Exercise Sheet 5: Advanced SPARQL

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Exercise 5.1. Show that Theorem 6.6 from the lecture fails in the presence of blank nodes: find disjoint BGPs P_1 and P_2 such that

$$\mathsf{BGP}_G(P) \neq \mathsf{Join}(\mathsf{BGP}_G(P_1), \mathsf{BGP}_G(P_2)).$$

Exercise 5.2. Show that there are sets of solution mappings M_1 and M_2 such that

- each solution in M_1 is compatible with each solution in M_2,
- M_1 and M_2 together contain more than two solutions, and
- $\mathsf{Join}(M_1, M_2)$ contains just one solution.

Note: for simplicity, we only consider sets here instead of multisets, and ignore multiplicities of solutions.

Exercise 5.3. Transform the following SPARQL group graph pattern into an expression of the SPARQL algebra. List all intermediate results.

```
{ ?person rdfs:label ?personLabel . FILTER (LANG(?personLabel) = "en")
  { ?person wdt:P166 wd:Q185667 } UNION
  { ?person wdt:P166 wd:Q1417143 }
  OPTIONAL { ?person wdt:P800 ?notableWork }
}
```

Exercise 5.4. Consider the RDF graph G:

```
eg:x eg:edge eg:x ;
     eg:value 1 .
eg:y eg:edge eg:x, eg:y ;
     eg:value 2 .
eg:z eg:edge eg:x, eg:y, eg:z ;
     eg:value 3 .
```

Evaluate the following expression of the SPARQL algebra over G:

```
Group(⟨ ?s ⟩,
  LeftJoin(
    BGP_G(?s eg:value ?v),
    BGP_G(?s eg:edge ?o),
    ?s != ?o)
)
```

The semantics of grouping are as follows: Consider some list of expressions $\Phi = \langle \varphi_1, \ldots, \varphi_n \rangle$. For a solution mapping μ, define $\Phi(\mu)$ as the list $\langle \varphi_1(\mu), \ldots, \varphi_n(\mu) \rangle$ of values obtained by evaluation these expressions for the bindings of μ. Then

$$\mathsf{Group}(\Phi, M) = \Big\{ \Phi(\mu) \mapsto \{\mu' \in M \mid \Phi(\mu') = \Phi(\mu)\} \mid \mu \in M \Big\}$$