Chair for Algorithms
and Data Structures
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Efficient Route Planning
SS 2011

http://ad-wiki.informatik.uni-freiburg.de/teaching

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Exercise Sheet 2

Submit until Friday, June 3 at 2:00pm

Exercise 1 (5 points)

Implement the landmark heuristic for A*. To that end, implement a routine that for a given set L of nodes (the landmarks), computes the shortest path distances $\text{dist}(u, \ell)$ for each node u in the graph and for each $\ell \in L$ and stores them. Also write a routine that for a given target node t uses these precomputed distances to compute $h(u) = \max_{\ell \in L}\{\text{dist}(u, \ell) - \text{dist}(t, \ell)\}$ for each node u in the graph. (Alternatively, you can also compute these values on the fly, during the shortest-path computation for target t.)

Implement both of the landmark selection heuristics presented in the lecture (random and farthest node). For the farthest node heuristic, given the set L' of already selected landmark nodes, do a (set) Dijkstra computation on the full graph to compute a node u which maximizes $\text{dist}(L', u)$, and pick this as the next landmark.

Compute average query times for A* with 16 landmarks with each of the two selection heuristics and report the numbers on the Wiki. Use the same dataset and number of queries as for the first exercise sheet.

Stick to the same coding standards as for the first exercise sheet. There is no need to put your code for this exercise sheet in a separate directory. In fact, it makes more sense to have it in the same directory as your code from the first exercise sheet because you will reuse much of the code you wrote for that sheet.

Exercise 2 (3 points)

Show that when starting Dijkstra's algorithm with a priority queue containing not just one node, but all nodes from a set S, each with tentative distance 0, then the algorithm will compute $\text{dist}(S, u) = \min\{\text{dist}(s, u) : s \in S\}$ for every node u of the graph.

Exercise 3 (1 point)

Show that the straightline heuristic from the first exercise sheet is monotone. Say under which conditions it is also strictly monotone?

Exercise 4 (1 point)

Don't forget your *feedback-exercise-sheet-2.txt* !