Introduction to Multi-Agent-Programming

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Exercise Sheet 4

Due: November 26th, 2008

Exercise 4.1 (Path Planning)

(a) **Graph of Long-Roads (1.5 pt)**
Compute the long-roads graph from the map and store it for the path planner to use.
Based on that, develop a planner interface to plan using the graph of long-roads. There should be two possible calls to the planner:

- one computing the actual path (as in SampleSearch)
- a second one, just returning the costs of the query

The interface should be able to convert a path planning query for any node to long-road queries and long-road answers of the planner back to full answers. Refer to the SampleSearch.java in the sample package for an example.

(b) **A* (1.5 pt)**
Based on the long-roads, design and implement the A* planner, and give a short description on the heuristic. Use this planner as the long-roads planner answering long-road queries for the previous task. Submit both the description and the source code. If you want, you can also implement another search algorithm (e.g. Dijkstra).

(c) **Point-to-Point matrix (1.5 pt)** Implement a matrix, that stores the path cost from each long-road node to each long-road node, i.e.: matrix(i, j) gives the cost to get from i to j. This matrix should only be invalidated upon updates (at most once in each cycle). Use this matrix to answer cost queries in the first task, if an entry is valid. In each cycle precompute the matrix rows for the agent's nearest long-road nodes and store information from other queries. To compute a matrix row, you can use the A* algorithm with start i and without a goal (i.e. explore until the whole graph is explored). Please note, that each time A* puts a node in the closed list, this node has optimal costs (not only the goal node). That means, after A*, you know the optimal costs to each node in the closed list.

Exercise 4.2 (Game Theory: Nash Equilibrium (1.5 pt))
Consider the following two-persons (a, b) game

	a_1	a_2	a_3	a_4	a_5
b_1	2,1	4,2	7,5	12,3	11,6
b_2	4,10	6,10	12,5	5,4	10,3

(a) Which strategies are strongly or weakly dominated?

(b) What are the rational solutions for the game?

(c) Find the pure-strategy Nash equilibrium.

Please send your solution to dornhege and zhangd @informatik.uni-freiburg.de
Note: We encourage you to submit the written solution in a ***pdf*** *file. The latex template is available at the exercise web page.*