

Principles of Knowledge Representation and Reasoning

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Exercise Sheet 13

Due: February 10th, 2013

Exercise 13.1 (FORMALIZATION IN DESCRIPTION LOGICS, 2+1+1)

- (a) Extend the family TBox from the lecture (chapter 14, slide 25) by defining the following concepts:

- **Grandson**, **Granddaughter**
- **Sister-in-law**
- **Bachelor** (Unmarried man)
- **Trigamist** (Person married to at least three other persons)

Besides the roles and concepts used in the lecture, you may use the atomic role **married-to** and the (half-)sibling role $\text{has-sibling} = (\text{has-child}^{-1} \circ \text{has-child}) \sqcap \neg 1$.

- (b) Prove that in this extended TBox the subsumption relation $\text{Trigamist} \sqcap \text{Male} \sqsubseteq \neg \text{Bachelor}$ holds (translate the statement into predicate logic semantics and give a proof in predicate logic).
- (c) Prove that in the extended TBox the subsumption relation $\text{Granddaughter} \sqsubseteq \text{Sister-in-law}$ *does not* hold by giving a counterexample, i.e., a model of the TBox in which the subsumption does not hold.

Exercise 13.2 (UNFOLDING, 3)

Specify the unfolding of the concepts **Granddaughter**, **Sister-in-law**, and **Trigamist** wrt. the TBox in exercise 13.1(a). Determine the primitive components used in your definitions. Provide an initial assignment by using the ABox given in the lecture (chapter 14, slide 26). Finally, specify the full assignments of these three concepts as induced by your initial assignment.

Exercise 13.3 (MODELING IN PROTÉGÉ, 2+2)

Download and install the ontology editor Protégé from the web page:

<http://protege.stanford.edu/>.

- (a) Use Protégé to extend the family TBox <http://www.informatik.uni-freiburg.de/~ki/teaching/ws1314/krr/family.owl> by the concepts listed in exercise 13.1(a). Determine the DL-logic of the resulting ontology.
- (b) Extend the family TBox by the concept **Patricide** by using a new role name **isMurdererOf**. Check (and explain) whether for the following Oedipus-ABox \mathcal{A}_{oe} it holds: Jocasta has a child that is a patricide and that has a child that is no patricide.

<code>hasChild(JOCASTA,OEDIPUS)</code>	<code>hasChild(JOCASTA,POLYNICES)</code>
<code>hasChild(OEDIPUS,POLYNICES)</code>	<code>hasChild(POLYNICES,THERSANDROS)</code>
<code>Patricide(OEDIPUS)</code>	<code>not Patricide(THERSANDROS)</code>

Please email your ontologies as OWL-files to woelfl@informatik.uni-freiburg.de.