Description Logics

Exercise Sheet 3

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Exercise 9

Revisit the procedure for expanding TBoxes given in the proof of Prop. 2.6 of the lecture. Prove that

a) this procedure always terminates, and

b) that it returns a TBox that is equivalent to its input.

Hint for proving termination: count, for each concept name A, the number of concept names (directly or indirectly) used in the definition of A.

Exercise 10

Prove that existential restrictions are monotonic, i.e. show that

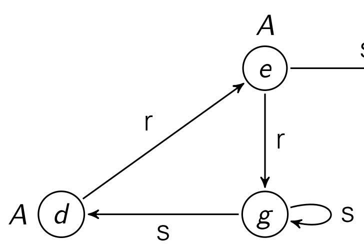
$$C \sqsubseteq_{\mathcal{T}} D \quad \Longrightarrow \quad \exists r.C \sqsubseteq_{\mathcal{T}} \exists r.D.$$

Exercise 11

Consider the ABox

$$\mathcal{A} = \{A(d),\ A(e),\ A(f),\ B(f),\ r(d,e),\ r(e,g),\ s(e,f),\ s(g,g),\ s(g,d)\}$$

with the following graphical representation:



For each of the following $\mathcal{ALC}$-concepts C, list all individuals that are instances of C w.r.t. $\mathcal{A}$. Compare your results to Exercise 7.

a) $A \sqcup B$

b) $\exists s.\neg A$

c) $\forall s.A$

d) $\exists s.\exists s.\exists s.\exists s.A$

e) $\neg\exists r.(\neg A \sqcap \neg B)$

f) $\exists s.(A \sqcap \forall s.\neg B) \sqcap \neg\forall r.\exists r.(A \sqcup \neg A)$

Exercise 12

Prove the following result: Let $\mathcal{K} := (\mathcal{T}, \mathcal{A})$ be a knowledge base.

If a is an instance of C w.r.t. $\mathcal{K}$ and $C \sqsubseteq_{\mathcal{T}} D$, then a is an instance of D w.r.t. $\mathcal{K}$.