Ontology Languages (COMP321)
Exercise 8

1. Query Rewriting. Let

   $$\mathcal{T} = \{\mathsf{Player} \equiv \exists \mathsf{plays}.\top, \mathsf{Player} \sqsubseteq \mathsf{Human}, \mathsf{Human} \sqsubseteq \exists \mathsf{has\_father}.\top\}$$

   and

   $$F(x) = \mathsf{Human}(x), \quad G(x) = \mathsf{Player}(x)$$

   Construct queries $F_{\mathcal{T}}(x)$ and $G_{\mathcal{T}}(x)$ such that for all ABoxes $\mathcal{A}$ and the corresponding interpretations $\mathcal{I}_{\mathcal{A}}$ the following holds for all individual names a:

   $$(\mathcal{T}, \mathcal{A}) \models F(a) \quad \Leftrightarrow \quad \mathcal{I}_{\mathcal{A}} \models F_{\mathcal{T}}(a)$$

   $$(\mathcal{T}, \mathcal{A}) \models G(a) \quad \Leftrightarrow \quad \mathcal{I}_{\mathcal{A}} \models G_{\mathcal{T}}(a)$$

2. Query Rewriting. Let

   $$\mathcal{T} = \{\exists \mathsf{has\_predecessor}.\mathsf{Number} \sqsubseteq \mathsf{Number}\}$$

   and let

   $$F(x) = \mathsf{Number}(x)$$

   Does there exist an FOPL query $F_{\mathcal{T}}(x)$ such that for all ABoxes $\mathcal{A}$ and the corresponding interpretations $\mathcal{I}_{\mathcal{A}}$ the following holds for all individual names a:

   $$(\mathcal{T}, \mathcal{A}) \models F(a) \quad \Leftrightarrow \quad \mathcal{I}_{\mathcal{A}} \models F_{\mathcal{T}}(a)$$

   Give an informal explanation for your answer.

3. Axiom Pinpointing. Let

   $$\mathcal{T} = \{C \sqsubseteq D, A \sqsubseteq E, E \sqsubseteq \exists r.F, F \sqsubseteq B, H \sqsubseteq B, F \sqsubseteq H\}$$

   be a TBox. Then we have that $\mathcal{T} \models A \sqsubseteq \exists r.B$. Determine two sets of axioms that are contained in the pinpointing set $\mathbf{Pin}(\mathcal{T}, A \sqsubseteq \exists r.B)$.