TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Computer Science Institute of Theoretical Computer Science, Chair of Automata Theory

Description Logics

Exercise Sheet 9

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Exercise 35

Show that the transformation of $\mathcal{FL}_0$-concepts into normal form requires only polynomial time.

Exercise 36

Show that subsumption in $\mathcal{FL}_0$ w.r.t. acyclic TBoxes is in co-NP by giving a polynomial-time reduction from this problem to the inclusion problem for acyclic finite automata (which is in co-NP).

Exercise 37

Let $\mathcal{T}$ be a general $\mathcal{EL}$-TBox and $\widehat{\mathcal{T}}$ the TBox obtained from exhaustive application of the normalisation rules NF1–NF5 to $\mathcal{T}$.

Finish the proof of Lemma 5.18 by showing the following:

a) $\widehat{\mathcal{T}}$ can be obtained from $\mathcal{T}$ in polynomial time.

b) $\widehat{\mathcal{T}}$ is in normal form.

c) For all concept names A, B occurring in $\mathcal{T}$, we have $A \sqsubseteq_{\mathcal{T}} B$ iff $A \sqsubseteq_{\widehat{\mathcal{T}}} B$.

Exercise 38

Consider the $\mathcal{EL}$-TBox $\mathcal{T}$ consisting of the following axioms:

$$\begin{aligned} A &\sqsubseteq B \sqcap \exists r.C \\ B \sqcap \exists r.B &\sqsubseteq C \sqcap D \\ C &\sqsubseteq \exists r.A \sqcap B \\ \exists r.\exists r.B \sqcap D &\sqsubseteq \exists r.(A \sqcap B) \end{aligned}$$

Check whether the following subsumption relations follow:

a) $A \sqsubseteq B$

b) $A \sqsubseteq \exists r.\exists r.A$

c) $B \sqcap \exists r.A \sqsubseteq \exists r.C$