Online Motion Planning, WT 13/14
Exercise sheet 8
University of Bonn, Inst. for Computer Science, Dpt. I

- *You can hand in your written solutions until Tuesday,* 17.12.*,* 14:15*, in room E.06.*

Exercise 22: Looking around a corner (4 points)

Compute the competitive factors of the following strategies for looking around a corner, given by the vertices of the exploration paths they specify. Here the starting point of our robot is the origin $(0, 0)$ of the coordinate system and the corner is at position $(0, 1)$.

a) $P_1 = (-1, 0)$, $P_2 = (-1, 2)$, $P_3 = (0, 2)$.

b) $P_1 = (-1, \frac{1}{2})$, $P_2 = (0, 1)$.

c) $P_1 = (-\frac{\sqrt{2}}{4}, \frac{2-\sqrt{2}}{4})$, $P_2 = (-\frac{1}{2}, \frac{1}{2})$, $P_3 = (-\frac{\sqrt{2}}{4}, \frac{2+\sqrt{2}}{4})$, $P_4 = (0, 1)$.

In part *c*), it suffices

- to provide a function that computes, for a given angle γ at the corner (see Figure 1), the distance the robot moves before it can look around the corner for the first time.
- to determine the distance moved by the optimal offline strategy, depending on γ.

Note that in this exercise we require that the additive constant, α, in the definition of the competitive factor is 0.

Please turn the page!

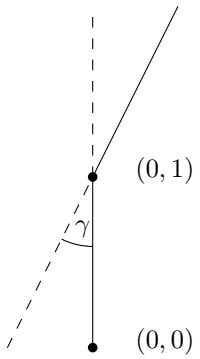

Figure 1: The angle γ.

Exercise 23: Properties of the angle hull (4 points)

Let for a polygon P in the free plane $A(P)$ denote the length of the boundary of its angle hull, $B(P)$ denote the length of its boundary.

a) Give an example of a polygon P with $A(P) = \frac{\pi}{2}B(P)$.

b) Give an example of a polygon P with $A(P) \leq \frac{101}{100}B(P)$.

c) Show that for every $x \in \mathbb{R}$ there is a P such that $B(P) \geq xA(P)$.

Exercise 24: The kernel of an orthogonal polygon (4 points)

Give a strategy for a robot at start position s in an unknown orthogonal simple polygon P that reaches the kernel of P on an optimal L_1-path, or reports after a finite amount of time that $ker(P)$ is empty.