Online Motion Planning, WT 13/14
Exercise sheet 2
University of Bonn, Inst. for Computer Science, Dpt. I

- *You can hand in your written solutions until Tuesday,* 05.11., 14:15, *in room E.06.*
- *We allow (and recommend) fixed groups of 2 students.*
- *Please subscribe to our mailing list:*
  https://lists.iai.uni-bonn.de/mailman/listinfo.cgi/vl-online

Exercise 4: Upper bound for Shannons Mouse (4 points)

Given a grid graph G over $n+1 \geq 2$ cells we denote by $c(s)$ the cell in G which is explored *last* by the *MOUSE* algorithm, given that the mouse starts at cell s.

Prove that for any cell s in G, the graph G' which we obtain by removing cell $c(s)$ from G, is a connected grid graph over n cells. Then, use a Proof by contradiction to show that after at most $n \cdot 4^n$ moves, the *MOUSE* algorithm has successfully explored graph G.

Exercise 5: Shortest paths and number of edges (4 points)

Prove that the length $d(s,t)$ of any shortest path between two cells s and t in the first layer of a grid polygon P is at most $\frac{1}{2}E(P) - 2$ (where $E(P)$ denotes the number of boundary edges of P).

Exercise 6: A property of simple grid polygons (4 points)

Prove that for any grid polygon P that contains no narrow passages, and that contains no split cells in its first layer, the equality

$$E(P) \leq \frac{2}{3}C(P) + 6$$

is fulfilled. Here, $E(P)$ denotes the number of boundary edges and $C(P)$ the number of cells of P.