Description Logics

Exercise Sheet 7

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Exercise 27

In the proof of Lemma 4.13, fill in the remaining case $C = \neg A$ in the inductive proof that $\mathcal{I}_\mathcal{A}$ satisfies every assertion $C(x) \in \mathcal{A}$.

Exercise 28

Show that the size of $|C|_\mathcal{T}$ of a concept C w.r.t. an acyclic TBox $\mathcal{T}$, as defined in the proof of Lemma 4.13 in the lecture, is well-defined.

Exercise 29

Use a tableau algorithm to decide whether the following 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 30

We consider another form of blocking, where an individual can be blocked by an individual that is not necessarily an ancestor: *anywhere blocking*. Instead of the depth of an individual and the ancestor relation, it uses the age of an individual and the relation $<$.

The *age* of an individual x ($\mathsf{age}(x)$) is defined as 0 for old individuals and n for a new individual x, if x was generated by the nth application of the $\exists$-rule.

Let $\mathcal{A}$ be an ABox obtained by applying the tableau rules and the GCI rule to an initial ABox $\mathcal{A}_0$. A new individual x is *anywhere blocked* by an individual a in $\mathcal{A}$ iff

- $\{C \mid C(x) \in \mathcal{A}\} \subseteq \{D \mid D(a) \in \mathcal{A}\}$, and
- $\mathsf{age}(a) < \mathsf{age}(x)$.

Prove the following for this form of blocking:

a) soundness,

b) completeness,

Hint: For what subset of the complete tableau do we need to construct a model?

c) termination.