

Exercise Sheet 6: Advanced SPARQL

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Exercise 6.1. A k -clique in a simple graph $G = \langle V, E \rangle$ is a set $C = \{v_1, v_2, \dots, v_k\}$ of k vertices, where any two vertices $v, w \in C$ are adjacent, i.e., $\{\{v, w\} \mid v, w \in C\} \subseteq E$. Recall that a *simple path* from vertex s to vertex t is a sequence of vertices p_0, p_1, \dots, p_ℓ with $\ell > 0$ and $s = p_0 \xrightarrow{e_1} p_1 \xrightarrow{e_2} \dots \xrightarrow{e_\ell} p_\ell = t$ such that if $p_i = p_j$ for some $i \neq j$, then $\{i, j\} = \{0, \ell\}$.

Compute the function $f : \mathbb{N} \rightarrow \mathbb{N}$ that maps a number k to the number of distinct simple paths $f(k)$ in a k -clique. What is $f(5)$?

Exercise 6.2. Use the Wikidata Query Service¹ to check for the existence of a 5-clique in the P3373 (“sibling”) property.

Exercise 6.3. Using the Wikidata Query Service¹, find all persons related to Q1339 (“Johann Sebastian Bach”) by a path going through P40 (“child”), P26 (“spouse”), P25 (“mother”), P22 (“father”), or P1038 (“relative”) edges, such that every person on this path has a statement for property P1303 (“instrument”).

Can you extend the query so that it also requires that every person on the path has an P1303 (“instrument”) statement with value Q1444 (“Organ”)? How?/Why not?

¹<https://query.wikidata.org>