TD: Inconsistency-Tolerant Query Answering

Exercise 12:

Consider the following DL-Lite TBox and four ABoxes $\mathcal{A}_i$ ($1 \leq i \leq 4$):

$$\begin{aligned}\mathcal{T} = \{&\mathsf{AProf} \sqsubseteq \mathsf{Prof},\ \mathsf{FProf} \sqsubseteq \mathsf{Prof},\ \mathsf{Prof} \sqsubseteq \mathsf{PhD},\ \mathsf{Postdoc} \sqsubseteq \mathsf{PhD},\\ &\mathsf{PhD} \sqsubseteq \mathsf{Person},\ \exists\mathsf{teach} \sqsubseteq \mathsf{Person},\ \exists\mathsf{teach}^- \sqsubseteq \mathsf{Course},\\ &\mathsf{Prof} \sqsubseteq \exists\mathsf{workFor}, \mathsf{Student} \sqsubseteq \exists\mathsf{memberOf}, \mathsf{workFor} \sqsubseteq \mathsf{memberOf},\\ &\mathsf{AProf} \sqsubseteq \neg\mathsf{FProf},\ \mathsf{Prof} \sqsubseteq \neg\mathsf{Postdoc},\ \mathsf{Student} \sqsubseteq \neg\mathsf{Prof},\\ &\mathsf{Person} \sqsubseteq \neg\mathsf{Course},\ \exists\mathsf{memberOf}^- \sqsubseteq \neg\mathsf{Postdoc}\}\end{aligned}$$

$$\begin{aligned}\mathcal{A}_1 = \{&\mathsf{AProf}(ann), \mathsf{FProf}(ann), \mathsf{Prof}(ann),\\ &\mathsf{teach}(ann, c), \mathsf{teach}(ann, ann)\}\\ \mathcal{A}_2 = \{&\mathsf{AProf}(ann), \mathsf{FProf}(ann), \mathsf{Postdoc}(ann),\\ &\mathsf{memberOf}(ann, dpt), \mathsf{teach}(ann, c)\}\\ \mathcal{A}_3 = \{&\mathsf{AProf}(ann), \mathsf{teach}(ann, c_1), \mathsf{teach}(ann, c_2),\\ &\mathsf{teach}(c_1, c_2), \mathsf{teach}(c_2, c_1)\}\\ \mathcal{A}_4 = \{&\mathsf{AProf}(ann), \mathsf{teach}(ann, c_1), \mathsf{teach}(ann, c_2),\\ &\mathsf{AProf}(c_1), \mathsf{AProf}(c_2)\}\end{aligned}$$

1. Compute the repairs of the KB $(\mathcal{T}, \mathcal{A}_i)$ for $1 \leq i \leq 4$.
2. For each $1 \leq i \leq 4$ and each semantics $S \in \{\text{AR, IAR, brave}\}$, decide whether $(\mathcal{T}, \mathcal{A}_i) \models_S q(ann)$, where q is as follows:

$$q(x) = \exists yz\, \mathsf{PhD}(x) \wedge \mathsf{memberOf}(x, y) \wedge \mathsf{teach}(x, z)$$

   Justify your answers.

Exercise 13:

Consider the TBox $\mathcal{T}$ of Exercice 12 and the query

$$q(x) = \exists y\ \mathsf{Prof}(x) \wedge \mathsf{teach}(x, y).$$

1. Propose an FO-rewriting $q'(x)$ of $q(x)$ w.r.t. IAR semantics, i.e., such that for every ABox $\mathcal{A}$ and candidate answer $\vec{a}$, $(\mathcal{T}, \mathcal{A}) \models_{\text{IAR}} q(\vec{a})$ iff $\mathcal{I}_\mathcal{A} \models q'(\vec{a})$.
2. Now propose an FO-rewriting of $q(x)$ w.r.t. brave semantics.