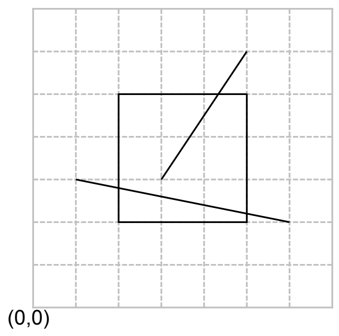
Prof. Dr. F. Sadlo, D. Aumiller *Heidelberg, Dezember 12, 2016*

Exercise Sheet 8

Assignment 8.1 Clipping [1.5 Points]

Clip the two given lines at the drawn sqare using the Cohen-Sutherland algorithm.



Assignment 8.2 Polygon Clipping [2.5 Points]

What is the maximum number of new vertices, if

- a n-sided convex polygon is clipped at a line? [*0.5 Points*]
- a n-sided concave polygon is clipped at a line? [*0.5 Points*]
- a n-sided convex polygon is clipped at a rectangle? [*0.5 Points*]
- a n-sided concave (possibly self-intersecting) polygon is clipped at a rectangle? [*1 Point*]

Assignment 8.3 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 at the square $(-1, -1, 1, 1)$. Provide the intermediate steps as well.

Assignment 8.4 Rasterization III: Visibility [4 Points]

The last part of the software rasterizer will be the visibility. The triangles are already transformed to screen coordinates and drawn accordingly. If you work with your own solution from the last exercise sheet, now reenable the loading of the triangle mesh. Since the triangles are now drawn, you may load the model `data/kopf.raw`. The triangle mesh will be drawn, but the triangles will be drawn in a more or less random order.

1. The simplest method to account for the visibility is the Painter's algorithm, where the objects furthest away from the camera are drawn first. Therefore, sort the triangles before drawing them, and only afterwards call `DrawTriangle()`. The skeleton already

provides a function `SortTriangles()`, which sorts a vector of triangles according to their average z-value. The result is already an improvement, but especially in the vicinity of the eyes and the nose, there are now overlappings and errors.

2. Extend your algorithm by z-buffering, to exactly resolve the problem of overlaps. The skeleton already allocates space for $width \cdot height$ `float` values and initializes the buffer with `1.0f`. You can access this array with `this->zBuffer`.

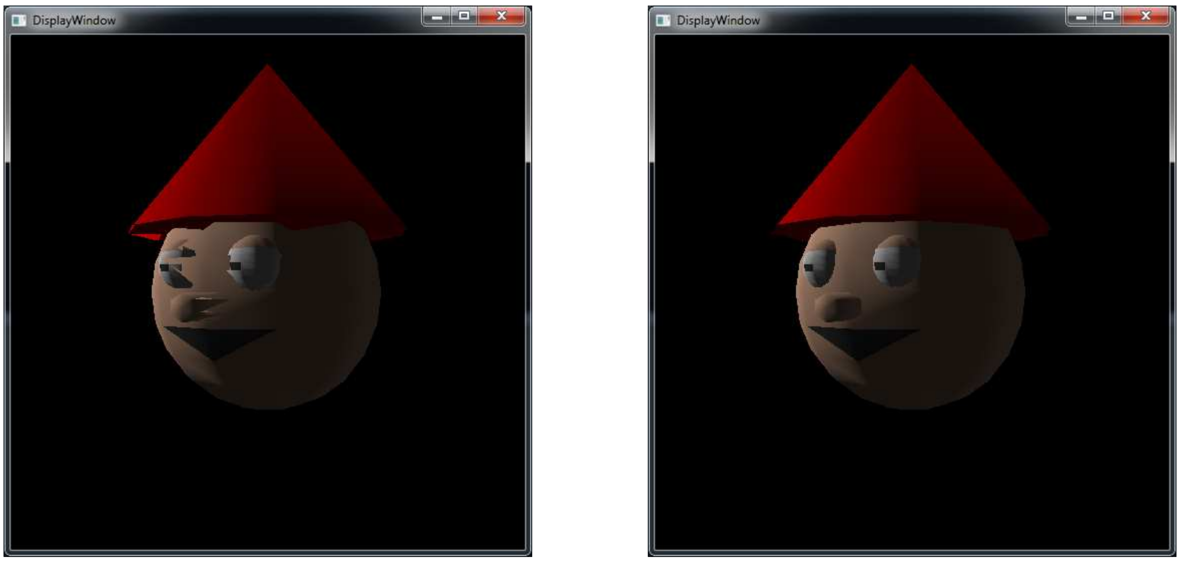


Figure 1: Rasterized results with Painter's algorithm (left) and z-buffering (right).

Submission: Dezember 19, 2016, 6:00 pm via Moodle