# TU Vienna

## 2007 Winter Semester

End of Semester Examination

# ESW

# Einführung ins Semantic Web

**Time:** 2.0 Hours
**Date of Examination:** January 28th, 2008

**SID: .....**

**Instructions to the Candidate:**

- **Please ensure that your student id number is filled in on this cover!**
- Answer all questions in this booklet in the spaces provided.
- The size of the empty space reflects roughly the expectation on the length of your answer.
- You may use any course material.
- For multiple-choice questions any number of correct answers is possible (zero, 1, ..., all).
- Text questions must be answered in a few sentences.
- If you run out of space, you can use the empty page on the left.

## Question 1 (10%)

Formalize each of the following statements into description logic (DL). When a particular statement (or a part of it) cannot be fully expressed in DL, explain why not.

- Someone is a `CATOWNER` if he (or she) `owns` at least one `CAT`.

- `sacklpicker` is a `CAT`.

- Always when someone is a `CATOWNER` he must be a `CATLOVER`.

- If a particular person `loves` a particular cat, then that person also owns that cat.

- A `DOGLOVER` is a `PERSON` who `owns` only `DOG`s as an `ANIMAL` (and not a single `CAT`, which is also an `ANIMAL`).

## Question 2 (10%)

In Topic Maps the identification of subjects is done with subject identifiers (sometimes called *indicators*) and/or subject locators (sometimes called the *addresses*). Explain how these relate to the identification of resources in RDF.

- *subject identifiers*:

- *subject address*:

## Question 3 (9%)

Consider the following T-box:

```
Bundesland    a       owl:Class ;
      owl:oneOf (:Wien :Burgenland :Salzburg) .

:Person       a       owl:Class .

:istHauptGemeldet
      a       owl:ObjectProperty ;
      rdfs:domain :Person .

:Wiener       a       owl:Class ;
      rdfs:subClassOf :Person ;
      rdfs:subClassOf
              [ a       owl:Restriction ;
                owl:onProperty :istHauptGemeldet ;
                owl:someValuesFrom
                        [ a       owl:Class ;
                          owl:oneOf (:Wien)
                        ]
              ] .

:NichtWiener  a       owl:Class ;
      rdfs:subClassOf :Person ;
      owl:equivalentClass
              [ a       owl:Class ;
                owl:complementOf :Wiener
              ] .

:Oesterreicher  a       owl:Class ;
      rdfs:subClassOf :Person ;
      owl:equivalentClass
              [ a       owl:Class ;
                owl:unionOf (:Wiener :NichtWiener)
              ] .
```

- Is it inconsistent? Justify your answer (e.g. by finding a model).

- If it is consistent, does it have another serious problem? Justify your answer.

## Question 4 (9%)

Given the following database schema for a relational database

```
Person  := ( id, Name, Birthdate )
Course  := ( id, Title, Code, Synopsis )
Student := ( Person.id, Course.id, MatrikelNr )
```

- How could this be expressed in RDF-S (any notation will do)?

- Write a SPARQL query against your RDF-S schema to select all students (only their birthdates) from the course `ESW` (use proper namespaces).

- How would this SPARQL query be translated into an SQL query statement for the above?

## Question 5 (10%)

Given the following ontology (together with some instance data)

```
@prefix :     <http://www.whatever.com/#> .

:Person       a       owl:Class .

:Opus         a       owl:Class .

:Painting     a       owl:Class ;  rdfs:subClassOf :Opus .

:MasterPiece  a       owl:Class ;   rdfs:subClassOf :Painting .

:hasCreated   a       owl:ObjectProperty .

:hasPainted   a       owl:ObjectProperty ;  rdfs:subPropertyOf :hasCreated .

:Genius       a       owl:Class ;  rdfs:subClassOf :Person ;
       owl:equivalentClass
               [ a       owl:Restriction ;
                 owl:onProperty :hasCreated ;
                 owl:someValuesFrom :MasterPiece
               ] .

:VanGogh      a       :Person ;  :hasPainted :TheOldMill .

:TheOldMill   a       :MasterPiece .
```

- If the SPARQL query

  ```
  SELECT ?person
   WHERE {
     ?person a  <http://www.whatever.com/#Genius>
   }
  ```

  is used with software (such as Redland libRDF) which does not support DL inferencing, what would be the expected result?

- If you **have to** use, say, Redland, but you need inferencing, what are your technical options? Describe at least one.

## Question 6 (15%)

Translate the following DL formulas into FOL (predicate logic):

- $\texttt{CATLOVER} \equiv \exists \texttt{loves.CAT} \sqcap \texttt{PERSON}$

- $\texttt{CATHATERS} \sqsubseteq \texttt{PERSON} \sqcap \neg \texttt{CATLOVER}$

- $\forall \texttt{loves.CAT} \sqsupseteq \exists \texttt{hates.DOG}$

Translate the following FOL formulas into DL:

- $\forall d \in \texttt{DOG} : \forall p \in \texttt{PERSON} : \texttt{loves}(d, p) \Rightarrow \texttt{loves}(p, d)$

- $\forall c \in \texttt{CAT} : \exists p \in \texttt{PERSON} : \texttt{loves}(c, p) \Rightarrow \texttt{loves}(p, c)$

## Question 7 (15%)

Regarding property characteristics in OWL:

- If you tag a property $p$ as *symmetric* and *functional*, what are the consequences for the property and the connected nodes, if any?

- If you tag a property $p$ as *symmetric* and *inverse functional*, what are the consequences for the property and the connected nodes, if any?

- If you tag a property $p$ as *transitive* and *functional*, what are the consequences for the property and the connected nodes, if any?

## Question 8 (10%)

Given the following RDF triples, how would that translate into a topic map? Draw a diagram and label all nodes and arcs appropriately.

```
:rho isa :Person .

:sacklpicker isa :Cat .

:rho :owns :sacklpicker .
```

## Question 9 (12%)

Ad SPARQL:

- The query result is a single boolean value if `ASK` instead of `SELECT` is used. Under which circumstances can (should) `ASK` be preferred over the more generic `SELECT`?

- You cannot write `SELECT ... WHERE { NOT $p a foaf:Person }` . Why not?

- Describe a use case for using several data sets.

End of Paper.