Online Motion Planning, WT 13/14
Exercise sheet 5
University of Bonn, Inst. for Computer Science, Dpt. I

- *You can hand in your written solutions until Tuesday,* 26.11.*,* 14:15*, in room E.06.*

Exercise 13: Shortest s-t-paths (4 points)

We consider a rectangle P as shown in Figure 1. Let a and b denote the

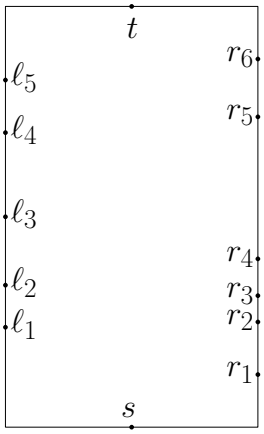

Figure 1: Rectangle P

width and height of P. Points s and t are centered at the low and high horizontal boundary edge of P. Furthermore, we are given two point sets $L = \{\ell_1, \ldots, \ell_k\}$ and $R = \{r_1, \ldots, r_m\}$ on the left and right vertical boundary edge of P. The points in the sets L (R) are labelled such that point ℓ_i (r_i) is strictly higher than any other point $\ell_j \in L$ ($r_j \in R$), if $j < i$.

Prove that any shortest path in P from s to t, that visits every point in the set $L \cup R$ before ending at t, visits the points in L in ascending order and also visits the points in R in ascending order.

Please turn the page!

Exercise 14: Existence of triangulations (4 points)

Prove that if a simple polygon P has at least 4 vertices, then in P there exists a line segment connecting two non-adjacent vertices of P. Furthermore show that this implies the existence of a triangulation of P.

Exercise 15: Visibility in arrangements of line segments (4 points)

a) Let P be a simple polygon of n vertices, and s be a point in P. Prove that the visibility polygon of s has a most n boundary edges.

b) Prove that the lower envelope of a given set of n non-intersecting line segments consists of at most $2n - 1$ line segments.