TECHNISCHE UNIVERSITÄT DRESDEN

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

Logic-Based Ontology Engineering

Summer Semester 2018

Exercise Sheet 7

13th June 2018

Dr.-Ing. Stefan Borgwardt, PD Anni-Yasmin Turhan

Exercise 7.1 In this exercise we consider concept expansion.

(a) Given the following TBox:

$$\mathcal{T} = \{ \begin{array}{rcl} A & \equiv & B \sqcap C \sqcap \exists r.D, \\ E & \equiv & G \sqcap H, \\ C & \equiv & \exists r.(E \sqcap D), \\ D & \equiv & H \sqcap \exists r.G, \\ B & \equiv & (\exists s.E) \sqcap (\exists s.F) \quad \} \end{array}$$

Expand the concept $A \sqcap \exists s.D$ w.r.t. $\mathcal{T}$ by exhaustively replacing all defined concepts by their definitions.

(b) How large can an $\mathcal{ELH}$ concept grow due to concept expansion (measured in the size of the TBox)? Devise a sequence of TBoxes and a concept that demonstrate this growth rate.

Exercise 7.2 The Expansion Lemma assumes that the ABox is irrelevant when testing subsumption in $\mathcal{ELH}$. Let C and D be $\mathcal{ELH}$ concepts and $\mathcal{O} = (\mathcal{A}, \mathcal{T}, \mathcal{R})$ an $\mathcal{ELH}$ ontology. Show that

$$C \sqsubseteq_{(\mathcal{A},\mathcal{T},\mathcal{R})} D \text{ iff } C \sqsubseteq_{(\emptyset,\mathcal{T},\mathcal{R})} D.$$

Hint: Use the fact that every $\mathcal{ELH}$ ontology is consistent.

Exercise 7.3 Complete the proof of the Structural Subsumption Lemma, by showing that the following statements hold for the canonical model $\mathcal{I}_{C,\mathcal{R}}$:

- $C \in C^{\mathcal{I}_{C,\mathcal{R}}}$
- $\mathcal{I}_{C,\mathcal{R}} \models \mathcal{R}$