

Knowledge Representation and Semantic Technologies

Exercises on OWL 2 profiles

Riccardo Rosati

Corso di Laurea Magistrale in Ingegneria Informatica

Sapienza Università di Roma

2016/2017

Exercise 1

Given the following TBox:

- (1) MALE \sqsubseteq PERSON
- (2) FEMALE \sqsubseteq PERSON
- (3) hasMother \sqsubseteq hasParent
- (4) hasFather \sqsubseteq hasParent
- (5) hasChild \sqsubseteq hasParent⁻
- (6) MALE \sqcap FEMALE \sqsubseteq \perp
- (7) \exists hasParent \sqsubseteq IS-CHILD
- (8) IS-CHILD \sqsubseteq \exists hasParent
- (9) \exists hasParent.HAPPY \sqsubseteq HAPPY-CHILD
- (10) \exists hasChild.HAPPY \sqsubseteq HAPPY-PARENT
- (11) HAPPY-CHILD \sqsubseteq \exists hasParent
- (12) HAPPY-PARENT \sqsubseteq \exists hasChild
- (13) HAPPY-PARENT \sqcap HAPPY-CHILD \sqsubseteq HAPPY

Exercise 1

- (a) Tell which of these axioms can be expressed in DL-Lite_R , EL, and RL, respectively;

Exercise 1

(b) given the following ABox:

MALE(Bob), MALE(Paul), FEMALE(Ann), hasMother(Paul,Ann),
hasFather(Mary,Paul), hasChild(Jane,Paul), hasChild(Jane,Bob),
HAPPY(Ann)

and the TBox obtained from the previous one by discarding the axioms not expressible in RL, determine the instances of the concept HAPPY by applying forward chaining;

(c) Given the above ABox and the TBox obtained from the previous one by discarding the axioms not expressible in DL_{Lite}_R: (c1) determine the instances of the concept HAPPY by applying query rewriting; (c2) determine the instances of the query $q(x) :- \text{hasParent}(x,y)$ by applying query rewriting.

Exercise 1(a): Solution

The axioms expressible in DL-Lite_R are:

(1), (2), (3), (4), (5), (6), (7), (8), (11), (12)

Notice that axiom (6) can be expressed in DL-Lite_R by the equivalent axiom $\text{MALE} \sqsubseteq \neg \text{FEMALE}$

The axioms expressible in EL are:

(1), (2), (7), (8), (9), (10), (11), (12), (13)

The axioms expressible in RL are:

(1), (2), (3), (4), (5), (6), (7), (9), (10), (13)

Exercise 1(b): Solution

The ABox obtained by chasing the initial ABox with the RL axioms of the TBox is the following:

MALE(Bob), MALE(Paul), FEMALE(Ann), hasMother(Paul,Ann),
hasFather(Mary,Paul), hasChild(Jane,Paul), hasChild(Jane,Bob),
HAPPY(Ann), HAPPY(Mary),
PERSON(Bob), PERSON(Paul), PERSON(Ann), hasParent(Paul,Ann),
hasParent(Mary,Paul), hasParent(Paul,Jane), hasParent(Bob,Jane),
IS-CHILD(Paul), IS-CHILD(Mary), IS-CHILD(Jane),
HAPPY-CHILD(Paul), HAPPY-PARENT(Paul), HAPPY(Paul),
HAPPY-PARENT(Ann), HAPPY-CHILD(Mary), HAPPY-PARENT(Jane)

The instances of concept HAPPY are therefore {Ann, Mary, Paul}.

Exercise 1(c1): Solution

The rewriting of the query

$q(x) :- \text{HAPPY}(x)$

w.r.t. the DL-LiteR axioms of the TBox is simply:

$q(x) :- \text{HAPPY}(x)$

since there are no subconcepts of HAPPY (notice that axiom (13) is not a DL-LiteR axiom, hence it is ignored).

By evaluating such a query on the initial ABox, we obtain the answers {Ann, Mary}.

Exercise 1(c2): Solution

The rewriting of the query

$q(x) \text{ :- hasParent}(x,y)$

w.r.t. the DL-LiteR axioms of the TBox is simply:

$q(x) \text{ :- hasParent}(x,y)$

$q(x) \text{ :- hasMother}(x,y)$

$q(x) \text{ :- hasFather}(x,y)$

$q(x) \text{ :- hasChild}(y,x)$

$q(x) \text{ :- IS-CHILD}(x)$

$q(x) \text{ :- HAPPY-CHILD}(x)$

By evaluating such a query on the initial ABox, we obtain the answers {Paul, Mary, Bob}.