10. Unfolding and Tableaux

Exercise 10.1 Unfoldings of UCQ queries with respect to a set of mappings.

1. Compute the perfect reformulation (using PerfectRef) of the following query:

   (a) $q(x, y) \leftarrow A(x),\ R(x, y),\ C(y)$

   with respect to the TBox $\mathcal{T}$ consisting of the following inclusion assertions:

$$\begin{aligned} A &\sqsubseteq \exists R \\ \exists R^- &\sqsubseteq B \\ B &\sqsubseteq A \\ R^- &\sqsubseteq S \end{aligned}$$

   On the obtained query, compute the unfolding with respect to the following set of mappings:

$$\mathcal{M} = \left\{ \begin{array}{lcl} \texttt{SELECT } a, b \texttt{ FROM T1} & \rightsquigarrow & A(f(a)), R(f(a), g(b)) \\ \texttt{SELECT } c, d \texttt{ FROM T2} & \rightsquigarrow & C(g(d)), R(f(c), g(d)) \\ \texttt{SELECT } e \texttt{ FROM T3} & \rightsquigarrow & C(h(e)), B(h(e)) \end{array} \right\}$$

Is it possible to shorten (e.g., less CQs or less atoms in each CQ) the obtained unfolded query? If yes, how and under what assumptions?

Exercise 10.2 Consider the following $\mathcal{ALC}$ concepts:

1. $(\exists R.A \sqcap \exists R.B) \sqcap \neg \exists R.(A \sqcap B)$
2. $(\mathsf{Person} \sqcap \forall \mathsf{eats}.\mathsf{Plants}) \sqcap \neg(\mathsf{Person} \sqcap \forall \mathsf{Eats}.(\mathsf{plants} \sqcup \mathsf{dairy}))$
3. $A \sqcap \exists P.(\forall Q.(B \sqcup \neg C)) \sqcap \forall P.(\exists Q.C \sqcap \exists Q.\neg B)$

(a) Determine, using tableaux, whether these concepts are satisfiable.

(b) If they are satisfiable, construct from the tableaux the canonical interpretation.