TD: Lightweight DLs

Exercise 1: Reasoning in \mathcal{EL}

Consider an \mathcal{EL} KB whose TBox \mathcal{T} contains the following inclusions:

 $A \sqsubseteq X \quad X \sqcap Y \sqsubseteq Z \quad \exists r.B' \sqsubseteq A' \quad A \sqsubseteq Y \quad Z \sqsubseteq \exists r.B \quad B \sqsubseteq B'$

and the ABox \mathcal{A} consists of the following assertions:

$$r(a,b)$$
 $B(b)$ $A(c)$ $Y(c)$

- 1. Run the saturation procedure on $(\mathcal{T}, \mathcal{A})$.
- 2. Use the result to determine which of the following assertions and inclusions are entailed from $(\mathcal{T}, \mathcal{A})$.
 - (a) $B \sqsubseteq B'$
 - (b) $B \sqsubseteq Z$
 - (c) $A \sqsubseteq A'$
 - (d) $A \sqsubseteq Z$
 - (e) $X \sqsubseteq Y$
 - (f) $X \sqsubseteq X$
 - (g) A(a)
 - (h) A'(a)
 - (i) A'(c)
 - (j) Z(c)

Exercise 2: Query answering in DL-Lite

Consider the following DL-Lite TBox \mathcal{T} :

$$A \sqsubseteq D \quad \exists s \sqsubseteq \neg A \quad s^- \sqsubseteq r \quad C \sqsubseteq A \quad E \sqsubseteq \exists s^-$$

the ABox \mathcal{A} with the following assertions:

$$A(a) \quad s(b,a) \quad C(d) \quad r(d,c) \quad r(f,d) \quad r(c,e) \quad A(g) \quad E(g)$$

and the conjunctive query

$$q(x,z) = \exists y \ A(x) \wedge r(x,y) \wedge r(z,y)$$

- 1. Give a query that can be used to test satisfiability w.r.t. \mathcal{T} .
 - Use your result to decide whether $(\mathcal{T}, \mathcal{A})$ is satisfiable.
- 2. Compute a rewriting of q and $\mathcal{T}' = \mathcal{T} \setminus \{ \exists s \sqsubseteq \neg A \}.$
 - Use your result to determine the certain answers to q w.r.t. $(\mathcal{T}', \mathcal{A})$.