Online Motion Planning, SS 17
Exercise sheet 8
University of Bonn, Inst. for Computer Science, Dpt. I

- *You can hand in your written solutions until Tuesday,* 20.06., 14:15, *postbox in front of room E.01 LBH.*

Exercise 22: Rays inside polygons (4 points)

Assume that we are searching for a ray inside a simple polygon P.

1. The agent can only move inside the polygon and only detects the ray when the ray is visited. The online agent competes against the shortest path to the ray as shown in Figure 1.

2. The agent can only move inside the polygon but detects the full ray, if some portion of the ray gets *visible* inside the polygon. The online agent competes against the shortest path to the ray.

For both configurations: Design a simple competitive strategy or prove that the competitive ratio cannot be bounded by a constant.

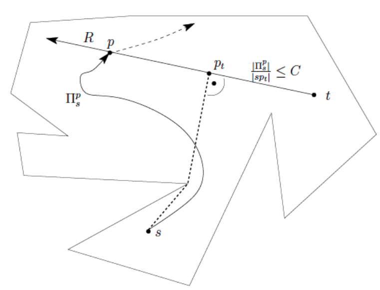

Figure 1: Searching for a ray inside a polygon. In this example, the ray has to be visited for detecting the ray. The agent need not move toward the origin.

Exercise 23: Spiral search (4 points)

Similar to the configuration discussed in the lecture, we are searching for a ray in the plane. Analogously, we would like to design a spiral strategy with some eccentricity β. Different from the situation in the manuscript the ray only has to be detected as in the previous exercise part 1.

Design the optimal spiral strategy and calculate the ratio, present a lower bound!

Exercise 24: Window Shopper special (4 points)

Consider the following Window-Shopper variant. The shopper is step one (orthogonal distance) away from the line l and would like to find the source of a ray. The origin of the unkwown ray lies on l and has coordinates $(1, y)$ for $y \geq 0$; see Figure 2.

The unknown ray has slope $+\infty$ and runs in parallel with l see for an example Figure 2. Any reasonable strategy will first hit l at some point p. If the rays is detected the agent has to move downwards to the origin. If the ray is not detected yet, the strategy moves upwards to the origin.

a) Analyse the worst-case ratio of the strategy that moves on the shortest path to l (this means $p = (1, 0)$) and then upwards.

b) Analyse the worst-case ratio of the following strategies:

   1. The strategy visits l in $p = (1, 0.2)$ on the shortest path. Then the strategy moves either upwards (ray not detected) or downwards to the origin.
   2. The strategy visits l in $p = (1, 0.3)$ on the shortest path. Then the strategy moves either upwards (ray not detected) or downwards to the origin.

c) Find the overall optimal strategy and the worst-case ratio.

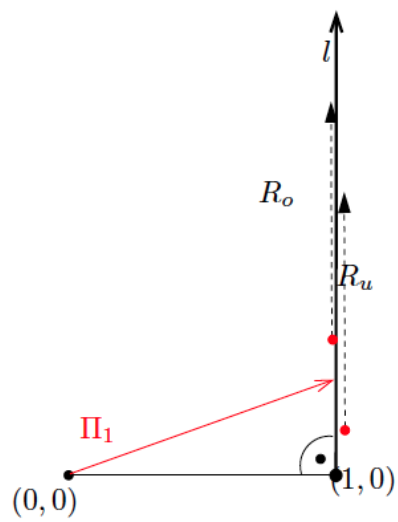

Figure 2: In this variant the ray is in parallel to l.