Principles of AI Planning

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SS 2005

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Exercise Sheet 4

To be submitted Monday, May 9

Exercise 4.1

When Romeo applied his regression planner to avoid dancing the week before last week, he did not manage to solve the planning problem in time and Juliet finally dragged him along when she left the house. To escape a similar fate for the coming weekend, Romeo has implemented a powerful satisfiability checking algorithm to help with his sometimes slow reasoning tasks. For converting his planning task to a satisfiability problem, he needs your help.

The planning task is the same as in Assignment 2.2. In the following, we will use short-hand notations like *rh* for *romeo-at-home* and *D* for *go-dancing*. So the set of propositions is:

$$P = \{rh, rd, rw, jh, jd\}$$

and the three operators $\{D, W, H\}$ are defined as:

$$D = \langle jh, jd \wedge \neg jh \wedge (rh \triangleright (rd \wedge \neg rh)) \rangle,$$

$$W = \langle rh, rw \wedge \neg rh \rangle,$$

$$H = \langle rw, rh \wedge \neg rw \rangle.$$

(a) Translate the operator set $\{D, W, H\}$ into propositional logic using the first encoding from the lecture. It is sufficient to record the *simplified* formulas for τ_D, τ_W and τ_H, and how $\mathcal{R}_1(P, P')$ relates to these formulas.
Note: It is *not* necessary to translate the resulting formula to CNF – using the "normal" encoding without variables for the operators, the corresponding CNF formula has some 100 clauses. Doing this translation is a task that Romeo can do himself.

(b) Translate the operator set $\{D, W, H\}$ into propositional logic using the second encoding from the lecture, and translate the resulting formula into CNF.
Note: You do not need to write down $\mathcal{R}_2(P, P')$ as a whole; you should rather record the individual clauses that you obtain from explanatory frame axioms ($\sim$ 12 clauses), effect axioms ($\sim$ 11 clauses) and operator interference ($\sim$ 3 clauses).

For both parts, you only need to record the end results, not the logical transformations that you use for obtaining them.

You may work on these assignments and submit your results **in groups of two students**. Make sure to clearly indicate both names on your work. **You may write your answers in English or German.** Please return your homework on monday **before** 14:15.

Exercise marks count towards your final grade for this course, which is calculated from exercise marks (**15%**) and exam marks (**85%**).