

Exercise 1

- 1 Under what conditions does $\{\vec{a} \mid \Sigma \cup D \models \varphi(\vec{a})\} = \bigcap_{I \models \Sigma, I|_D = D} \{\theta \mid I, \theta \models \varphi\}$ hold?
- 2 Show that, given a DL-Lite/ \mathcal{EL} TBox \mathcal{T} ,
 - if $\mathcal{K} = (\mathcal{T}, \{A(a)\})$ is consistent, then it has a tree model rooted by (the interpretation of) a ;
 - if $\mathcal{K} = (\mathcal{T}, \{R(a, b), R(b, c), R(c, a)\})$ is consistent, then it has a model consisting of three disjoint trees rooted by a , b , and c , respectively, such that the roots are connected by R (clockwise), but that it has no tree model.
 - extend (b) to an arbitrary ABox \mathcal{A} .
- 3 Let \mathcal{K} be a DL-Lite/ \mathcal{EL} KB, $\mathcal{U}_{\mathcal{K}}$ its canonical model, and φ a CQ. Show that $\mathcal{K} \models \varphi(\vec{a})$ if and only if $\mathcal{U}_{\mathcal{K}} \models \varphi(\vec{a})$.
- 4 Consider a DL-Lite/ \mathcal{EL} knowledge base \mathcal{K} and a conjunctive query

$$\varphi = \exists z_1, z_2. R(z_1, x) \wedge R(z_1, y) \wedge R(x, z_2) \wedge R(y, z_2) \wedge A(z_2).$$

Which of the variables in φ must be mapped to (interpretations of) ABox individuals and which can be mapped to anonymous individuals (and under what conditions) in the canonical model $\mathcal{U}_{\mathcal{K}}$?