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15. Exercises for the Course „Logic-based Knowledge Representation“

Exercise 50:

(a) Let
$$\begin{aligned} D &:= \left\{\frac{\text{Italian}(x) : \text{lovesWine}(x)}{\text{lovesWine}(x)}, \frac{\text{French}(x) : \text{lovesWine}(x)}{\text{lovesWine}(x)}\right\} \\ W &:= \{\text{Italian}(\text{Tom}) \vee \text{French}(\text{Tom})\}. \end{aligned}$$

Compute the extensions of D and W and decide whether Tom loves wine.

(b) Let
$$\begin{aligned} D &:= \left\{\frac{\text{true} : \text{usable}(x) \wedge \neg\text{broken}(x)}{\text{usable}(x)}\right\} \\ W &:= \{\text{broken}(\text{leftArm}) \vee \text{broken}(\text{rightArm})\}. \end{aligned}$$

Compute the extensions of D and W and decide whether both arms are usable.

Exercise 51:

Consider the default theory (D, W) from Example 8.5 of the lecture: for closed atomic formulae a, b, c of first order predicate logic, we define

$$\begin{aligned} D &:= \left\{\frac{a : b}{c}, \frac{c : \neg b}{\neg b}\right\} \\ W &:= \{a\}. \end{aligned}$$

Prove that (D, W) has no extension.

Exercise 52:

Let (D, W) be a default theory.

- Let $\mathcal{E}_{(D,W)}$ be the set of all extensions of (D, W).
- We call $E, E' \in \mathcal{E}_{(D,W)}$ *incomparable*, if neither $E \subseteq E'$ nor $E' \subseteq E$.

Prove of disprove the following claims:

(a) There exists a default theory (D, W) with $|\mathcal{E}_{(D,W)}| \geq 2$ and where all $E, E' \in \mathcal{E}_{(D,W)}$ with $E \neq E'$ are incomparable.

(b) There exists a default theory (D, W) with $|\mathcal{E}_{(D,W)}| \geq 2$ and where, for all $E, E' \in \mathcal{E}_{(D,W)}$, either $E \subseteq E'$ or $E' \subseteq E$.

Exercise 53:

Let Π be a ground logic program without NAF. Prove that, if Γ is the (non-empty) set of all models of Π, then $\cap\Gamma$ is also a model of Π.