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5. Exercises for the Course 'Description Logics'

Exercise 17:

Prove the following Points of Theorem 2.13:

(a) C is satisfiable w.r.t. $\mathcal{T}$ iff $C \not\sqsubseteq_{\mathcal{T}} \bot$;

(b) C is satisfiable w.r.t. $\mathcal{T}$ iff $(\mathcal{T}, \{C(a)\})$ is consistent;

(c) a is an instance of C w.r.t. $\mathcal{K}$ iff $(\mathcal{T}, \mathcal{A} \cup \{\neg C(a)\})$ is inconsistent.

Exercise 18:

Load the ontology Cow.owl into Protege, in the menu "Reasoner" pick a reasoner (Fact++ or Pellet as you like) and classify the TBox.

(a) When classification is invoked, reasoners first check whether the TBox is satisfiable. Which concept in the TBox is unsatisfiable? Why?

(b) If a concept C is defined as a specialisation of another concept D, as for example in $C \equiv D \sqcap \exists r.\top$, then D is a so-called *told subsumer* of C. Which pairs of concepts from the TBox have implicit subsumption relationships, i.e., are not told subsumers?

(c) Introduce a defined concept "Carnivore" (and if necessary change the TBox) in such way that the concepts "Cat" and "Dog" are subsumed by "Carnivore".

Exercise 19:

Use the tableau algorithm from the lecture to decide whether the following subsumption holds:

$$\neg\forall r.A \sqcap \forall r.C \sqsubseteq_{\mathcal{T}} \forall r.E$$

where $\quad \mathcal{T} = \{C \equiv (\exists r.\neg B) \sqcap \neg A, \quad D \equiv \exists r.B, \quad E \equiv \neg(\exists r.A) \sqcap \exists r.D\}.$

Exercise 20:

Extend the proof of Lemma 3.4 (local correctness) to the $\sqcap$-rule and the $\forall$-rule.