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 has-sibling = (has-child^{-1} \circ has-child) \cap \neg 1.

(b) Prove that in this extended TBox the subsumption relation Trigamist \sqcap Male \sqsubseteq \neg 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 Granddaughter \sqsubseteq 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 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 A_{\omega} it holds: Jocasta has a child that is a patricide and that has a child that is no patricide.

hasChild(JOCASTA,OEDIPUS) hasChild(JOCASTA, POLYNICES)
hasChild(OEDIPUS, POLYNICES) hasChild(POLYNICES, THERSANDROS)
Patricide(OEDIPUS) not Patricide(THERSANDROS)

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