



Introduction to nonmonotonic reasoning

Winter Semester 2019/20

Exercise Sheet 8 – Circumscription, inference relations

19th December 2019

Dr. (habil.) Anni-Yasmin Turhan

Exercise 8.1 We consider the connection between default logics and autoepistemic logic.

Let $\delta = \frac{\varphi : \psi_1, \dots, \psi_n}{\chi}$ be a default rule. We define the translation function for default rules as follows:

$$\text{trans}(\delta) = (L \varphi \wedge \neg L \neg \psi_1 \wedge \dots \wedge \neg L \neg \psi_n) \longrightarrow \chi.$$

Let $T = (W, D)$ be a default theory. We define the translation function for default theories as follows:

$$\text{trans}(T) = W \cup \{\text{trans}(\delta) \mid \delta \in D\}.$$

Consider $T_{DT} = (W, D)$ with $W = \emptyset$ and $D = \left\{ \frac{p : \text{true}}{p} \right\}$.

- Compute the extensions of T_{DT} .
- Compute the expansions of $T_{AE} = \text{trans}(T_{DT})$.
- Explain the difference.

Exercise 8.2 Define $\varphi[p_1/\psi_1, \dots, p_n/\pi_n]$, the simultaneous substitution of the predicates in p_i by the predicate expressions ψ_i in φ .

Exercise 8.3 Consider the circumscription schema for *isBlock* and the given formula

$$\text{isBlock}(a) \wedge \text{isBlock}(b).$$

Explain what happens when ...

- ... the predicate expression $\psi(X) \equiv X = a$ is used.
- ... the predicate expression $\psi(X) \equiv (X = a \vee X = b \vee X = c)$ is used.¹
- ... *isBlock(c)* is added to the given knowledge.

¹An earlier version of the exercise sheet had \wedge instead of \vee , unfortunately.