Foundations of Artificial Intelligence

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Exercise Sheet 1

Due: March 14, 2018

Exercise 1.1 (1+1+1 marks)
Check the literature and the internet to investigate to which extent the following tasks can nowadays be performed automatically by computers and/or robots.

(a) Recognizing the semantics of natural language

(b) Carrying heavy loads in rough and bumpy terrain

(c) Playing first person shooters

Exercise 1.2 (3 marks)
Discuss strengths and weaknesses of the three problem solving methods that were presented in Chapter 4. Provide at least one strength and one weakness for each of the proposed methods.

Exercise 1.3 (1+1+1 marks)
Characterize the following environments by describing if they are *static / dynamic*, *deterministic / non-deterministic / stochastic*, *fully / partially / not observable*, *discrete / continuous*, and *single-agent / multi-agent*. Explain your answer.

(a) Sokoban (see, e.g., `https://en.wikipedia.org/wiki/Sokoban`)

(b) Ski Robot at the Olympic Ski Robot Challenge in Pyeongchang, 2018 (see, e.g., `http://www.bbc.co.uk/bbcthree/article/600322f6-a118-4289-b69e-4ae763afbc01`)

(c) Monopoly (see, e.g., `https://en.wikipedia.org/wiki/Monopoly_(game)`)

Exercise 1.4 (0.5 + 0.5 + 0.5 + 0.5 + 0.5 + 0.5 marks)
Determine if the following statements about state spaces $\mathcal{S} = \langle S, A, cost, T, s_0, S_\star \rangle$ are correct or not. Explain your answer.
Remark: The cardinality of a set X is denoted by $|X|$.

(a) If all actions have equal costs, each solution for $\mathcal{S}$ is optimal.

(b) There can be infinitly many transitions in T even if S and A are finite.

(c) The length of an optimal solution is no larger than $|S| - 1$.

(d) There is no solution for $\mathcal{S}$ if $T = \emptyset$.

(e) If $\pi = \langle \pi_1, \ldots, \pi_n \rangle$ is a minimal cost path from state $s \in S$ to state $s' \in S$ and $\pi' = \langle \pi'_1, \ldots, \pi'_m \rangle$ is a minimal cost path from s' to state $s'' \in S$, then $\pi'' = \langle \pi_1, \ldots, \pi_n, \pi'_1, \ldots, \pi'_m \rangle$ is a minimal cost path from s to s''.

(f) Let π, π', and π'' be minimal cost paths from $s \in S$ to $s' \in S$, s' to $s'' \in S$ and s to s'', respectively. Then $cost(\pi'') \leq cost(\pi) + cost(\pi')$.

The exercise sheets can be submitted in groups of two students. Please provide both student names on the submission.