Foundations of Artificial Intelligence

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Exercise Sheet 2

Due: Friday, May 9, 2008

Exercise 2.1 (Classification of environments)

Classify the tasks/environments (a) autonomous navigation of a Mars rover, (b) playing Skat (c) playing robot soccer, (d) nursing robots, and (e) playing Sudoku with respect to the criteria (i) full observability vs. partial observability, (ii) deterministic vs. stochastic, (iii) static vs. dynamic, (iv) discrete vs. continuous, and (v) single-agent vs. multi-agent.

Exercise 2.2 (Formalizing problems)

Formalize the following problems as precisely as possible, by defining the initial state, the state space, the set of actions, the goal test and the path cost function:

- You want to drive from Freiburg to Berlin by car. You carry with you an up-to-date highway map of Germany and a list of traffic jams in certain highway segments. Your car is *not* equipped with an automated navigation system.
- You have to color a map of Europe with only four colors. In order for the national borders to be recognizable, no two neighboring countries may be assigned the same color.

Exercise 2.3 (Uninformed Belief Space Search)

You have to sort three blocks of different sizes, which are lined up at positions 0, 1, and 2, by increasing size. Unfortunately, you can neither see the blocks nor move them yourself. However, you can give another person instructions of the following form: "Compare the blocks at positions i and j and swap them if this is necessary to bring them in the correct order relative to each other" (instruction a_{ij}). Initially, you know nothing about the ordering of the blocks. Produce a sequence of instructions after which you can be sure that the blocks are ordered correctly. Show how your belief state evolves over time.

Exercise 2.4 (A* Search)

A* search will find a solution if one exists, provided that (a) every node has a finite number of successor nodes, and (b) there exists a constant $\delta > 0$ such that every operator o has cost $c(o) \geq \delta$.
Show that the second condition *cannot* be relaxed to (b') every operator o has cost $c(o) > 0$.

The exercise sheets may and should be worked on in groups of three (3) students. Please fill the cover sheet[1] and attach it to your solution.

[1] `http://www.informatik.uni-freiburg.de/~ki/teaching/ss08/gki/coverSheet-english.pdf`