

Principles of AI Planning

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Exercise Sheet 11

Due: Monday, February 3rd, 2014

Exercise 11.1 (Weak and strong preimages, 2 points)

Let $\mathcal{T} = \langle S, O, T, s_0, S_\star \rangle$ be a transition system that happens to be deterministic, i.e., for each state $s \in S$ and each label $o \in O$, there exists at most one state $s' \in S$ such that $\langle s, o, s' \rangle \in T$.

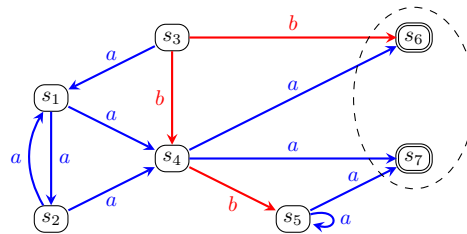
Show that for all operators $o \in O$ and all state sets $S' \subseteq S$, $\text{wpreimg}_o(S') = \text{spreimg}_o(S')$.

Exercise 11.2 (Nondeterministic progression search, 3 + 2 points)

- Model the game *Tic-Tac-Toe* as a nondeterministic planning task for a grid of size 2×2 with the goal to get two markers in a row, column or diagonally. Formalize the game from the first player's perspective. See <http://en.wikipedia.org/wiki/Tic-tac-toe> if rule questions arise.
- Determine a strong plan for this planning task as a graph by providing a solution graph generated by progression search.

Exercise 11.3 (AO* search, 3 points)

Consider the nondeterministic planning task that induces the following nondeterministic transition system:



Determine a strong plan for the initial state s_3 using AO*-Search. Give the configuration of \mathcal{T}_e and \mathcal{T}_p in each iteration. It is sufficient to draw the graph \mathcal{T}_e (including f and h values), marking the corresponding hyper-edges to visualize \mathcal{T}_p .

During search, use the heuristic estimates given by the following table:

	s_1	s_2	s_3	s_4	s_5	s_6	s_7
$h(\cdot)$	1	3	2	2	∞	0	0

You can and should solve the exercise sheets in groups of two. You can send your solution to ortlieb@informatik.uni-freiburg.de. Please give both your names on your solution.