Principles of AI Planning

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Exercise Sheet 6

Due: Friday, December 5th, 2014

Exercise 6.1 (Inaccuracy of $h_{\max}$, 2 points)

Prove that the heuristic $h_{\max}$ is arbitrarily inaccurate, i.e., for all $c \in \mathbb{R}^+$ there exists a relaxed planning task $\Pi = \langle A, I, O^+, \gamma \rangle$ such that $c \cdot h_{\max}(I) \leq h^+(I)$.

Exercise 6.2 (Stability of h_{add}, 4 points)

Show that it is important to test for stability when computing h_{add} by giving an example where you get an unnecessarily high overestimation when not performing this test.

Hint: The solution to this exercise is a planning task and its relaxed planning graph where h_{add} is higher in the goal node in layer k than in the goal node of layer $j > k$.

Exercise 6.3 (Relaxed planning graph and heuristics, 4 points)

Consider the relaxed planning task Π^+ with variables $A = \{a, b, c, d, e\}$, operators $O = \{o_1, o_2, o_3\}$, $o_1 = \langle d, c \wedge (c \rhd e) \rangle$, $o_2 = \langle c, a \rangle$, $o_3 = \langle a, b \rangle$, goal $\gamma = b \wedge e$ and initial state $s = \{a \mapsto 0, b \mapsto 0, c \mapsto 0, d \mapsto 1, e \mapsto 0\}$. Solve the following exercises by drawing the relaxed planning graph for the lowest depth k that is necessary to extract a solution.

(a) Calculate $h_{\max}(s)$ for Π^+.

(b) Calculate $h_{\text{add}}(s)$ for Π^+.

(c) Calculate $h_{\text{sa}}(s)$ for Π^+.

(d) Calculate $h_{\text{FF}}(s)$ for Π^+.

You can and should solve the exercise sheets in groups of two. Please state both names on your solution.