TECHNISCHE UNIVERSITÄT DRESDEN

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

Description Logic

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Exercise Sheet 9

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Prof. Dr.-Ing. Franz Baader, Dr.-Ing. Stefan Borgwardt

Exercise 9.1 Determine whether Player 1 has a winning strategy in the following finite Boolean games, where in both cases $\Gamma_1 = \{p_1, p_3\}$ and $\Gamma_2 = \{p_2, p_4\}$:

(a) $((p_1 \wedge p_3) \rightarrow \neg p_2) \wedge (\neg p_1 \rightarrow p_1) \wedge (\neg p_2 \rightarrow (p_3 \vee p_4))$

(b) $(p_1 \vee \neg p_2) \wedge (p_2 \vee p_3) \wedge (\neg p_3 \vee \neg p_4) \wedge (\neg p_1 \vee \neg p_2 \vee p_3 \vee p_4)$

Exercise 9.2 Use the $\mathcal{ALC}$-Elim algorithm to decide satisfiability of

(a) the concept name A w.r.t. $\mathcal{T} = \{A \sqsubseteq \exists r.A,\ \top \sqsubseteq A,\ \forall r.A \sqsubseteq \exists r.A\}$.

(b) the concept $\forall r.\forall r.\neg B$ w.r.t. $\mathcal{T} = \{\neg A \sqsubseteq B,\ A \sqsubseteq \neg B,\ \top \sqsubseteq \neg\forall r.A\}$.

Give the constructed type sequence $\Gamma_0, \Gamma_1, \ldots$. In case of satisfiability, also give the satisfying model constructed in the proof of Lemma 5.10.

Exercise 9.3 Extend the $\mathcal{ALC}$-Elim algorithm to the description logic $\mathcal{ALCI}$. Prove the correctness of the extended algorithm.