Description Logics

Winter Semester 2016

Exercise Sheet 4

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Exercise 4.15 In the lecture, we defined bisimulations for $\mathcal{ALC}$-concepts s.t. they capture the expressive power of $\mathcal{ALC}$, i.e. that bisimulation invariance for $\mathcal{ALC}$-concepts follows.

(a) Extend the notion of a bisimulation relation to $\mathcal{ALCN}$ s.t. bisimulation invariance for $\mathcal{ALCN}$-concepts follows.

(b) Show bisimulation invariance for the bisimulation relation defined in exercise (a).

(c) Prove that $\mathcal{ALCQ}$ is more expressive than $\mathcal{ALCN}$.

Exercise 4.16 Prove or refute the following claim:
If an $\mathcal{ALC}$-concept C is satisfiable w.r.t. an $\mathcal{ALC}$-TBox $\mathcal{T}$, then for all $n \geq 1$ there is a model $\mathcal{I}_n$ of $\mathcal{T}$ such that: $|C^{\mathcal{I}_n}| \geq n$.

Exercise 4.17 Prove that bisimulations are closed under

(a) composition $\circ$, and

(b) union $\cup$.

Exercise 4.18 Prove or refute the following claim:
Given an $\mathcal{ALC}$-concept C and an $\mathcal{ALC}$-TBox $\mathcal{T}$. If $\mathcal{I}$ is an interpretation and $\mathcal{J}$ its filtration w.r.t. $\mathsf{sub}(C) \cup \mathsf{sub}(\mathcal{T})$, then the relation $\rho = \{(d, [d]) \mid d \in \Delta^{\mathcal{I}}\}$ is a bisimulation.