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Knowledge-Based Systems Group

Knowledge Graphs
Exercise Sheet 4: More SPARQL and Wikidata

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Exercise 1

Use the Wikidata query service[2] to find all characters that appear in two distinct works that are instances of a subclass of Q7725634 („literary work“).

Hint: You can use the SQID browser[3] to explore how literary works are modelled on Wikidata. Start from a simpler query and gradually refine it. For simple queries, it is good to use LIMIT to avoid overly large results while testing.

Exercise 2

Use the Wikidata query service (WDQS)[1] to find all people that have returned from two spaceflights operated by organisations from different countries and the amount of time they have spent in space. You can expect Q255764 („Yelena Kondakova“) in the results.

Exercise 3

An instance of 4×4-Sudoku is a partially-filled table as illustrated below. The goal is to fill the remaining cells with values 1, 2, 3, and 4 such that no value occurs twice in a row, in a column, or in one of the four 2×2 blocks.

1			
	2		
		4	
			3

Use SPARQL to solve this problem: find a query that returns all admissible ways of filling the grid as its answers.

a) First, define a suitable SPARQL query *and* underlying RDF graph to solve the problem.

b) Then show that your query can be modified to work using WDQS over the RDF data of this system.

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

[3] https://tools.wmflabs.org/sqid/

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

Exercise 4

A k-*clique* in a simple graph $G = \langle V, E \rangle$ is a set $C = \{ v_1, v_2, \ldots, v_k \}$ 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 $p_0, p_1, \ldots, p_\ell$ with $\ell > 0$ and $s = p_0 \xrightarrow{e_1} p_1 \xrightarrow{e_2} \cdots \xrightarrow{e_\ell} p_\ell = t$ such that if $p_i = p_j$ for some $i \neq j$, then $\{ i, j \} = \{ 0, \ell \}$.

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

Exercise 5

Use the WDQS to check for the existence of a 5-clique in the P3373 („sibling“) property.

Exercise 6

The bibliographic database DBLP[1] offers individual data records as RDF in N-Triples format. This data can be downloaded from the URL obtained by appending `.nt` to the URI. Use this interface to find all publications that have https://dblp.org/pid/s/RudiStuder.html as their only author.

- Download some RDF files in your browser to find out how this information is encoded.
- Write a program that crawls a small part of the data to answer the query.

Note: If your program sends too many requests in a short time, the server will deny the request and cancel the connection. Dirty trick: use `time.sleep(1)` before executing a request.

Hint: `requests`[2] provides a high-level API for making HTTP requests in Python, but you may need to install it, e.g., using `pip`.[3] A built-in alternative that provides a lower-level interface is `urllib.requests`.[4]

[1] https://dblp.org
[2] https://requests.readthedocs.io/en/latest/
[3] https://pypi.org/project/pip/
[4] https://docs.python.org/3/library/urllib.request.html