



## Exercise Sheet 8

### Assignment 8.1 Polygon Clipping

[2.5 Points]

What is the maximum number of new vertices, if

- a) a  $n$ -sided convex polygon is clipped with a line? [0.5 Points]
- b) a  $n$ -sided non-convex polygon is clipped with a line? [0.5 Points]
- c) a  $n$ -sided convex polygon is clipped with a rectangle? [0.5 Points]
- d) a  $n$ -sided non-convex (possibly self-intersecting) polygon is clipped with a rectangle? [1 Point]

### Assignment 8.2 Sutherland–Hodgman Algorithm

[4 Points]

Give the result of the clipping with the Sutherland–Hodgman algorithm for the polygon  $(-\frac{1}{2}, -\frac{1}{2}), (\frac{3}{2}, -1), (\frac{1}{2}, \frac{3}{2}), (-\frac{3}{2}, \frac{1}{2})$ , clipped with the square  $(-1, -1, 1, 1)$ . Provide the intermediate steps as well.

### Assignment 8.3 Bresenham Algorithm

[2.5 Points]

- a) Rasterize the two given lines with the help of Bresenham's algorithm. For this, use the line equation  $F(x, y) = y(x_1 - x_0) + x(y_0 - y_1) + y_1x_0 - y_0x_1$ , with  $F(x + 1, y + 0.5)$ . Provide your steps and mark the pixels, that get filled by the algorithm. [1.5 Points]
- b) How would Line 1 look like if it would be drawn using antialiasing? Provide your steps and the intensity for each pixel. [1 Point]

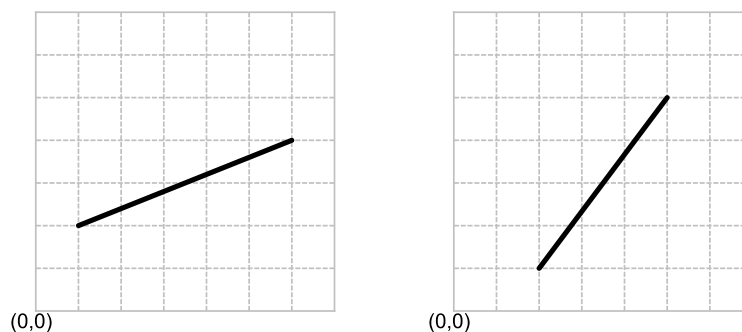


Figure 1: Line 1 (left) and Line 2 (right) to rasterize in a pixel grid.

### Assignment 8.4 Bresenham Algorithm for Ellipses

[1.5 Points]

The Bresenham algorithm, as introduced in the lecture, was used to draw straight lines. How can the algorithm be modified to draw ellipses? Provide a pseudocode.

**Submission: December 17, 2019, 14:15 CEST, via Moodle**