



Description Logics

Exercise Sheet 3

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Exercise 1

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

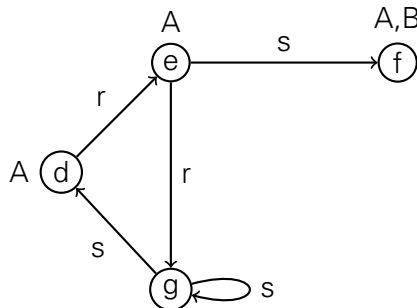
$$C \sqsubseteq_{\mathcal{T}} D \rightarrow \exists r.C \sqsubseteq_{\mathcal{T}} \exists r.D.$$

Exercise 2

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 3 from Sheet 2.

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

Exercise 3

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} .

Exercise 4

Prove the following results.

Let $\mathcal{K} = (\mathcal{T}, \mathcal{A})$ be a knowledge base, C and \mathcal{ALC} -concept description and a an individual name.

- a) \mathcal{K} is consistent iff $\tau(\mathcal{K})$ is consistent.
- b) a is an instance of C w.r.t. \mathcal{K} iff $\tau(\mathcal{K}) \models \tau_x(C)(a)$.