Principles of AI Planning

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Exercise Sheet 2

Due: Friday, November 15th, 2013

Exercise 2.1 (Effect normal form, 2+2 points)

(a) Transform the operator

$$\langle \neg d \vee \neg f, (\neg c \rhd (e \rhd a)) \wedge (\neg b \rhd a) \wedge (\neg(\neg f \wedge c) \rhd (b \wedge d)) \wedge (b \rhd d) \rangle$$

into effect normal form and simplify it as much as possible. For each step, state which one of the equivalences (3) to (9) from the lecture you use. To save you some writing, you may apply the equivalences (1) (commutativity) and (2) (associativity) without explicitly mentioning it.

(b) Prove the following equivalence for effects:

$$(\chi_1 \rhd e) \wedge (\chi_2 \rhd e) \equiv (\chi_1 \vee \chi_2) \rhd e \tag{9}$$

Exercise 2.2 (Positive normal form, 2 points)

Transform the ENF operator

$$\langle \neg e \vee f, (((a \wedge b) \vee \neg d) \rhd c) \wedge ((c \vee a) \rhd d) \wedge ((c \vee a \vee d) \rhd \neg e) \rangle$$

into positive normal form. Again, in each step mark what you have done (e.g., "identify negative atom"). Remember that the transformation can destroy the ENF character!

Exercise 2.3 (Correctness of STRIPS regression, 1+3 points)

Prove the correctness of STRIPS regression:
Let φ be a conjunction of atoms, $o = \langle \chi, e \rangle$ a STRIPS operator which makes the atoms $a_1, \ldots, a_k$ true and the atoms $d_1, \ldots, d_l$ false, and s an arbitrary state. Show:

(a) If o is *not* applicable in state s, then $s \not\models \mathit{sregr}_o(\varphi)$.

(b) If o is applicable in state s, then $s \models \mathit{sregr}_o(\varphi)$ iff $\mathit{app}_o(s) \models \varphi$.

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.