

Online Motion Planning  
Problem Set 5  
Universität Bonn, Institut für Informatik I

*To be solved until the 29th of November*

**Problem 1:**

You are given 10 lists. You know, that half of the lists have length 10 and the others have length 40. Consider the following strategies to traverse the lists until the end of at least one list is reached. Determine the numbers of steps the strategies take in the worst case as well as in average over all possible orderings of the lists.

- a) Traverse the first list it until the end of this list is reached.
- b) Explore every list (one after the other) up to depth 10. Stop if some list's end is reached.

**Problem 2:**

Now consider the general form of this problem where you are given  $m$  lists and you know their lengths  $\lambda_1 \geq \lambda_2 \geq \dots \geq \lambda_m$  but you do not know which list has what length.

Show that the strategy that explores in turn every list up to depth  $\lambda_k$  has average cost at most

$$\frac{\lambda_k(m+1)}{m-k+2}$$

**Problem 3:**

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