Polygon Rasterization

CS418 Computer Graphics

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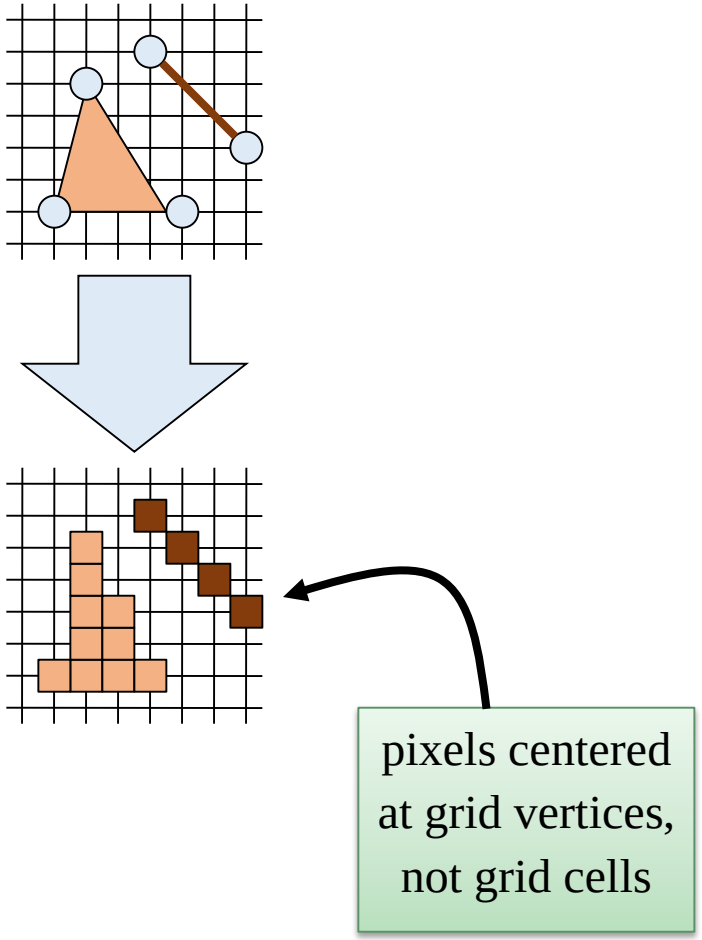
Rasterization

Converts

- lines and triangles
- with floating point vertices
- in viewport (screen) coordinates

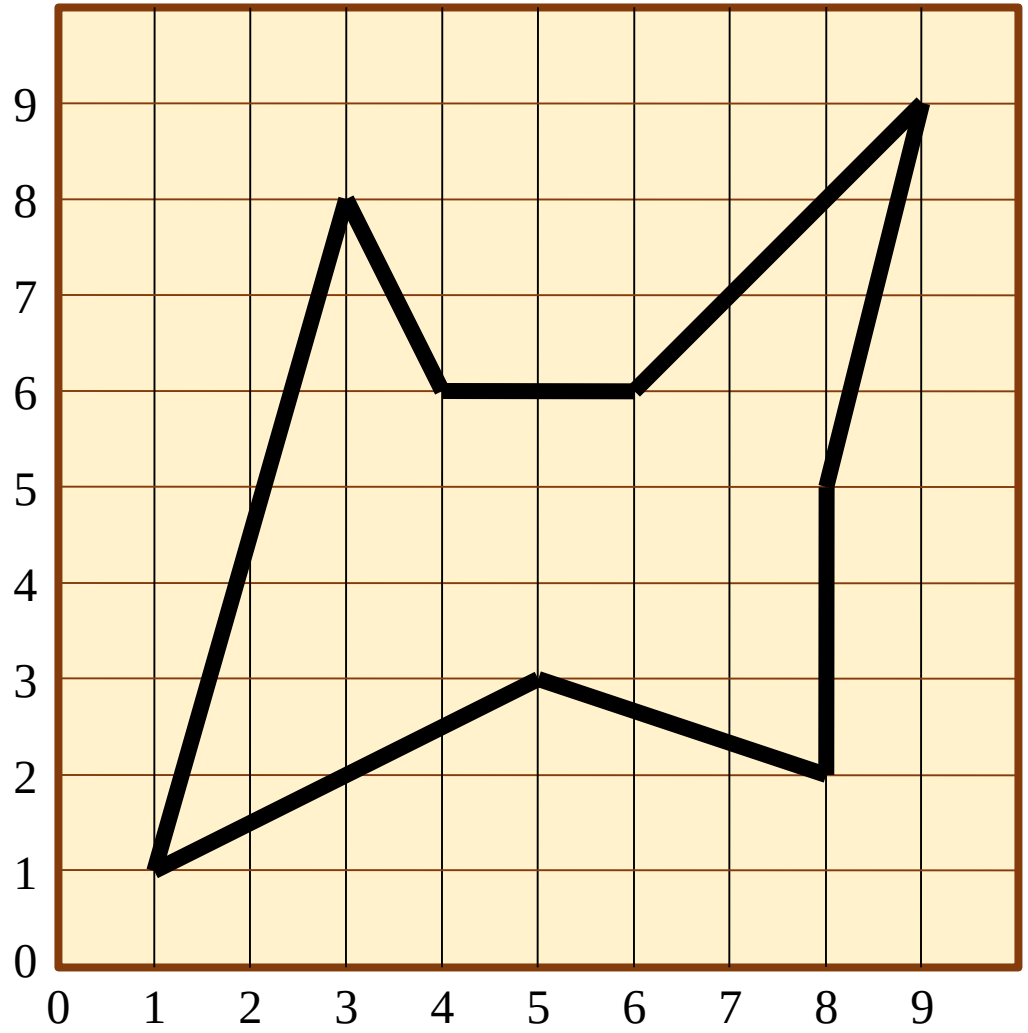
into

- pixels
- with integer coordinates
- in viewport (screen) coordinates



Polygon Rasterization

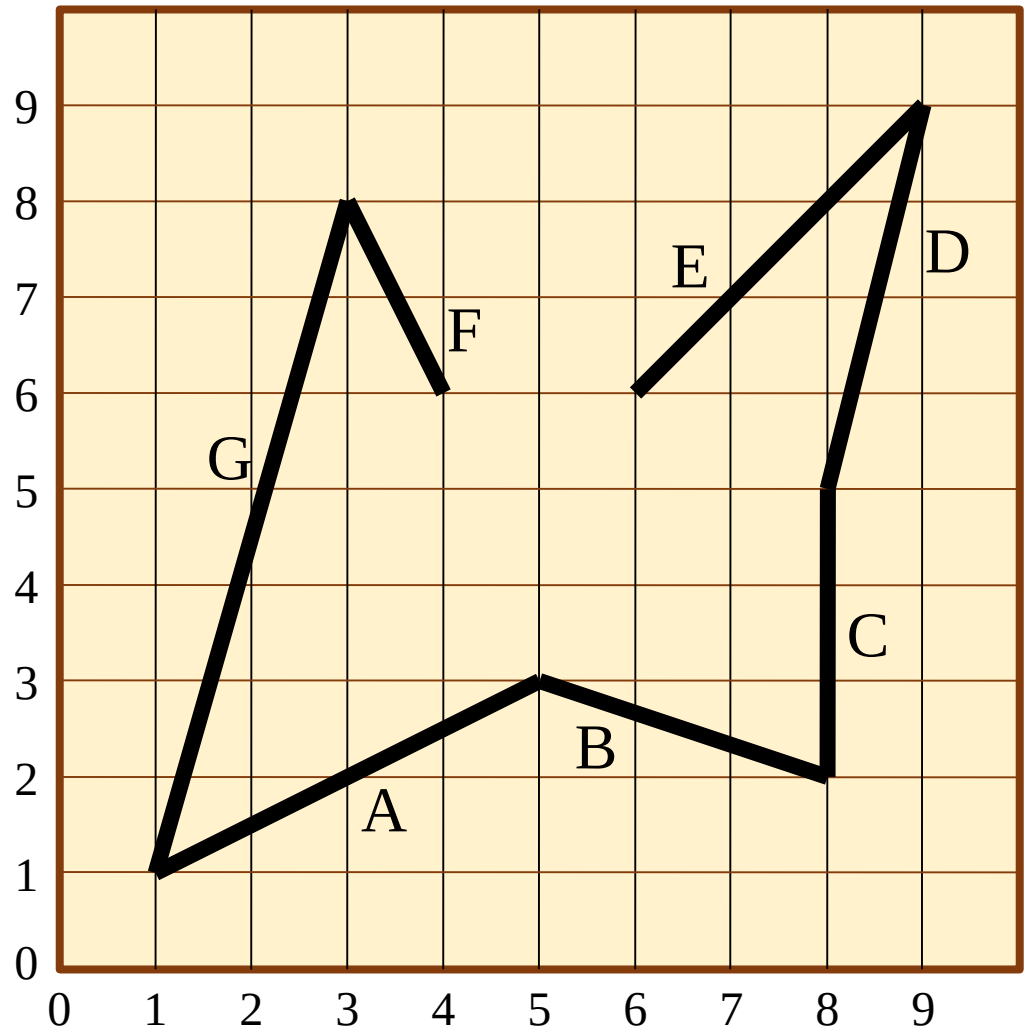
- Ignore horizontal lines



Polygon Rasterization

- Ignore horizontal lines
- Sort edges by smaller y coordinate

Edge	ymin
A	1
G	1
B	2
C	2
D	5
E	6
F	6

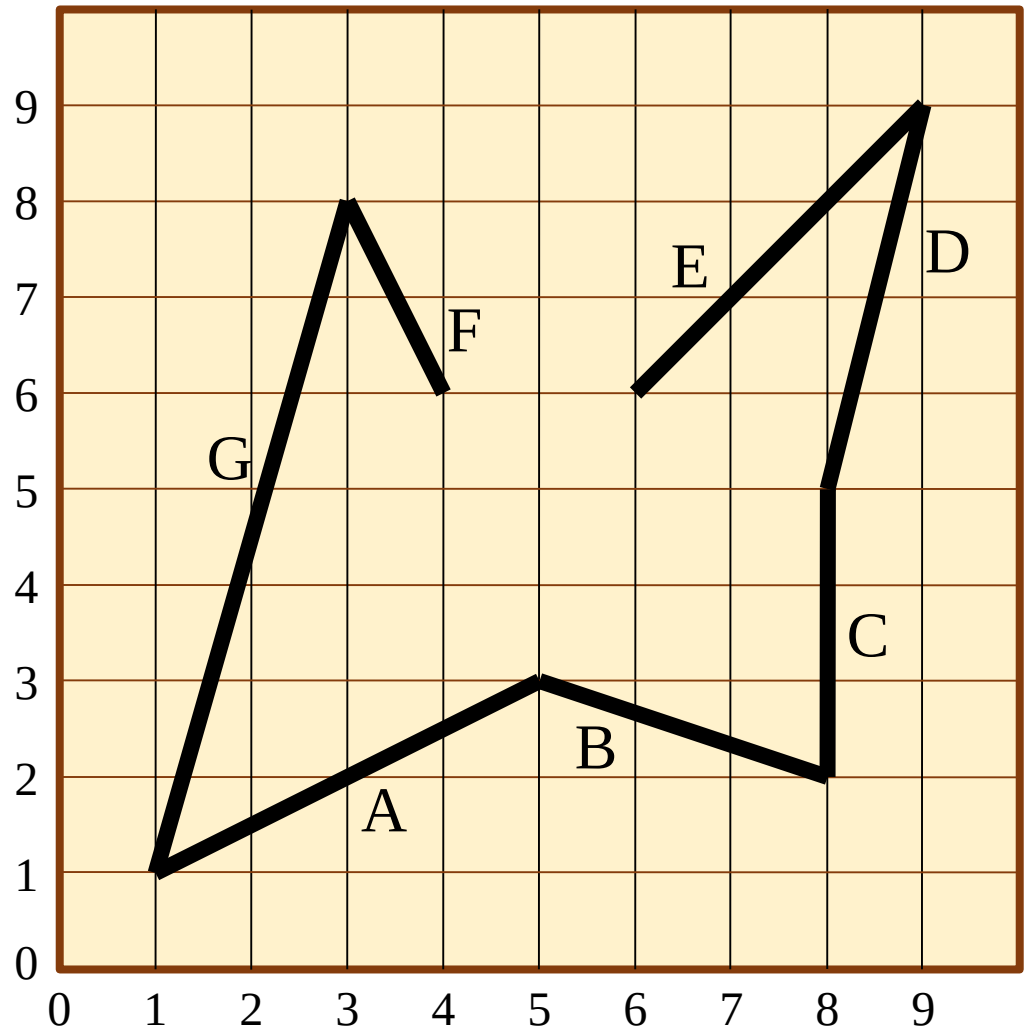


Polygon Rasterization

Edge	x	dx/dy	ymax

- For each scanline…
- Add edges where y = ymin
- Sorted by x
- Then by dx/dy

Edge	ymin
A	1
G	1
B	2
C	2
D	5
E	6
F	6



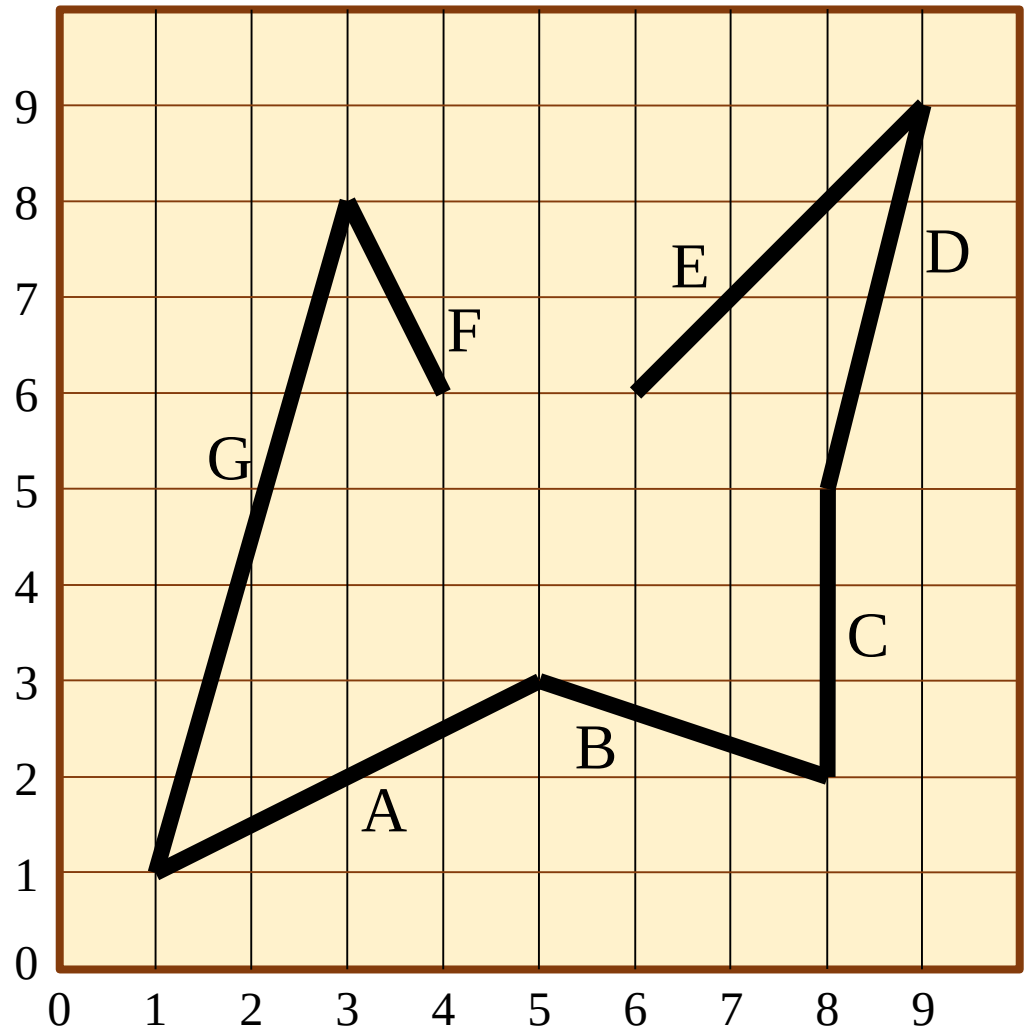
Polygon Rasterization

Edge	x	dx/dy	ymax

Plotting rules for when segments lie on pixels

1. Plot lefts
2. Don’t plot rights
3. Plot bottoms
4. Don’t plot tops

Edge	ymin
A	1
G	1
B	2
C	2
D	5
E	6
F	6

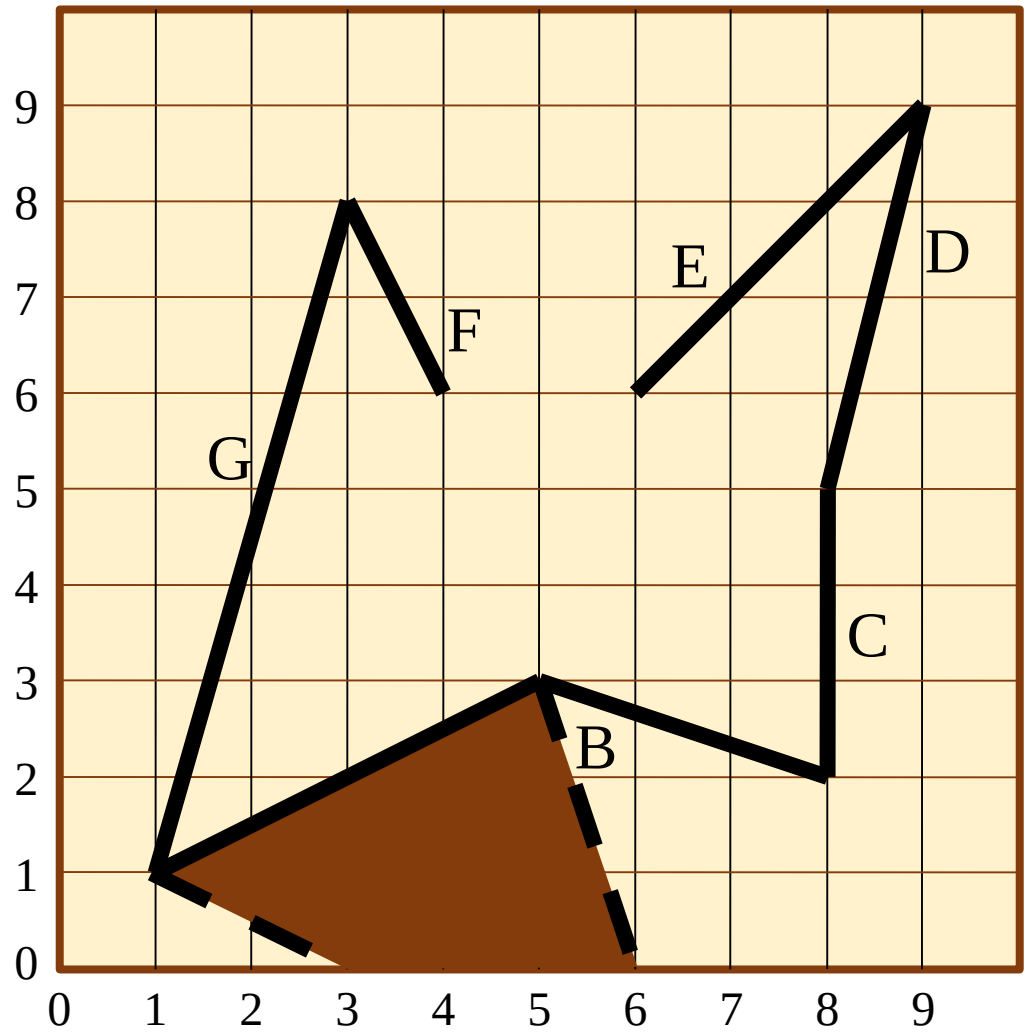


Polygon Rasterization

Edge	x	dx/dy	ymax
G	1	2/7	8
A	1	4/2	3

- y = 1
- Delete y = ymax edges
- Update x
- Add y = ymin edges
- For each pair x_0,x_1, plot from ceil(x_0) to ceil(x_1) – 1

Edge	ymin
A	1
G	1
B	2
C	2
D	5
E	6
F	6

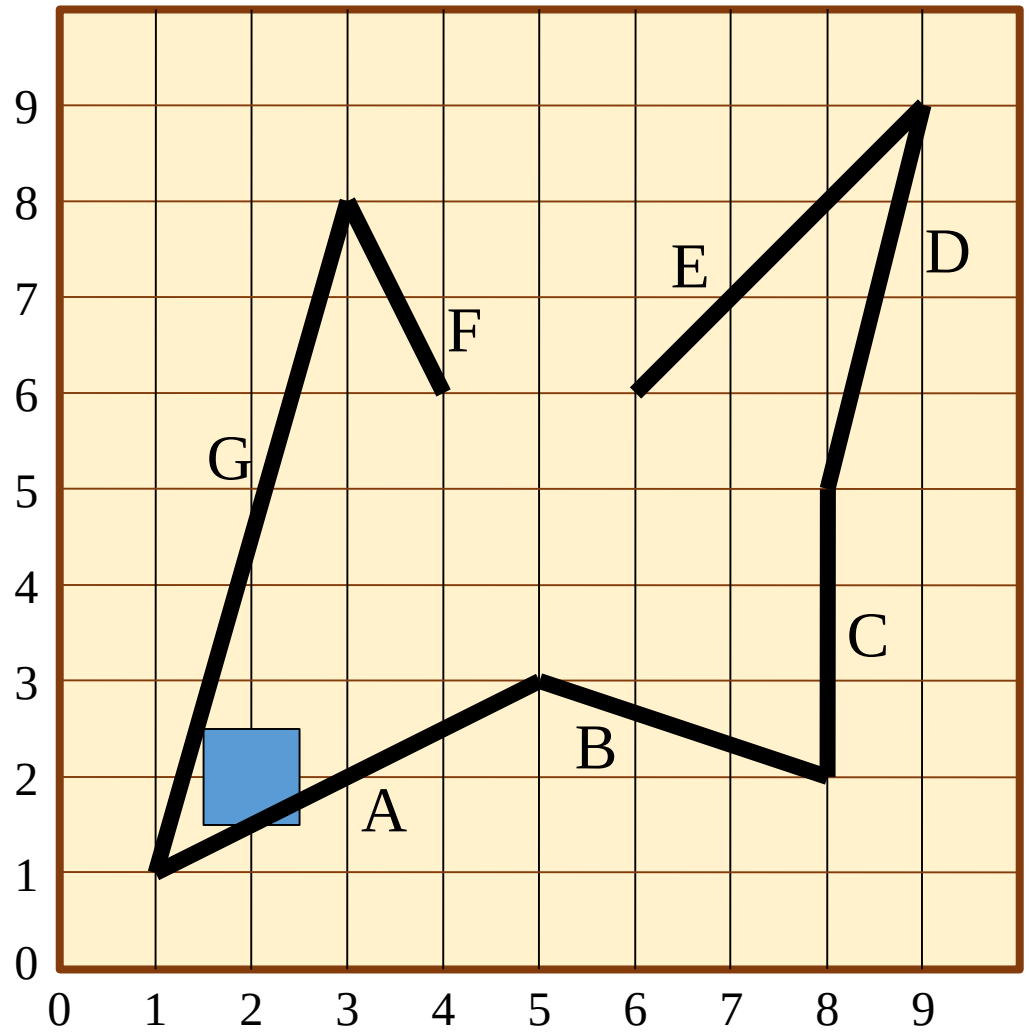


Polygon Rasterization

Edge	x	dx/dy	ymax
G	1 2/7	2/7	8
A	3	4/2	3
B	8	-3/1	3
C	8	0/3	5

- y = 2
- Delete y = ymax edges
- Update x
- Add y = ymin edges
- For each pair x_0,x_1, plot from ceil(x_0) to ceil(x_1) – 1

Edge	ymin
A	1
G	1
B	2
C	2
D	5
E	6
F	6

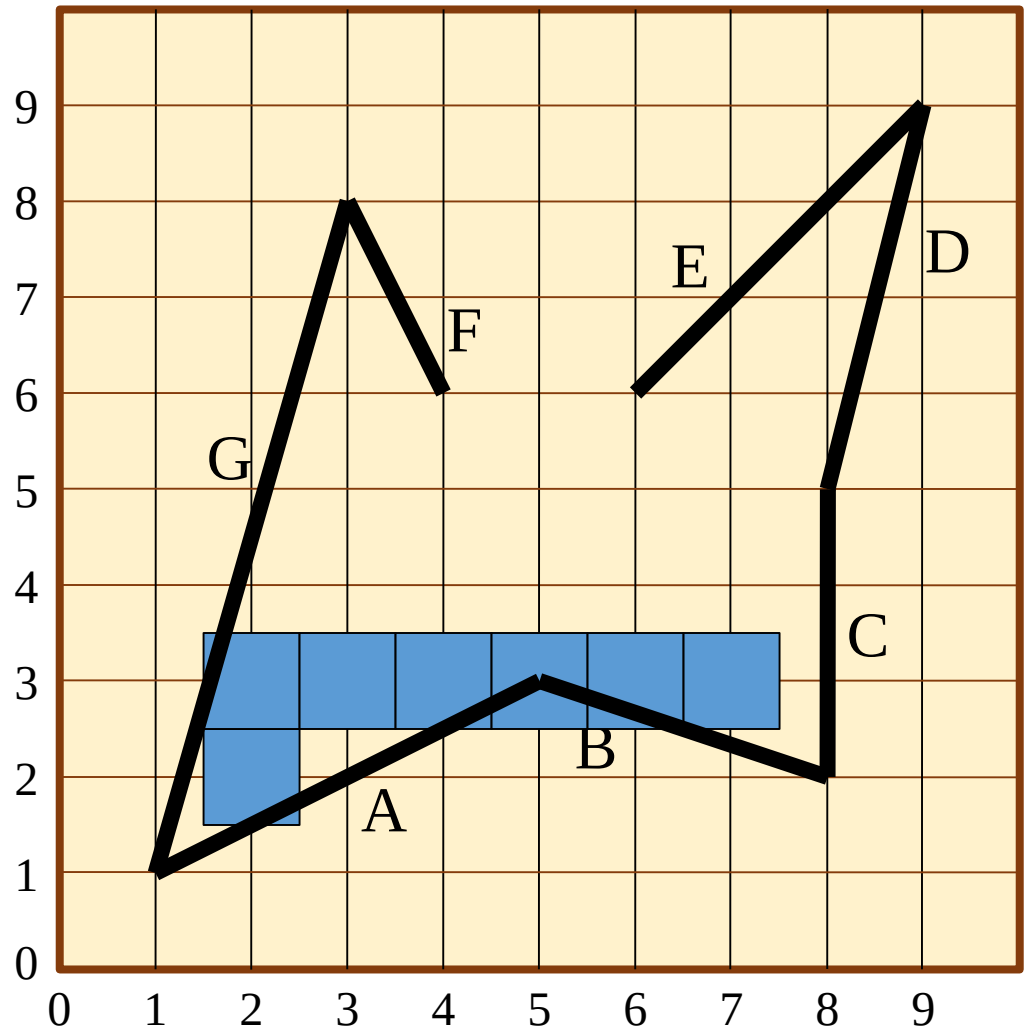


Polygon Rasterization

Edge	x	dx/dy	ymax
G	1 4/7	2/7	8
C	8	0/3	5

- y = 3
- Delete y = ymax edges
- Update x
- Add y = ymin edges
- For each pair x_0,x_1, plot from ceil(x_0) to ceil(x_1) – 1

Edge	ymin
A	1
G	1
B	2
C	2
D	5
E	6
F	6

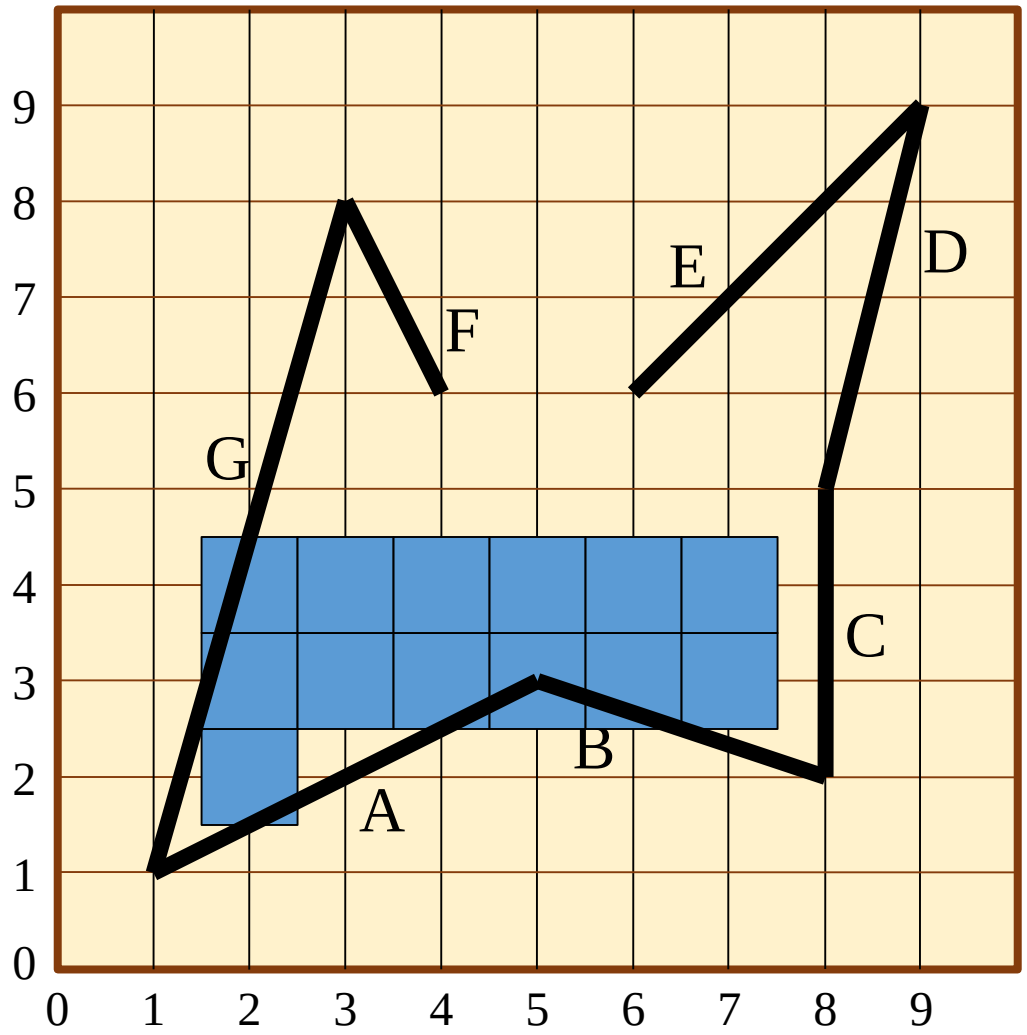


Polygon Rasterization

Edge	x	dx/dy	ymax
G	1 6/7	2/7	8
C	8	0/3	5

- y = 4
- Delete y = ymax edges
- Update x
- Add y = ymin edges
- For each pair x_0,x_1, plot from ceil(x_0) to ceil(x_1) – 1

Edge	ymin
A	1
G	1
B	2
C	2
D	5
E	6
F	6

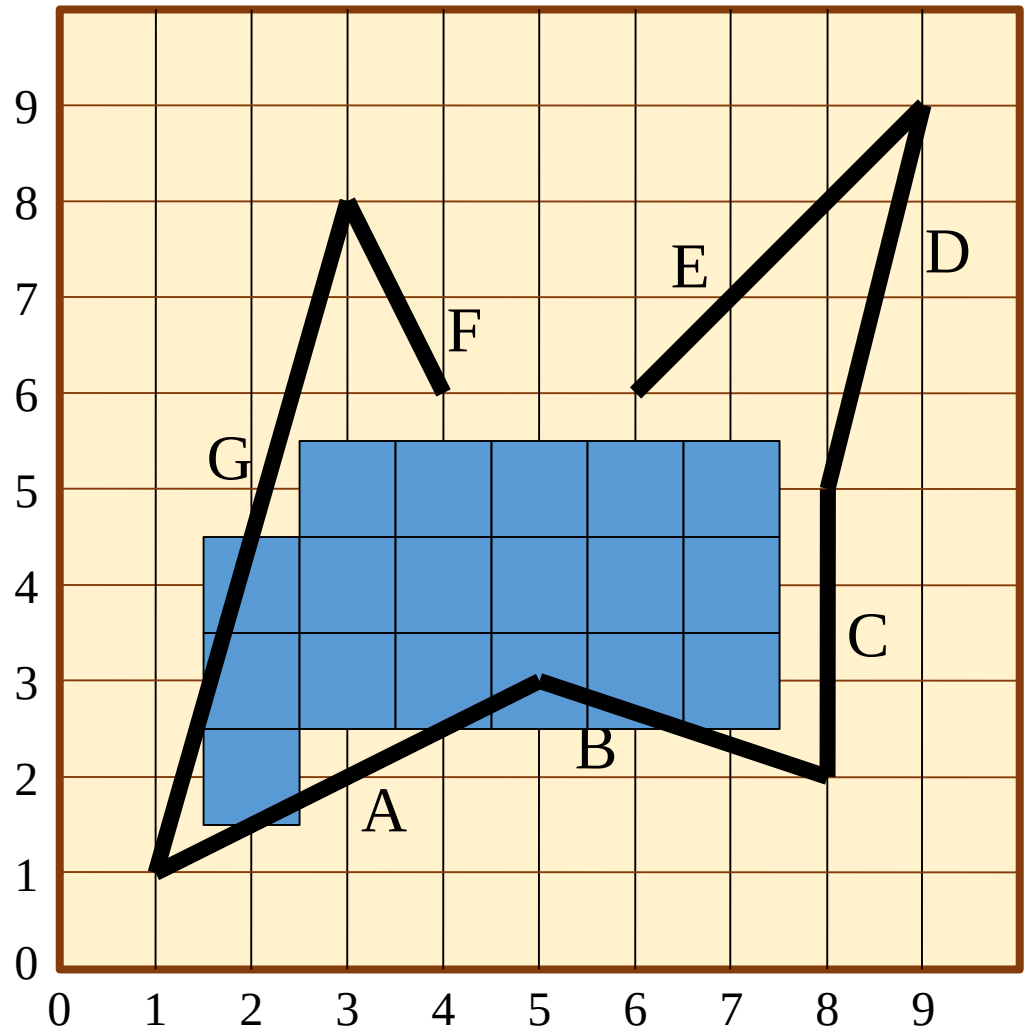


Polygon Rasterization

Edge	x	dx/dy	ymax
G	2 1/7	2/7	8
D	8	1/4	9

- y = 5
- Delete y = ymax edges
- Update x
- Add y = ymin edges
- For each pair x_0,x_1, plot from ceil(x_0) to ceil(x_1) – 1

Edge	ymin
A	1
G	1
B	2
C	2
D	5
E	6
F	6

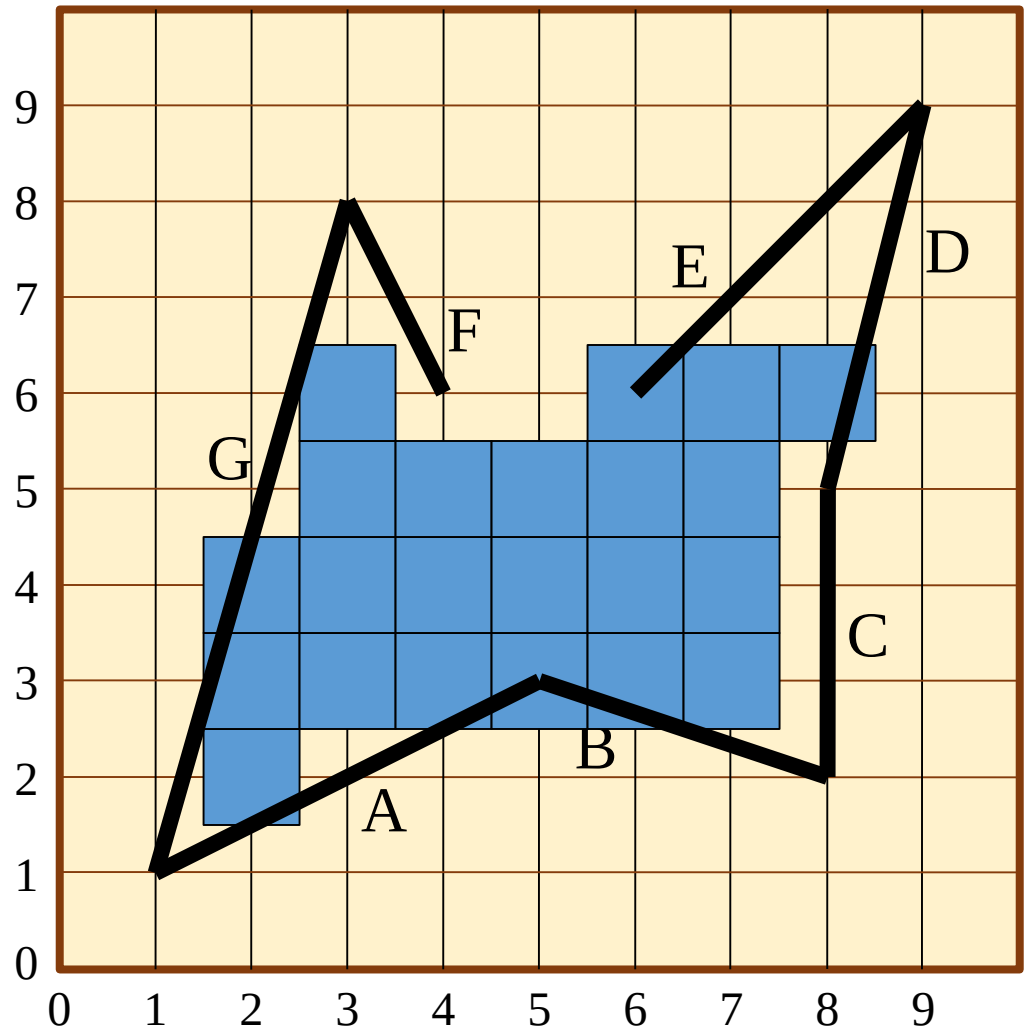


Polygon Rasterization

Edge	x	dx/dy	ymax
G	2 3/7	2/7	8
F	4	-1/2	8
E	6	1/1	9
D	8 1/4	1/4	9

- y = 6
- Delete y = ymax edges
- Update x
- Add y = ymin edges
- For each pair x_0,x_1, plot from ceil(x_0) to ceil(x_1) – 1

Edge	ymin
A	1
G	1
B	2
C	2
D	5
E	6
F	6

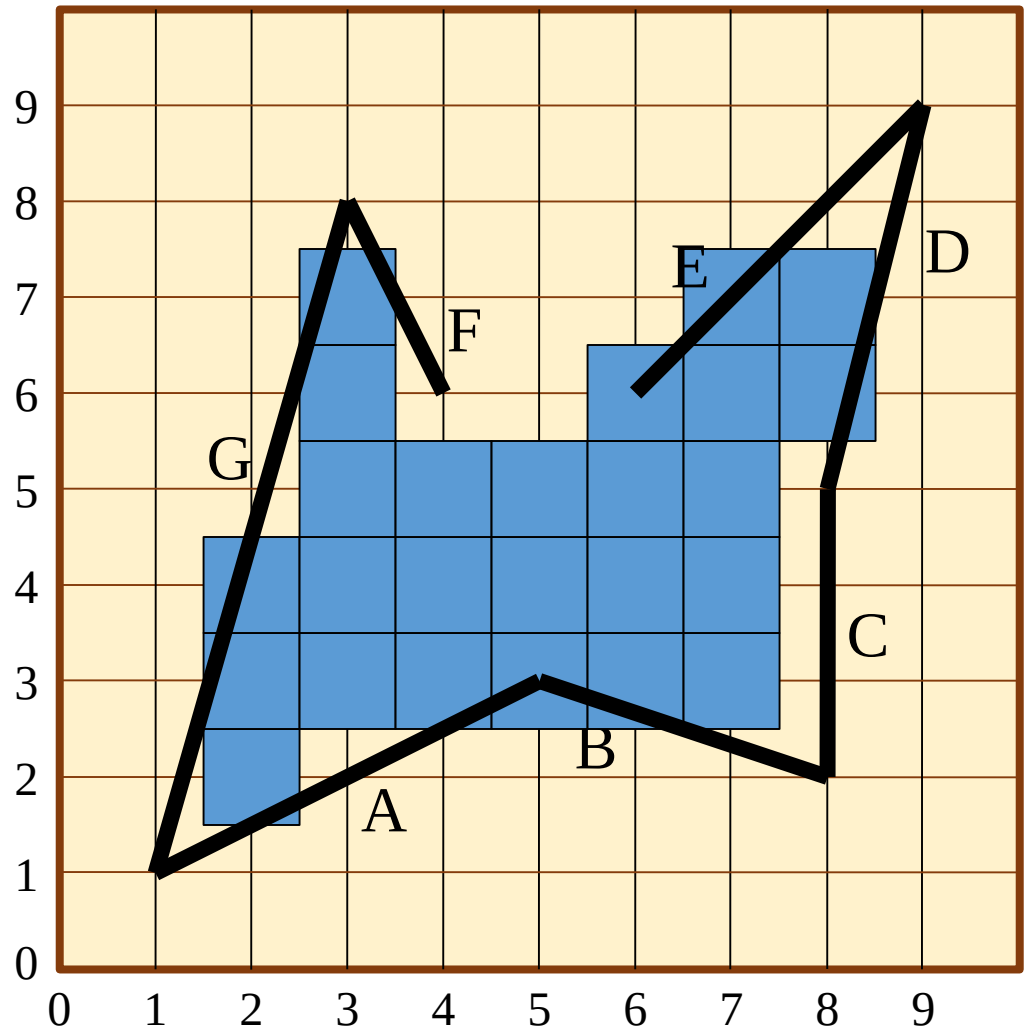


Polygon Rasterization

Edge	x	dx/dy	ymax
G	2 5/7	2/7	8
F	3 1/2	-1/2	8
E	7	1/1	9
D	8 2/4	1/4	9

- y = 7
- Delete y = ymax edges
- Update x
- Add y = ymin edges
- For each pair x_0,x_1, plot from ceil(x_0) to ceil(x_1) – 1

Edge	ymin
A	1
G	1
B	2
C	2
D	5
E	6
F	6

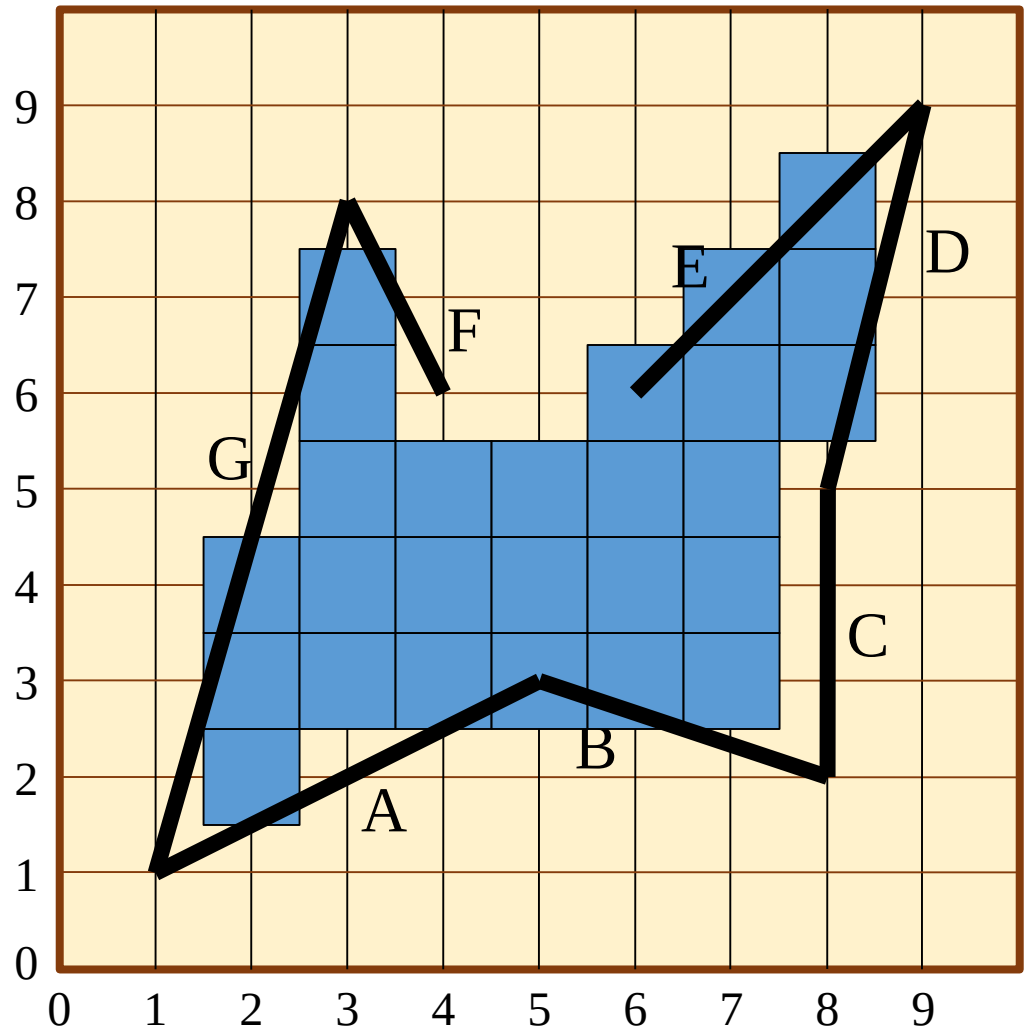


Polygon Rasterization

Edge	x	dx/dy	ymax
E	8	1/1	9
D	8 3/4	1/4	9

- y = 8
- Delete y = ymax edges
- Update x
- Add y = ymin edges
- For each pair x_0,x_1, plot from ceil(x_0) to ceil(x_1) – 1

Edge	ymin
A	1
G	1
B	2
C	2
D	5
E	6
F	6

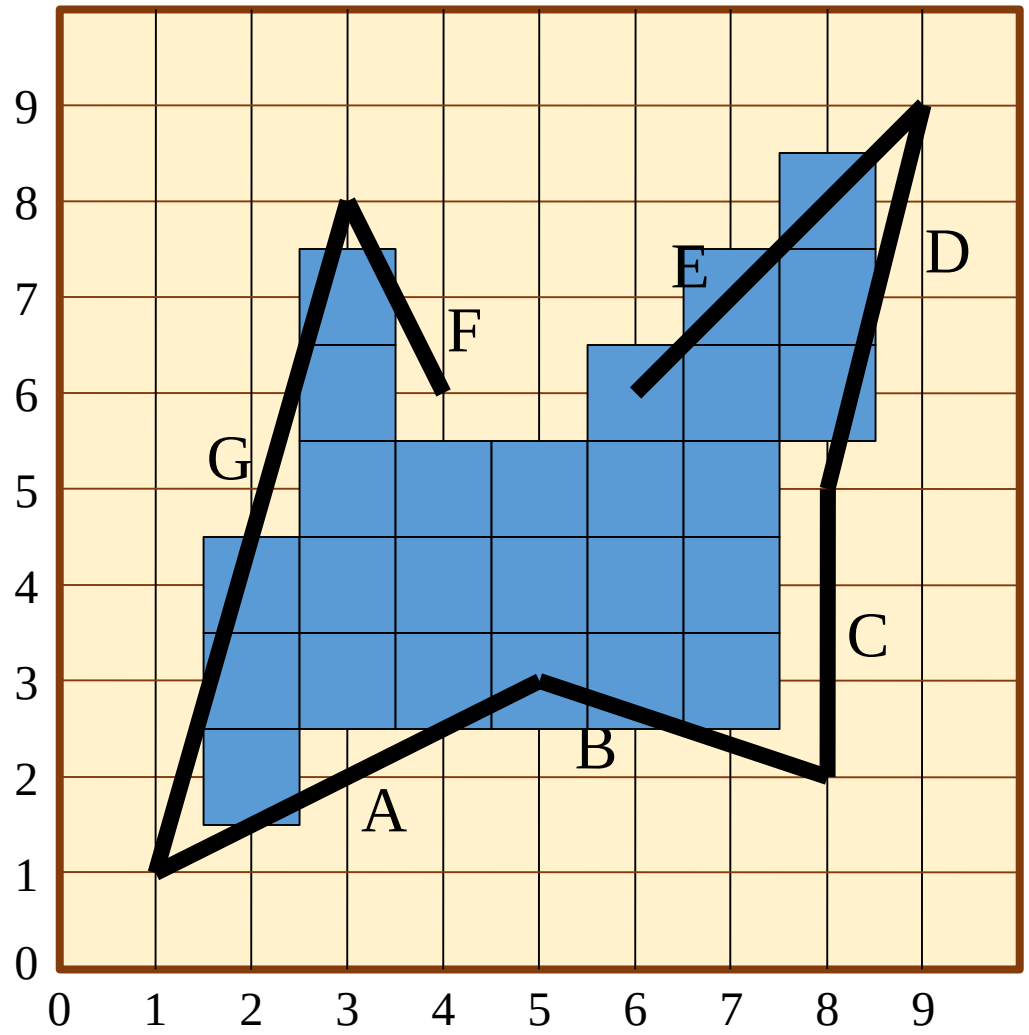


Polygon Rasterization

Edge	x	dx/dy	ymax

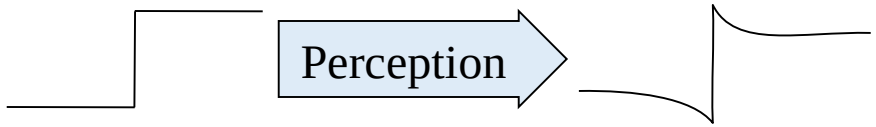
- y = 9
- Delete y = ymax edges
- Update x
- Add y = ymin edges
- For each pair x_0,x_1, plot from ceil(x_0) to ceil(x_1) – 1

Edge	ymin
A	1
G	1
B	2
C	2
D	5
E	6
F	6



Gouraud Interpolation

- Flat shading
  - Per face normals
  - Color jumps across edge
  - Human visual perception accentuates edges



- Smooth shading
  - Per vertex normals
  - Colors similar across edge
  - Edges become harder to discern

Gouraud Interpolation

- Keep track of R, G, B at edge endpoints
- Compute dR/dy, dG/dy and dB/dy per edge
- Compute dR/dx, dG/dx and dB/dx at each scanline
- Color each pixel

  R += dR/dx

  G += dG/dx

  B += dB/dx