12. Assignment, Introduction to Robotics WS17/18 - Ver. 0.99

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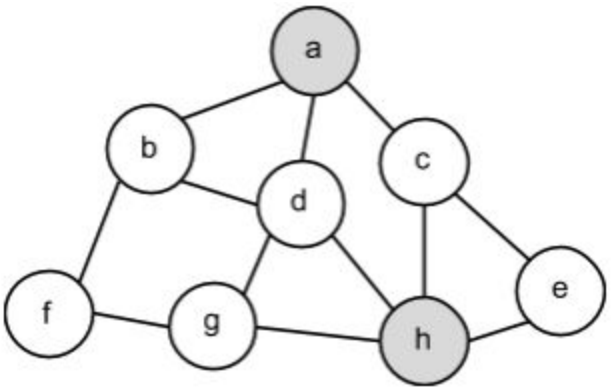
Submission: online until Tuesday, 06 Feb 2018, 11:55 a.m.

Please summarize your results (images and descriptions) in a pdf-document and name it, e.g., "RO-12-<surnames of the students - group name>.pdf".
Only one member of the group must submit the necessary files.
Do not copy solutions to or from other groups.
Every group must contain two people, unless granted differently.
Only submissions via KVV will be accepted.

1. A* - Search (6 Points):

We have the following graph:



a	b	c	d	e	f	g	h
0	9	42	35	20	18	1	19

a) (4 Points) Execute the hard version of A* on the graph, the start node (vertex) is h, the goal node is a. The edges have a weight of 10. Provide for each calculation step the OPEN and the CLOSED list. The heuristic function is represented in the above table. If nodes have the same complete costs, the alphanumerical smaller node should be considered to be smaller - this is important to consider while sorting the OPEN list.

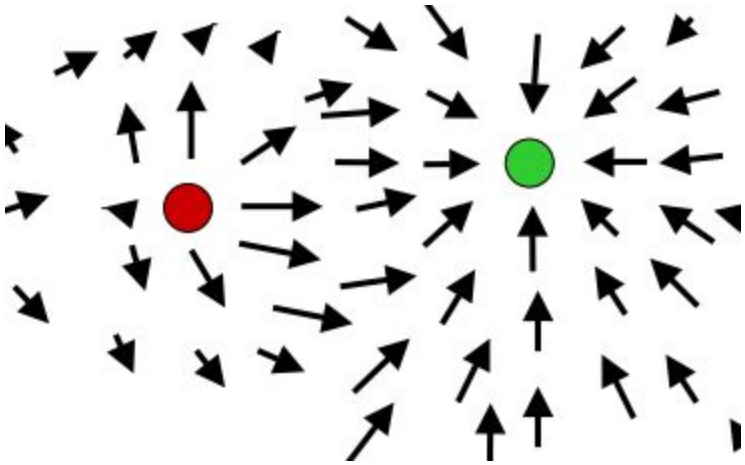
b) (2 Points) Is the heuristic consistent? Why?
Is it optimistic? Why?
What are the implications with respect to finding an optimal path?

2. Voronoi-Diagrams (2 Points)

Create a Voronoi diagram (the graph) for the points A (5,5), B(3,4), C(4,1) , in the space of [0,10]x[0,10] for

a) L1- Norm
b) L2 Norm

3. Potential Fields (2 Points)



(Image just for illustration purposes)

Assume a start position of S(0,0), a Goal position of G(3,4) and a point obstacle at O(2,3). The potential energy (resulting in a repulsive force) of the obstacle is given by 3 / d_o^2 , (with d as the euclidean distance between the obstacle and a point), the potential energy (resulting in an attractive force) of the goal position is d_g^2, where d_o is the distance to the obstacle, d_g to the goal position.
Calculate the force vector (the gradient vector) at the position (1,1) (for the sum of obstacle and goal force) and provide the calculation steps.