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Data Models and Query Languages Summerterm 2014

5. Exercise Sheet: RDF & SPARQL

Submission: 10.07.2014, 14:00
Discussion: 10.07.2014

Submission Guidelines: Please hand out your written solutions directly to your tutors right before the exercise session. If you want to submit before the deadline, you can leave your solutions in the mail box in building 51-01 (first floor). Hand written solutions are also accepted as long as these are readable.

Exercise 1 (Modelling in RDF, 5 Points)

Encode the following scenario in RDF. Modellieren Sie das folgende Szenario als RDF Datenbank.

Die Grundschule Freiburg hat drei MitarbeiterInnen: Lehrer Herr Maier, Lehrerin Frau Schmidt, sowie die Direktorin Frau Koster, die – zusätzlich zu ihren administrativen Aufgaben als Rektorin – auch Schüler unterrichtet. Herr Maier ist den Erstklässlern zugeteilt, während Frau Schmidt und Frau Koster gemeinsam die Klassen 2-4 unterrichten. Herr Maier hat eine Spezialausbildung als Sportlehrer und unterrichtet deshalb alle Klassen im Fach Sport. Jede Klasse hat einen Klassensprecher und mindestens einen Schüler. Marie ist Klassensprecherin der vierten Klasse. Ihre Lieblingsfächer sind Sport, Malen und Mathematik.

The elementary school of Freiburg has three employees: the two teachers Mr. Maier and Mrs. Schmidt, and the schoolmaster Mrs. Koster. In addition to their administrative duties, Mrs. Koster also does some teaching. In particular, Mr. Maier is assigned to the first-graders, while Mrs. Schmidt and Mrs. Koster together teach the second-, third-, and fourth-graders. Mr. Maier has specialized in sports and therefore is assigned to physical education for all four grades of school. Each grade has a class representative and at least one pupil. Actually, Marie is a fourth-grader. Her favourite subjects in school are physical education, painting, and mathematics.

Use URIs, Blank Nodes, Literals, and RDF containers in your RDF graph. Whenever it makes sense, also use the `rdfs` vocabulary, in particular `rdfs:subClassOf`, `rdfs:subPropertyOf`, `rdfs:domain`, and `rdfs:range`. Finally list the facts that can be derived from your graph according to the RDFS semantics.

Exercise 2 (Evaluating SPARQL Queries, 10 Points)

Consider the RDF database

```
D := { (.:P1,rdf:type,Person), (.:P1,name,"Pete"), (.:P1,age,"17"), (.:P1,email,"pete@abc.com"),
      (.:P2,rdf:type,Person), (.:P2,name,"John"), (.:P2,email,"john@abc.com"),
      (.:P3,rdf:type,Person), (.:P3,name,"Sue"), (.:P3,age,"21"),
      (.:P1,knows,.:P2), (.:P1,knows,.:P3), (.:P2,knows,.:P1), (.:P2,knows,.:P3) }.
```

Draw the RDF graph. Evaluate the following SPARQL graph patterns step by step according to the semantics introduced in the lecture and phrase their semantics in plain English.

Assume that every of the following queries is preceded by the necessary namespace definitions and the Select * solution format.

- a) { ?p rdf:type Person. ?p age ?age. FILTER (?age>20) }
- b) { { ?p rdf:type Person. ?p name ?name. } OPTIONAL { ?p age ?age . } }
- c) { { ?p rdf:type Person. ?p age ?age. } UNION { ?p rdf:type Person. ?p email ?email. } }
- d) { { ?p rdf:type Person. OPTIONAL ?p email ?email. } FILTER (!bound(?email)) }

Exercise 3 (SPARQL Queries, 10 Points)

Consider the RDF database *D* from the previous exercise. You can find the corresponding RDF triples in the attached file (persons.n3). Use the Sesame Workbench in order to import the triple file into an In memory store. Afterwards, Specify the following requests as SPARQL queries and indicate the final results obtained when evaluating them on document *D*. Verify your queries using the Sesame Workbench and its SPARQL engine.

- a) All pairs of distinct persons that have a common friend (i.e., it must hold that the intersection of persons they know is non-empty).
- b) The names of all persons that know at least one person or are younger than 20 years. If present, the email address and, also if present, the age of this person should be included in the result.
- c) Construct a new graph using the CONSTRUCT form that contains all persons (including their names) that know at least two persons.
- d) All Persons, which are directly or indirectly connected via the knows-predicate.
- e) All cyclic knows-relationships.