

Semantic Web Technologies - First Exam

20 June 2007

You are not allowed to use any course material; the only thing on the table should be this exam sheet, the helper sheet, the answer sheets, and a pen.

All RDF graphs are written using the Turtle syntax.

Throughout the exam, the namespace abbreviation `rdf` stands for `http://www.w3.org/1999/02/22-rdf-syntax-ns#`, `rdfs` stands for `http://www.w3.org/2000/01/rdf-schema#`, `owl` stands for `http://www.w3.org/2002/07/owl#`, `xsd` stands for `http://www.w3.org/2001/XMLSchema#`, and the default namespace is `http://example.org/example#`.

You can earn a total of 100 points for this exam. The maximum number of points awarded for each individual question is indicated together with the question.

55 points corresponds to the grade of 18, which the minimum grade required to pass the exam.

1. (10) Ontologies

- (a) Why is it a good idea to formulate competency questions in the first step of ontology modeling?
- (b) What is the benefit of specifying an ontology using a *formal* language?

2. (20) RDF(S)

We say that the RDFS properties for ontology specification (`rdf:type`, `rdfs:subClassOf`, `rdfs:subPropertyOf`, `rdfs:range`, `rdfs:domain`) are used in a nonstandard way if they do not occur in the property position of a triple.

Consider the RDF graph S :

```
:john rdf:type :Person .
```

```
rdf:type rdfs:range :myClass .
```

In S , the property `rdf:type` is used in a non-standard way: The `rdfs:range` of `rdf:type` is declared to be `:myClass`. An example of a triple which is entailed because of this use is: `:Person rdf:type :myClass` .

- (a) Create an RDF graph G which features the use of `rdfs:range` and/or `rdfs:subPropertyOf` in a nonstandard way. You can choose to either extend the given RDF graph or create a new graph.
- (b) Show at least two triples involving the RDF(S) vocabulary which are entailed by G due to the nonstandard use of `rdfs:range` and/or `rdfs:subPropertyOf` and which are not included in G .

3. (20) RDFS Entailment

Given the RDF graph H :

```

:napolitano rdf:type :HeadOfState .
:President rdfs:subClassOf :HeadOfState .
_:x :presidentOf :italy .
:presidentOf rdfs:domain :President .
:presidentOf rdfs:range :Country .
:napolitano :presidentOf _:y .
:presidentOf rdfs:subPropertyOf _:z .

```

Which of the following triples are **not** part of the RDFS-entailed graph (there may be 0 or more)?

- (a) `:HeadOfState rdf:type _:h .`
- (b) `:napolitano :presidentOf :italy .`
- (c) `:presidentOf rdfs:subPropertyOf _:l .`
- (d) `_:z rdfs:domain :President .`
- (e) `_:o :presidentOf _:q.`
- (f) `:italy rdf:type :Country .`

4. (20) SPARQL

Consider the graph H from question 3.

- (a) Write a SPARQL query which retrieves all properties whose domain and range are different (assuming every property has one domain and one range). What are the answers to your query if evaluated with respect to the graph H ?
- (b) Write a SPARQL query which retrieves all countries which have a president and, optionally, the `rdf:type` of this president.
- (c) Which entailment regime is used in SPARQL?
- (d) Will your query, if evaluated with respect to H , retrieve any course? And which `rdf:type` will its president have?

5. (10) OWL

- (a) RDFS has the following main ontology modeling features: (1) class and class hierarchies, (2) properties and property hierarchies, (3) domain restrictions, and (4) range restrictions. Mention at least 5 ontology modeling features of OWL Lite which are not in RDFS.
- (b) What is the main distinction between OWL Lite and OWL DL?

6. (10) F-Logic

Write the RDFS ontology of question 3 as an F-logic ontology plus rules.

7. (10) Applications

- (a) What is GRDDL used for? Sketch how it works.
- (b) What is the (or one of the) main application scenario(s) for Semantic Web technologies in Life Sciences, i.e. what are Semantic Web technologies used for? What are the major benefits of using Semantic Web technologies in this scenario?