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MATH. - NATURWISS. FAKULTÄT
FACHBEREICH INFORMATIK
KOGNITIVE SYSTEME · PROF. A. ZELL

Mobile Robots

Summer Semester 2013
Assignment 10

due date: 09.07.2013, presentation: 16.07.2013
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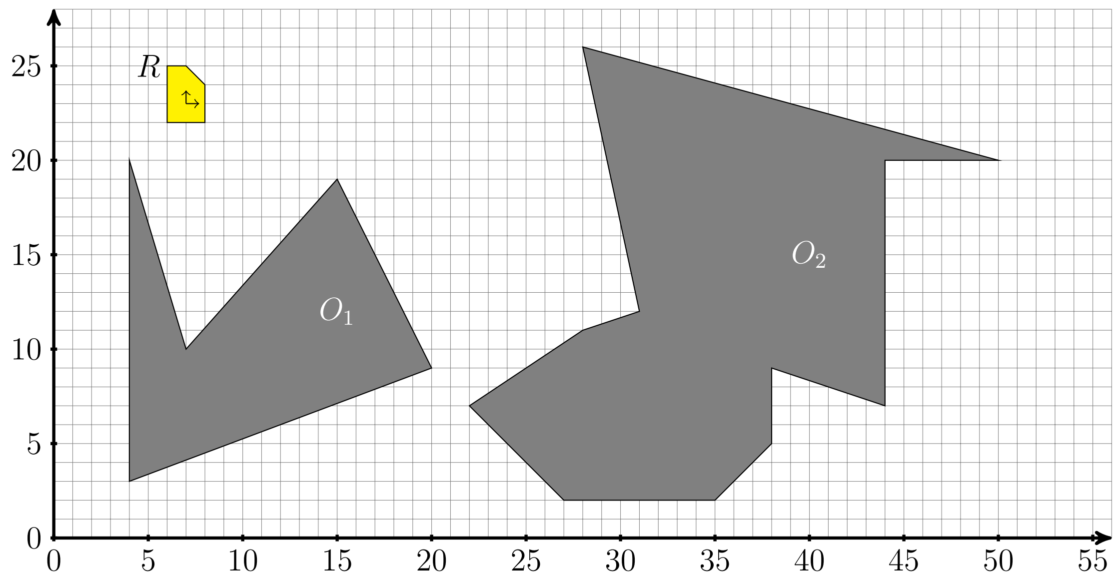
Exercise 1 Growing the obstacles (12 points)

Let the workspace W_1 and the robot R be represented by the following image:



(a) Grow the given obstacle O_1 using the "improved algorithm" taught in the lecture. Visualize all generated points and their convex hull. Assume that O_2 has already been grown.

(b) Use the variant of Sklansky's Algorithm which was presented in the lecture to compute the convex hull of O_2. First visualize the center point, then assign each node the number of its position in the sorted list, beginning with 0. Using this number as the name of each node, write down the contents of stack S for each step of the algorithm. Also describe why S changes the way it does.

(c) Now use QuickHull to compute the convex hull of O_2. Draw a new image for each recursive step, that is not a dead end. Use different colors to highlight the expanded edge, newly added edges as well as the current convex hull.

(d) What is the worst-case runtime of Sklansky's Algorithm on a sorted list of points?

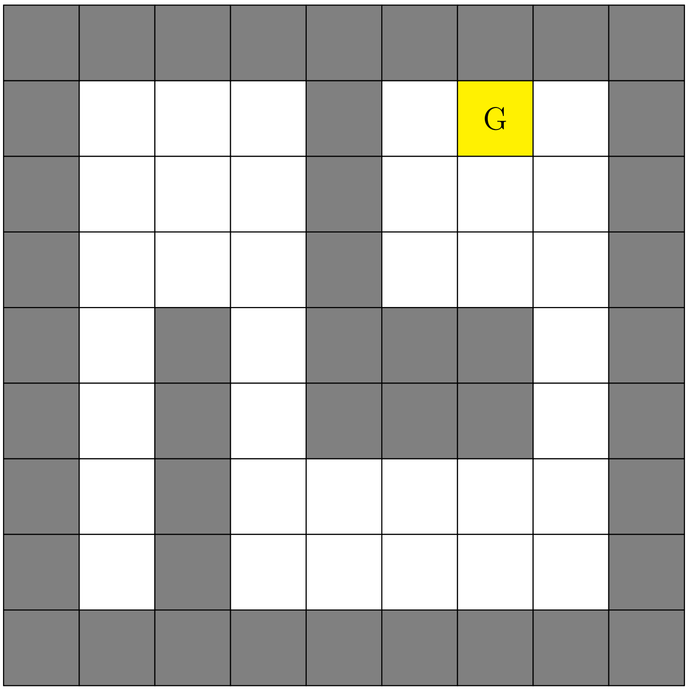
(e) What is the worst-case runtime of Sklansky's Algorithm on an unsorted list?

(f) What is the worst-case runtime of QuickHull? Describe the case in which it has the given runtime.

Tip: You can download presets for the visualization on the lecture website.

Exercise 2 Path planning by dynamic programming (8 points)

Let the following image represent the grid map m_2 of workspace W_2. Furthermore let $G = (6, 7)$ be the goal state.



Apply the Distance Transform Algorithm for path planning using dynamic programming:

(a) Initialize an array D of distance values.

(b) Apply the algorithm. Apply pairs of forward and backward iterations until there are no more changes in D. Visualize D for each forward and each backward iteration. Values that did not change can be marked with "-".

Tip: You can download presets for the visualization on the lecture website.