TECHNISCHE UNIVERSITÄT DRESDEN

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

Description Logics

Exercise Sheet 12

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Exercise 45

Determine whether Player 2 has a winning strategy in the ExpTime game $G = (\phi, \Gamma_1, \Gamma_2, t_0)$ with

- $\phi = (p_1 \wedge p_2 \wedge p_3 \wedge \neg q) \vee (\neg p_1 \wedge \neg p_2 \wedge \neg p_3 \wedge q)$,
- $\Gamma_1 = \{p_1, p_2, p_3\}$,
- $\Gamma_2 = \{q\}$,
- $t_0(p_1) = t_0(p_2) = t_0(p_3) = t_0(q) = 0$.

Exercise 46

Use a tableau algorithm to decide whether the following $\mathcal{ALC}$-knowledge base is consistent:

$$\mathcal{T} := \{A \sqcap \forall r.\neg A \sqsubseteq \bot\}$$
$$\mathcal{A} := \{(\forall r.\neg A)(a),\ (\exists r.A)(b),\ r(a,b)\}$$

Exercise 47

For each of the following $\mathcal{ALC}$-concept descriptions C and $\mathcal{ALC}$-TBoxes $\mathcal{T}$ decide whether C is satisfiable w.r.t. $\mathcal{T}$ by constructing the looping tree automaton $\mathcal{A}_{C,\mathcal{T}}$ and checking its accepted language $L(\mathcal{A}_{C,\mathcal{T}})$ for emptiness.

a) $C := A$
$\mathcal{T} := \{A \sqsubseteq \neg A\}$

b) $C := A$
$\mathcal{T} := \emptyset$

c) $C := A \sqcap \exists r.A$
$\mathcal{T} := \{A \sqsubseteq \forall r.\neg A\}$

Exercise 48

Show that transitivity of a role cannot be expressed in $\mathcal{ALC}$.

Hint: Show that the FOL-formula $\forall x.\forall y.\forall z.(R(x,y) \wedge R(y,z)) \rightarrow R(x,z)$ is not equivalent to a formula in the two-variable-fragment of FOL.