



Fuzzy Description Logics

Exercise Sheet 3

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Exercise 1

Let \mathcal{T} be the TBox

$$\begin{aligned}\mathcal{T} = \{ & \langle B \sqsubseteq \exists r.A, 0.5 \rangle, \\ & \langle \exists r.A \sqsubseteq B, 0.9 \rangle, \\ & \langle \exists r.B \sqsubseteq B, 0.7 \rangle, \\ & \langle A \sqsubseteq B, 0.4 \rangle, \\ & \langle A \sqsubseteq \exists r.A, 1.0 \rangle\end{aligned}$$

Using completion determine the best subsumption degree for $A \sqsubseteq_{\mathcal{T}} B$. Which of the following strategies terminates faster?

- When several rules are applicable always choose the axiom with the highest degree.
- When several rules are applicable always choose the axiom with the lowest degree.

Exercise 2

Show that the exhaustive application of the normalization rules NF1-NF5 to a fuzzy \mathcal{EL} -TBox terminates in polynomial time and yields a normalized TBox.

Exercise 3

Let \mathcal{T} be a fuzzy \mathcal{EL} -TBox and \mathcal{T}' the fuzzy TBox obtained from \mathcal{T} by the rule NF1 or the rule NF2. Prove that for every $A, B \in \mathcal{N}_{\mathcal{C}} \cup \{\top\}$ and every $q \in [0, 1]$ it holds that

$$\langle A \sqsubseteq_{\mathcal{T}} B, q \rangle \text{ iff } \langle A \sqsubseteq_{\mathcal{T}'} B, q \rangle.$$

Exercise 4

Show that the application of the completion rules R1 and R2 preserves the invariants

- $(B, q) \in S(A)$ implies $\langle A \sqsubseteq_{\mathcal{T}} B, q \rangle$, and
- $(r, q) \in R(A, B)$ implies $\langle A \sqsubseteq_{\mathcal{T}} \exists r.B, q \rangle$.