Eidgenössische
Technische Hochschule
Zürich

Ecole polytechnique fédérale de Zurich
Politecnico federale di Zurigo
Federal Institute of Technology at Zurich

Department Informatik
Markus Püschel
Peter Widmayer
Thomas Tschager
Tobias Pröger

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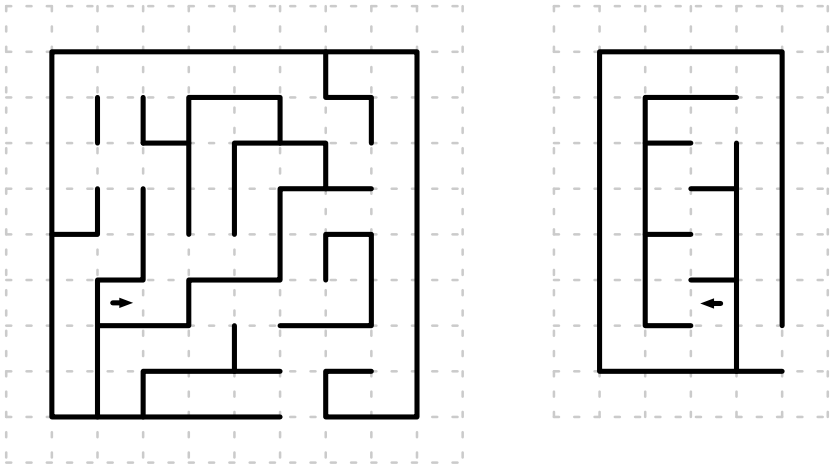
Algorithmen & Datenstrukturen Exercise Sheet 13 AS 16

Hand-in: You do not have to hand-in your solution for this exercise sheet. We will publish a solution at our website.

Exercise 13.1 *Path Planning in Labyrinths.*

You are given a labyrinth as a drawing on squared paper, like in the example below. At the marked point there is a robot facing the direction indicated by the arrow. The question is how fast the robot can escape the labyrinth. The robot can travel "forward" one square in the direction it is facing within 3 seconds. To stop after a forward movement takes 2 seconds. While standing still, the robot can rotate 90 degrees, which costs 2 seconds. The robot does not need to stand still between two consecutive forward movements (although it could, but that would take more time).

In the examples below, the robot needs 113s and 79s to escape.



a) Model the above problem as a shortest path problem. Describe how to represent the labyrinth as a graph such that the length of the shortest path in the graph equals the time that the robot needs to escape.

b) What is an efficient algorithm to solve this problem?

c) Which running time in dependency of the number of squares of the labyrinth does this algorithm have when it is applied to the graph constructed in a)?