이화여자대학교
EWHA WOMANS UNIVERSITY

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Polygon Rasterization

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What To Learn

Definition of a Polygon

Polygon Inside/Outside Test

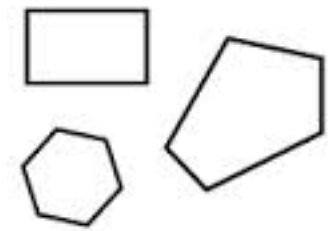
- Odd/even rule
- Winding number

Polygon Rasterization

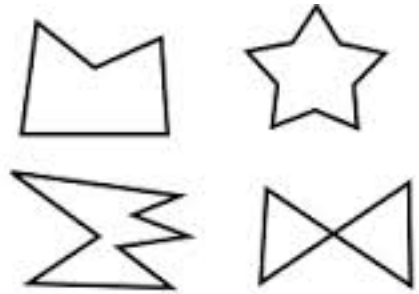
- Scanline algorithm
- Triangle rasterization

Polygon

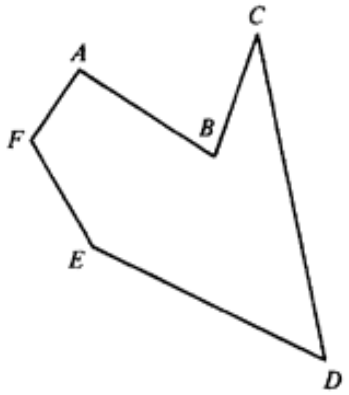
- Specified by a set of three or more *vertices* connected by *edges*
- Convex VS non-convex
- Simple VS non-simple
- Degenerate
  - Collinear or duplicated vertices



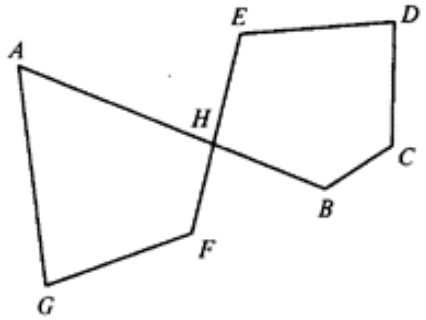
Convex Polygons



Non-convex Polygons



Simple

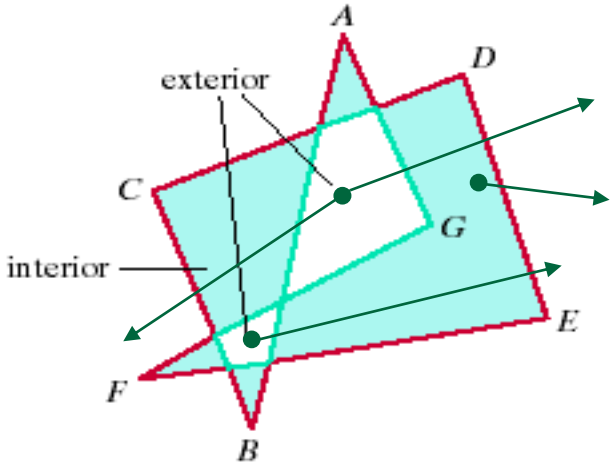


Non-simple

Inside-Outside Tests

☐Odd-even rule

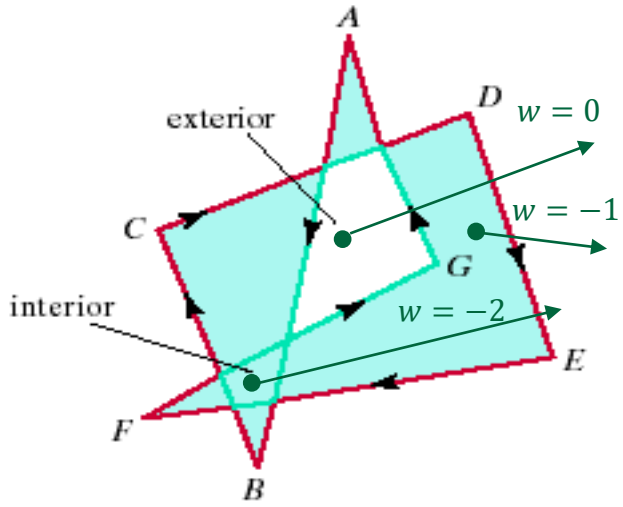
- ■Shoot a ray from the point and count edge crossings: inside if the count is an odd number



Odd-Even Rule

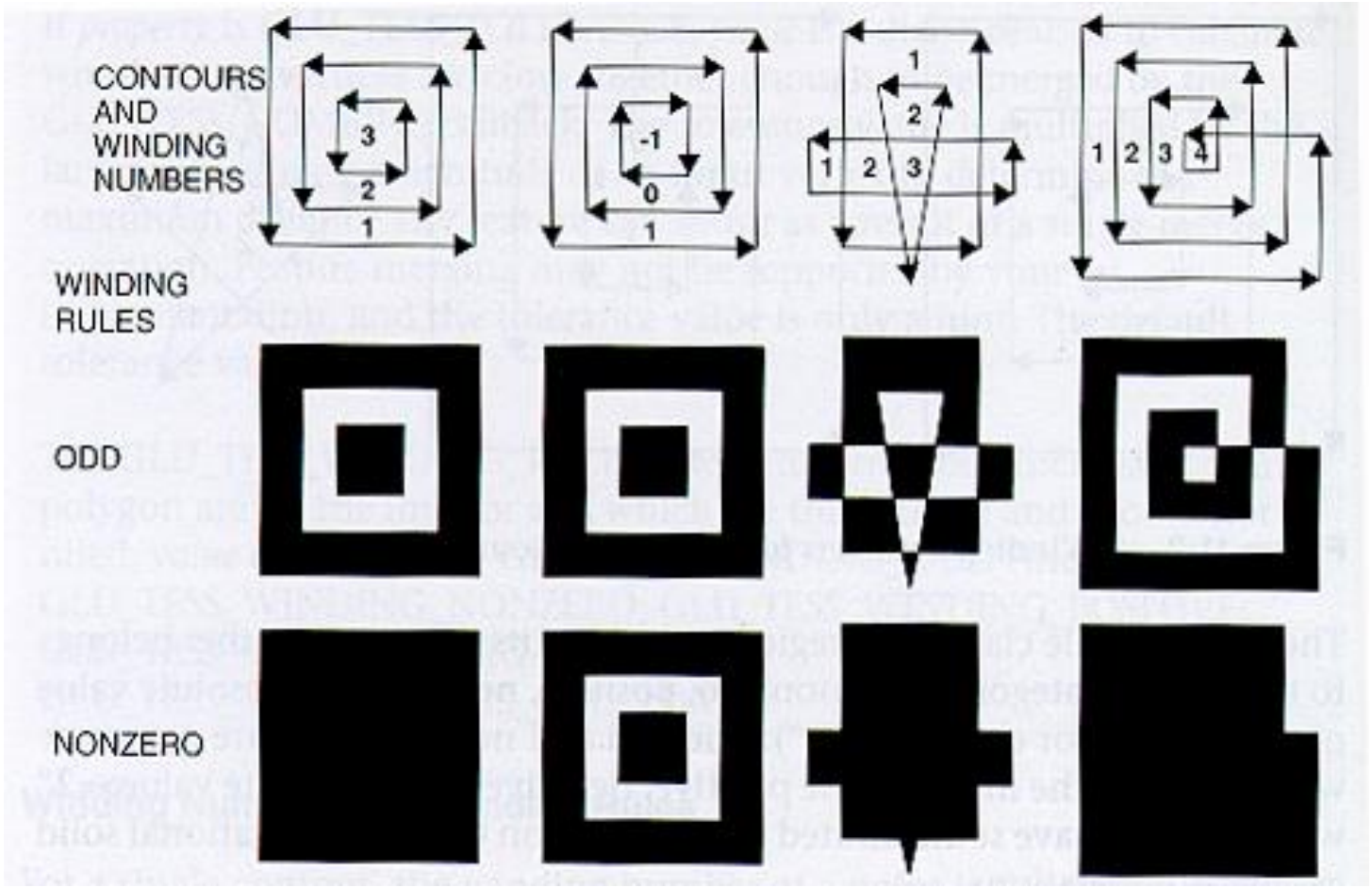
☐Winding number

- ■ Shoot a ray from the point and +1 when crossing a counter-clockwise encircling line and -1 otherwise
- ■ Inside if winding number ≠ 0



Nonzero Winding-Number Rule

Odd-Even VS Winding



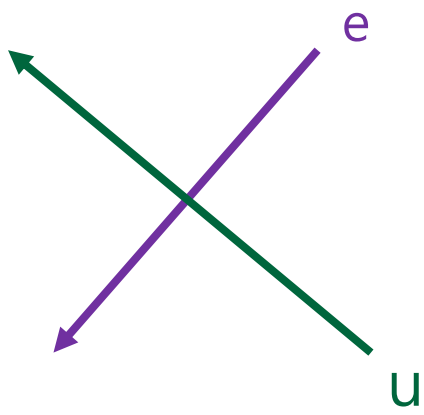
Implementation of Winding Rule

☐Inputs

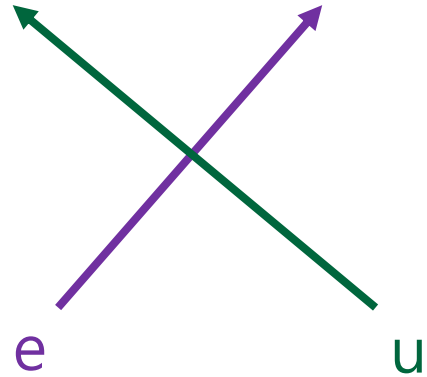
- Edge direction: e = (e_x, e_y, 0)
- Ray direction: u = (u_x, u_y, 0)

☐Using cross product (×)

- CCW: z component of u × e = u_xe_y-u_ye_x > 0
- CW: otherwise



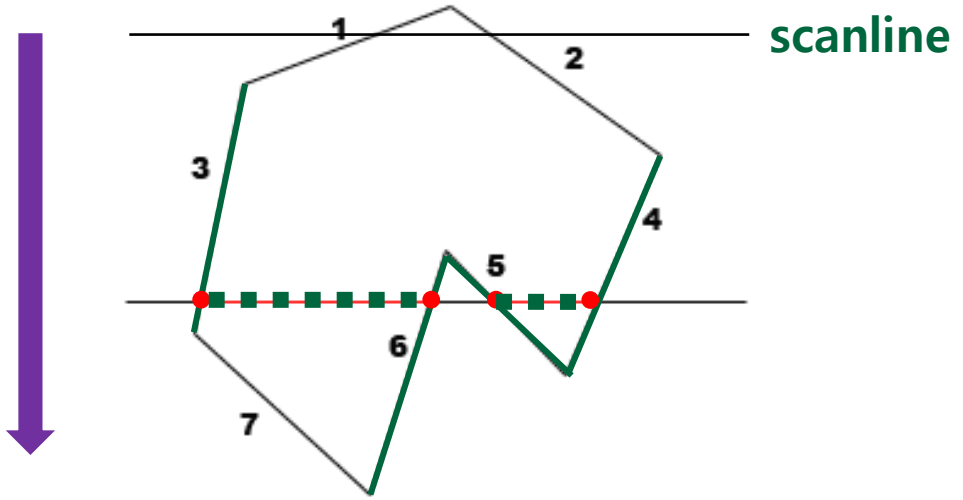
CCW



CW

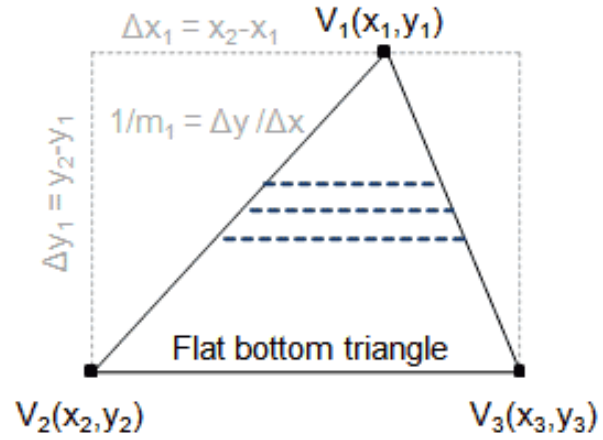
General Polygon Rasterization: Scanline Algorithm

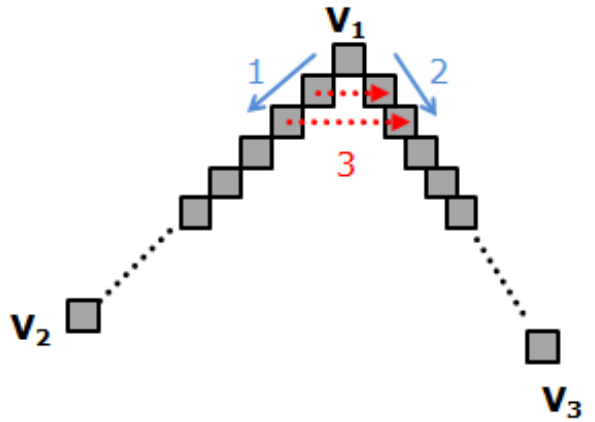
1. Soring the edges in y-coordinates
2. For each scan line
   - ① Get all edges intersected
   - ② Get all intersected points and sort them
   - ③ Fill the intersected segments using a polygon I/O test



Special Case: Triangle Rasterization

1. Draw v_1v_2 using Bresenham's algorithm until it proceeds by one pixel in y-direction
2. Do the same for v_1v_3
3. Fill the current line segments
4. Repeat 1-3 until arriving at v_2 or v_3





Special Case: Triangle Rasterization