

## Exercise 5 - RL Materialization

### Exercise 5

Given the *RL* knowledge base  $\langle \mathcal{T}, \mathcal{A} \rangle$ , where  $\mathcal{T}$  is the following TBox:

$$\begin{aligned} \textit{hasMother} &\sqsubseteq \textit{hasParent} \\ \textit{hasFather} &\sqsubseteq \textit{hasParent} \\ \textit{hasParent}^- &\sqsubseteq \textit{hasChild} \\ \exists \textit{hasChild}.\top &\sqsubseteq \textit{PARENT} \\ \exists \textit{hasChild}.\textit{PARENT} &\sqsubseteq \textit{GRANDPARENT} \\ \exists \textit{hasChild}.\textit{GRANDPARENT} &\sqsubseteq \textit{GREAT-GRANDPARENT} \end{aligned}$$

and  $\mathcal{A}$  is the following ABox:

$$\begin{aligned} \textit{hasMother}(\textit{John}, \textit{Ann}), \quad \textit{hasFather}(\textit{John}, \textit{Bob}), \quad \textit{hasMother}(\textit{Ann}, \textit{Mary}), \\ \textit{hasFather}(\textit{Ann}, \textit{Paul}), \quad \textit{hasMother}(\textit{Bob}, \textit{Jane}), \quad \textit{hasMother}(\textit{Paul}, \textit{Liz}) \end{aligned}$$

1. compute the materialization of the ABox  $\mathcal{A}$  with respect to the TBox  $\mathcal{T}$ ;
2. tell whether the concept assertion  $\textit{GREAT-GRANDPARENT}(\textit{Liz})$  is entailed by  $\langle \mathcal{T}, \mathcal{A} \rangle$ .

1.

The Abox obtained by chasing the initial Abox with the axioms of the Tbox is obtained by adding to the initial Abox the following assertions:

- |                           |   |                               |
|---------------------------|---|-------------------------------|
| 1 - hasParent (John, Ann) | ] | from 'hasMother (John, Ann)'  |
| 2 - hasParent (John, Bob) | ] | from 'hasFather (John, Paul)' |
| 3 - hasParent (Ann, Mary) | ] | from 'hasMother (Ann, Mary)'  |
| 4 - hasParent (Ann, Paul) | ] | from 'hasFather (Ann, Paul)'  |
| 5 - hasParent (Bob, Jane) | ] | from 'hasMother (Bob, Jane)'  |
| 6 - hasParent (Paul, Liz) | ] | from 'hasMother (Paul, Liz)'  |
|                           |   |                               |
| 7 - hasChild (Ann, John)  | ] | from 1.                       |
| 8 - hasChild (Bob, John)  | ] | from 2.                       |
| 9 - hasChild (Mary, Ann)  | ] | from 3.                       |
| 10 - hasChild (Paul, Ann) | ] | from 4.                       |
| 11 - hasChild (Jane, Bob) | ] | from 5.                       |
| 12 - hasChild (Liz, Paul) | ] | from 6.                       |
|                           |   |                               |
| 13 - PARENT (Ann)         | ] | from 7.                       |

14 -	PARENT (Bob)	]	from 8.
15 -	PARENT (Mary)	]	from 9.
16 -	PARENT (Paul)	]	from 10
17 -	PARENT (Jane)	]	from 11.
18 -	PARENT (Liz)	]	from 12.

19 -	GRANDPARENT (Mary)	]	from 9. + 13.
20 -	GRANDPARENT (Paul)	]	from 10. + 13.
21 -	GRANDPARENT (Jane)	]	from 11. + 14.
22 -	GRANDPARENT (Liz)	]	from 12. + 16.

23 -	GREAT - GRANDPARENT (Liz)]	]	from 12 + 22
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2.

GREAT - GRANDPARENT (Liz) is entitled in  $\langle T, A \rangle$   
because it does belong in the materialization of  $A$