



Description Logics

Exercise Sheet 4

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Exercise 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.

- Extend the notion of a bisimulation relation to \mathcal{ALCN} s.t. bisimulation invariance for \mathcal{ALCN} -concepts follows.
- Show bisimulation invariance for the bisimulation relation defined in exercise (a).
- Prove that \mathcal{ALCQ} is more expressive than \mathcal{ALCN} .

Exercise 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 17

Prove that bisimulations are closed under

- composition \circ , and
- union \cup .

Exercise 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. $\text{sub}(C) \cup \text{sub}(\mathcal{T})$, then the relation $\rho = \{(d, [d]) \mid d \in \Delta^{\mathcal{I}}\}$ is a bisimulation.