



Algorithm Theory

Exercise Sheet 11

Due: Friday, 19th of January 2024, 10:00 am

Exercise 1: Robot in 1D

(3+7 Points)

We have a robot on the 1D line at the 0th position additionally you know that at some distance integer $D \geq 1$ along the path there is your car; however, you do not know the distance D or the direction in which you have to go. The robot can move 1 integer step in any direction. If the robot is at a point on the line you automatically check if the given integer point has the car or not. Your objective is to minimize the number of steps the robot takes to reach the car. Create an algorithm that has

- (a) 16 competitive ratio. (You will move at most $16D$.)
- (b) 9 competitive ratio.

(If you give an algorithm with 9 competitive ratio then you automatically solved problem *a* too.)

Exercise 2: Online MST

(10 Points)

Let G be a complete graph on n nodes. Every edge has a weight in the interval of $[1, 2]$. Our aim is to get an MST. The edges with the weights arrive one by one, and we need to decide to include the current edge or not to in the spanning tree. Create an online-algorithm with competitive ratio of $\sqrt{2}$.
Hint: Use a carefully chosen global constant c which you use to decide what to do with a given edge. Is the weight of the edge smaller or larger than c .