Exercise 6.1. Can you write a SPARQL query for the Wikidata Query Service[1] that finds 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")? How?/Why not?

Does anything change if you relax the restriction on all persons on the path and only require that they have a statement for property P1303 ("instrument") with an arbitrary value?

Exercise 6.2. Given a formula φ of propositional logic, show how to decide $\varphi \in \mathbf{SAT}$ using a SPARQL query that does not contain any BGPs.

Exercise 6.3. Which of the following QBF are satisfiable? Why?/Why not?

1. $\exists p_1.\ p_1$

2. $\forall p_1.\ p_1$

3. $\exists p_1.\ \bot$

4. $\forall p_1.\exists p_2.\ p_2 \rightarrow p_1$

5. $\forall p_1.\exists p_2.\forall p_3.\ (p_1 \vee p_2) \wedge p_3$

6. $\forall p_1.\forall p_2.\exists p_3.\forall p_4.\ (p_1 \wedge p_2 \rightarrow p_4) \vee \neg p_3$

Exercise 6.4. Use the Wikidata query service[1] to find answers to the following queries:

1. the top 25 universities that employed the most professors that have been educated there (Q16188175 ("Ingerid Dal") is one such professor),

2. the top 10 musical instruments played by people who are composers by occupation or have composed something (Q1339 ("Johann Sebastian Bach") is a good starting point to explore the schema),

3. the top 15 bands and musicians by the number of bands and musicians they have influenced (you can expect both Q1299 ("The Beatles") and Q5928 ("Jimi Hendrix") to be among the results),

4. the top 30 bands by the number of things named after them or after something performed by them (except for any type of Q83620 ("thoroughfare")), together with all these things,

Hints:

- Use the SQID browser[2] to explore the schema.

- Some of the queries can be written in different ways. While this should not have any impact on the results, it might lead to different query execution plans. Hence, when your query times out, try a different approach.

- GROUP_CONCAT does not work on labels injected via the label service, you will need to retrieve these from the RDF data, or explicitly list them as parameters to the label service. They are represented using the rdfs:label predicate; you can use FILTER(LANG(?label) = "en") to restrict the results to English labels.