

First Order Logic, Description Logics, and Reasoning Excursus

Semantic Web

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1 Solution 1: First Order Logic

Express the following statements in First Order Logic:

1. Each Employee works for a Company:
 $\forall E.\exists C.(Employee(E) \rightarrow worksFor(E, C) \wedge Company(C))$
2. A Company has at least one Employee:
 $\forall C.(Company(C) \rightarrow \exists E.(worksFor(E, C)))$
3. A Manager is a (special) Employee:
 $\forall X.(Manager(X) \rightarrow Employee(X))$
4. A Manager must not work for more than two Companies:
 $\forall M.\forall X.\forall Y.\forall Z.(Manager(M) \wedge worksFor(M, X) \wedge worksFor(M, Y) \wedge worksFor(M, Z) \rightarrow (X = Y) \vee (X = Z) \vee (Y = Z))$
5. A Company cannot be an Employee at the same time
 $\forall X.(Company(X) \rightarrow \neg Employee(X))$
6. For each Employee that works for a Company we can automatically deduce that the Company employs the Employee: $\forall E.\forall C.(worksFor(E, C) \rightarrow employs(C, E))$

2 Solution 2: Description Logic

Given are again the statements from Exercise 1. Express those statements in Description Logics.

1. Each Employee works for a Company:
 $Employee \sqsubseteq \exists worksFor.Company$
2. A Company has at least one Employee:
 $Company \sqsubseteq \exists worksFor^{-}.Employee$
3. A Manager is a (special) Employee:
 $Manager \sqsubseteq Employee$

4. A Manager must not work for more than two Companies:
 $Manager \sqsubseteq \leq 2worksFor.Company$
5. A Company cannot be an Employee at the same time:
 $\perp \equiv Company \sqcap Employee$
6. For each Employee that works for a Company we can automatically deduce that the Company employs the Employee:
 $worksFor^- \equiv employs$

3 Solution 3: Description Logic

Given are the following facts and rules.

Facts:

$employs(l3s, daniel).$
 $worksFor(fabian, l3s).$

Rules:

$\forall X.\forall Y.(worksFor(X, C) \wedge workFor(Y, C)) \rightarrow colleagues(X, Y).$
 $\forall X.\forall Y.(employs(Y, X) \rightarrow worksFor(X, Y).$

1. Use SLD Resolution to formally prove that “daniel” and “fabian” are “colleagues”.

Solution: <http://www.personal-reader.de/semweb08/slides/sld-resolution.pdf>