

# Problem description:

## Pseudo one-sided segments in rectangular duals

Sander Beekhuis, nr: 0972717

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### Setting

A *rectangular layout* is a partition of a rectangle into a finite set of interior-disjoint rectangles. Hence the interior of this rectangle contains vertical and horizontal line segments. We will call any such line segment that is not extended any further on either side a *maximal segment*. Such an layout is *one-sided* if every maximal segment has only one rectangle on one of its sides.

We define a *rectangular dual* of a graph as a rectangular layout whose adjacencies are the same as those of the graph.

In for example atlases *rectangular cartograms* can be used to display information. A rectangular cartogram is a map where the regions are replaced by rectangles of different areas while keeping their adjecencies. That is, we take a rectangular dual of the adjacency graph of the map.

The areas assigned to each region change depending upon the variable displayed in the cartogram. If the areas change it might be that a certain rectangular layout can't fulfil it's adjecencies anymore and we have to switch to another, combinatorilly diferent, rectangular dual of the adjecendy grap of the map.

One would thus want to find a *area-universal* rectangular dual. Such an dual has adjecencies that hold regardless of the area sizes we assign to each rectangle.

Eppstein et al. have shown that rectangular duals are area-universal exactly when they are one-sided. [1] Unfortunately not all graphs admit a one-sided dual. One such graph is given by Rinsma. [2]

### Goal

The goal of this thesis is twofold.

On the one hand we will try to show that all graphs can be drawn in a nearly one-sided fashion. We will investigate exactly which properties on the maximal segments can be fulfilled. We will call such a graph *pseudo one-sided*.

On the other hand we will attempt to develop an algorithm that will draw any graph with as few rectangles on one side of each maximal segment as possible.

## References

- [1] D. Eppstein, E. Mumford, B. Speckmann, and K. Verbeek. “Area-Universal and Constrained Rectangular Layouts.” In: *SIAM Journal on Computing* 41.3 (2012), pp. 537–564. DOI: 10.1137/110834032.
- [2] I. Rinsma. “Nonexistence of a certain rectangular floorplan with specified areas and adjacency.” In: *Environment and Planning B: Planning and Design* 14.2 (1987), pp. 163–166. DOI: 10.1068/b140163.