- Odd number of crossings = inside
- Even number of crossings = outside



Power Point uses this rule!

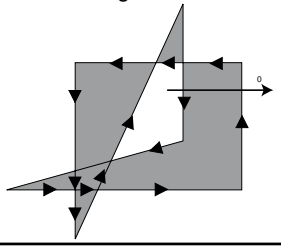
Winding Numbers



- Count the number of times a point is circled counter clockwise
  - Clockwise counts negative
- Can pick any ray from point and count left/right
  - Right (relative to away direction) = CCW = +1
  - Left = CW = -1

Non-Zero Winding Rule

- Any non-zero winding is "inside"
- What Adobe Illustrator does
- Odd Winding Rule / Positive Winding Rule / ….



Inside/Outside Rules