Exercise Sheet 6: Advanced Datalog

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Exercise 6.1. Show that any query expressible in Datalog can be expressed as a safe Datalog query.

Exercise 6.2. Show that the inferences under stratified negation and under classical logical semantics do not coincide.

Exercise 6.3. Show how to express the following SPARQL features in (stratified) Datalog:

- property path expressions,
- UNION,
- MINUS, and
- NOT EXISTS.

Exercise 6.4. Compute a stratification for the following Datalog program:

$$
\begin{aligned}
\mathsf{mother}(x, y) &:- \mathsf{triple}(x, \texttt{wdt:P25}, y) \\
\mathsf{father}(x, y) &:- \mathsf{triple}(x, \texttt{wdt:P22}, y) \\
\mathsf{notSameMother}(x, y) &:- \mathsf{mother}(x, z), \neg\mathsf{mother}(y, z) \\
\mathsf{sameFather}(x, y) &:- \mathsf{father}(x, z), \mathsf{father}(y, z) \\
\mathsf{notSameFather}(x, y) &:- \neg\mathsf{sameFather}(x, y) \\
\mathsf{sameMother}(x, y) &:- \neg\mathsf{notSameMother}(x, y) \\
\mathsf{halfSiblings}(x, y) &:- \mathsf{sameMother}(x, y), \mathsf{notSameFather}(x, y) \\
\mathsf{halfSiblings}(x, y) &:- \mathsf{sameFather}(x, y), \mathsf{notSameMother}(x, y)
\end{aligned}
$$

Exercise 6.5. Use Nemo[1] to solve the following query using a Datalog program and the Wikidata SPARQL endpoint[2]: find all persons related to Q1339 (“Johann Sebastian Bach”) by a path going through P40 (“child”), P25 (“mother”), or P26 (“spouse”) edges, such that every person on this path has a statement for property P1303 (“instrument”) with value Q1444 (“Organ”).

[1] https://tools.iccl.inf.tu-dresden.de/nemo

[2] https://query.wikidata.org