M2R Exam – Semantic web: from XML to OWL
Semantic web part

Duration : 1h
Documents allowed – no communication device allowed

November 2015

Note: Read all the questions carefully before answering.

RDF Entailment

We have two graphs coming from two different sources. Consider the graph G_1 coming from the municipality made of the following triples:

```
a:Pierre o1:father a:Carole .
a:Pierre o1:father a:Kevin .
a:Jacques o1:father a:Jean .
_:b1 o1:father a:Sylvie .
_:b1 o1:father a:William .
a:Jacques o1:father a:Julie .
a:Sven o1:father a:Laurent .
```

```
a:Marie o1:mother a:Carole .
a:Marie o1:mother a:Kevin .
a:Marie o1:mother a:Jean .
a:Stephanie o1:mother a:Sylvie .
a:Stephanie o1:mother a:William .
a:Nabila o1:mother a:Julie.
a:Lucie o1:mother a:Laurent .
```

and G_2 coming from the school made of the following information:

```
a:Carole o2:attendsClass b:4e3.
a:Kevin o2:attendsClass b:6e1 .
a:Sylvie o2:attendsClass b:5e2 .
a:William o2:attendsClass b:5e2 .
a:Julie o2:attendsClass b:5e2 .
a:Laurent o2:attendsClass b:4e3  .
a:Jasmine o2:attendsClass b:5e1 .
```

```
a:Carole rdf:type o2:Female .
a:Kevin rdf:type o2:Male .
a:Sylvie rdf:type o2:Female .
a:William rdf:type o2:Male .
a:Julie rdf:type o2:Female .
a:Laurent rdf:type o2:Male .
a:Jasmine rdf:type o2:Female .
```

1. Draw these two graphs (together);
2. In order, to work with these two graphs, we want to answer queries that span through both of them. Consider the following graph Q_1:

   ```
   _:x o2:attendsClass _:w .
   _:y o2:attendsClass _:w .
   _:x rdf:type o2:Male .
   _:y rdf:type o2:Female .
   _:z o:parent _:x .
   _:z o:parent _:y .
   ```

   Express in English the meaning of Q_1. Is Q_1 entailed by any of G_1 or G_2? (explain why)
3. Express the graph Q_2 corresponding to the English: "there exist two people sharing at least one parent attending the same class"? Does $Q_2 \models_{RDF} Q_1$ or $Q_1 \models_{RDF} Q_2$?

RDFS and OWL interpretation

4. One convenient way to interpret together two heterogeneous sources is to interpret them through a common ontology. Consider the ontology O made of the following statements:

```
o:parent rdfs:domain foaf:Person .
o:parent rdfs:range foaf:Person .
o1:mother rdfs:subPropertyOf o:parent .
o1:father rdfs:subPropertyOf o:parent .
o1:mother rdfs:domain o2:Female .
o1:father rdfs:domain o2:Male .
```

   Does $O \cup G_1 \cup G_2 \models_{RDF} Q_1$?

5. Does $O \cup G_1 \cup G_2 \models_{RDFS} Q_1$? (explain your answer) Give all mappings (variable/blank assignments) which support this entailment. What additional facts does $O \cup G_1 \cup G_2$ RDFS-entail? (provide an example).

6. Can you express in OWL the class `o:ParentOfNumerousChildren`, as the class of those parents with more than three children, using the concepts and properties of ontology O? Give the interpretation of this (compound) class.