Principles of AI Planning

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Exercise Sheet 10

Due: Friday, January 20th, 2017

Exercise 10.1 (LM-cut heuristic, 5 points)

Consider the STRIPS planning task specified by $\Pi = \langle A, I, O, \gamma \rangle$, where

$$\begin{aligned}
A &= \{a, b, c, d, e, f\} \\
I &= \{a \mapsto 1, b \mapsto 0, c \mapsto 0, d \mapsto 0, e \mapsto 0, f \mapsto 0\} \\
O &= \{o_i \mid 1 \leq i \leq 5\} \\
o_1 &= \langle a, b \wedge c \rangle \\
o_2 &= \langle b, d \rangle \\
o_3 &= \langle c, e \rangle \\
o_4 &= \langle d \wedge e, f \rangle \\
o_5 &= \langle c \wedge e, f \rangle \\
\gamma &= f
\end{aligned}$$

Compute $h_{\text{LM-cut}}(I)$. In each iteration i of the algorithm (except for the last iteration where you identify $h_{\max}^{c_i}(t) = 0$), give the respective **pcf** D_i, the corresponding **justification graph** G_i of D_i, the **sets** V_i^*, V_i^0, V_i^b and L_i as well as the (intermediate) **heuristic value**.

For the sake of a unique solution, please break possible pcf ties in favor of proposition e in operators o_4 and o_5.

Exercise 10.2 (Active operators and projections, 2+3 points)

Let $\Pi = \langle V, O, I, \gamma \rangle$ be a SAS+ planning task without trivially inapplicable operators and let s be a state of Π. Show that the set of active operators $Act(s) \subseteq O$ in s can be identified efficiently by considering paths in the projection of Π onto v:

(a) Establish and prove a connection between the projection of Π onto v and the domain transition graph of v.

(b) Specify an efficient algorithm for the identification of $Act(s)$, prove its soundness and completeness, and reason about the runtime of the algorithm in terms of the input size.

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