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Problem set 6
May 20, 2016
Summer Semester 2016

Online and Approximation Algorithms

Due May 27, 2016 before 10:00

Exercise 1 (Navigation on a line - 10 points)

Propose a randomized algorithm for the navigation problem on a line and show that it is 7-competitive.

Exercise 2 (Navigation on multiple paths - 10 points)

We are standing at a point s which is the beginning of k paths and we want to reach a target t. We know that t is at distance d from s but we do not know on which path. Our objective is to reach t by travelling the minimum distance possible. Show that the competitive ratio of any deterministic algorithm is at least $2k-1$ and that the competitive ratio of any randomized algorithm is at least k.

Exercise 3 (Room problem - 10 points)

In the lecture we saw an algorithm for the square room problem that achieves a competitive ratio of $\sqrt{n}$.
Modify the algorithm as well as its analysis for rooms of dimension $2N \times 2n$ where $N \neq n$. The starting point is $s = (0, 0)$, the target $t = (N, n)$.

Exercise 4 (Spiral - 10 points)

Imagine yourself standing on a 2-dimensional grid, searching for a point $t = (t_v, t_h)$ where t_v and t_h are the vertical and horizontal distances from your current position. You do know that t is finite, however you do not know the exact values for t_v and t_h. Develop an algorithm for reaching t and prove its competitiveness.