Online Motion Planning, SS 17
Exercise sheet 11
University of Bonn, Inst. for Computer Science, Dpt. I

- *You can hand in your written solutions until Tuesday,* 04.07., 14:15, *postbox in front of room E.01 LBH.*

Exercise 31: Online search ratio approximation fails (4 points)

We are searching for a point on an unknown *directed* graph $G = (V, E)$ with unit length edges. The goal can be located at the vertices or on the edges. The agent sees the next outgoing edges only after the visit of the corresponding vertex and can build a map.

Give a counter example that shows, that a constant online approximation of the optimal search ratio cannot be guaranteed.

Exercise 32: Online search ratio approximation (4 points)

1. We are searching for a point on a binary tree with positive edge weights. The goal can be located on the edges and the vertices. The agent sees the next outgoing edges and its length only after the visit of the corresponding vertex and can build a map of the tree.

   Design a strategy that approximates the optimal search ratio within a ratio of 4. Repeat the analysis for this example.

2. Consider a planar graph $G = (V, E)$. The goal can only be located at the vertices.

   Develop an online search strategy that attains a constant competitive approximation of the optimal search ratio and give an analysis for the approximation ratio.

Exercise 33: Search ratio approximation proof (4 points)

The very general approximation scheme for an agent without vision makes use of the assumption that in the given environment the shortest path from s to p, $\texttt{sp}(s,p)$, has the same length as the shortest path from p to s, $\texttt{sp}(p,s)$. Let us assume that for a constant D we can always assume that $|\texttt{sp}(p,s)| \leq D \cdot |\texttt{sp}(s,p)|$ holds.

What does this mean for the approximation ratio of the general approximation scheme. Follow the proof scheme and give an analysis of the approximation factor.