Inference in Description Logics

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1 Inference Procedures

1. Why inconsistency of an ontology is a problem ? What is its consequence ?
2. Show that disjointness of two concepts can be reduced to unsatisfiability of a single concept.
3. A satisfiable concept is interpreted as a non-empty set in at least one model of the theory/ontology. How to check that a concept is interpreted as a non-empty set in all models ?

2 Tableaux Algorithm for $\mathcal{ALC}$

1. Decide, whether the $\mathcal{ALC}$ concept $\exists hasChild \cdot (Student \sqcap Employee) \sqcap \neg(\exists hasChild \cdot Student \sqcap \exists hasChild \cdot Employee)$ is satisfiable (w.r.t. an empty TBox). Show the run of the tableau algorithm in detail.
2. Decide, whether the theory/ontology $\mathcal{K} = (\mathcal{T}, \mathcal{A})$ is consistent. Show the run of the tableau algorithm in detail.
   - $\mathcal{T} = \{\exists hasChild \cdot \top \equiv Parent\}$
   - $\mathcal{A} = \{hasChild(JOHN, MARY), Woman(MARY)\}$
3. Decide and show, whether the ontology
$$\mathcal{K}_1 = \{\mathcal{T} \cup \{Parent \sqsubseteq \forall hasChild \cdot \neg Woman\}, \mathcal{A}\}$$
is consistent.
4. Decide and show, whether the ontology
$$\mathcal{K}_1 = \{\mathcal{T} \cup \{Parent \sqsubseteq \exists hasChild \cdot Parent\}, \mathcal{A}\}$$
is consistent.

3 Practically in Protégé

1. Model the previous ontology in Protégé and check (using the Pellet/HermiT reasoner) whether your solutions in the previous tasks were correct.

2. Adjust the Pizza ontology introduced in the previous seminar, so that the class $IceCream$ and $CheeseyVegetableTopping$ become satisfiable.

3. Explain, why the Pizza ontology is consistent, although it contains unsatisfiable classes.