Logics for Data and Knowledge Representation: 7th July 2014

NAME …….. SURNAME …….. STUDENT ID……..

1. [6 PT] Say (mark with an X) whether the following statements are true (T) or false (F).

a)	**Venn diagrams can be used to prove the satisfiability of a DL formula w.r.t. a TBox, but they cannot be used to prove its validity**	**□ T** **□ F**
b)	**The DERA methodology provides concrete guidelines to develop a classification ontology**	**□ T** **□ F**
c)	**In DL, the ABox service that given a concept C retrieves all the instances *a* which satisfy C is called concept realization**	**□ T** **□ F**
d)	**Structured attributes such as address and contact can be represented in RDF using blank node**	**□ T** **□ F**
e)	**The SPARQL construct OFFSET is applied to show the elements of the solution set starting after a specified number**	**□ T** **□ F**
f)	**In OWL Lite equivalentClass and intersectionOf can be used in a triple if the subject or object represents an anonymous class**	**□ T** **□ F**

2. [2 PT] Briefly explain the role of natural language processing in semantic matching.

NLP has a key role in the process that leads to the conversion of a classification into a lightweight ontology. In fact, NLP is the process by which node labels are translated into concepts at labels. In turn, this is preliminary to the computation of the concept at node.

3. [2 PT] Provide the formal definition of satisfiability and validity in DL

Satisfiability:
Let σ be a class-valuation on language L, we define the truth-relation (or class-satisfaction relation) ⊨ and write σ ⊨ P (read: σ satisfies P) iff σ(P) ≠ ∅

Validity:
P is valid if σ ⊨ P for all σ

4. **[4 PT] Translate the following natural language sentences in DL language with lowest expressiveness possible (e.g. AL, ALC, FL0…) and say which of the languages you used:**
   a. **Monkeys are animals that only eat bananas**
   b. **A doctor is a person with at least a degree in medicine**
   c. **A bird is a vertebrate with two wings**
   d. **A Policeman cannot read restricted files**

MONKEY $\sqsubseteq$ ANIMAL $\sqcap$ $\forall$EAT.BANANA (FL0)

DOCTOR $\sqsubseteq$ PERSON $\sqcap$ $\exists$hasMedicineDegree.$\top$ (AL)

BIRD $\sqsubseteq$ VERTEBRATE $\sqcap$ $\geq$2 WING $\sqcap$ $\leq$2 WING (ALN)

POLICEMAN $\sqsubseteq$ $\neg\exists$READ.RESTRICTED-FILE (ALCE)

5. **[2 PT] Explain the meaning of the following access control rule of RELBAC: $O \sqsubseteq \forall P^{-1}.S$**

It defines the class of objects O which can be accessed, through permission P, only by subjects in S.

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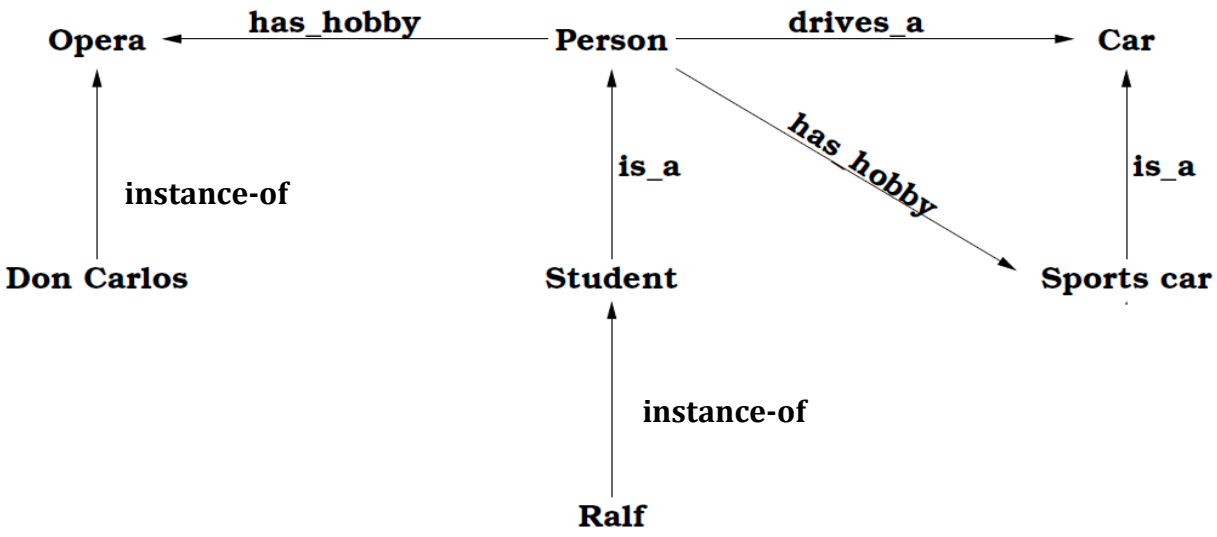
6. [3 PT] Given the TBox T and ABox A below, check if A is consistent with T via expansion of A. T = {A ≡ ¬ B ⊓ ¬ C, B ≡ D ⊓ C}; A = {¬ B(a), C(a), A(a)};

It is not. In fact, by expanding A(a) we obtain ¬ B(a) and ¬ C(a). Thus, we have both C(a) and ¬C(a) in the ABox.

7. [3 PT] Formalize the following semantic network in DL



Person ⊑ ∃Drives.Car
Person ⊑ ∃HasHobby.SportCar
Person ⊑ ∃HasHobby.Opera
Student ⊑ Person
SportCar ⊑ Car
Student(Ralf)
Opera(DonCarlos)

8. **[3 PT] The Linked Data approach forms the basis of data publishing guidelines underlining how data from government, public and private sectors can be more valuable for the consumers. Briefly describe the 5-star rating publishing system.**

Star rating system in publishing data is described below:

- **Getting 1-star requires publishing data on the Web with an open license regardless of format, e.g., datasets can be published as images; this is also called Open Data**
- **Producing 2-star data requires the Open Data to be made available in structured format (e.g., excel; proprietary) in order to make it become machine readable**
- **Producing 3-star data requires non-proprietary formats, e.g., csv or tsv, on top of the previous rating levels**
- **Getting 4-star requires publishing data using W3C open standards, e.g., RDF**
- **Achieving 5-star, the highest level in the rating spectrum, demands establishing links to RDF datasets published by others**

9. **[3 PT] Human brain has 6 different lobes; each performs a set of functions. Represent in OWL that a** *:BrainLobe* **is exclusively either a** *:FrontalLobe*, **a** *:ParietalLobe*, **a** *:TemporalLobe*, **a** *:OccipitalLobe*, **a** *:LimbicLobe or* **a** *:InsularLobe*

DisjointUnion(*:BrainLobe :FrontalLobe :ParietalLobe :TemporalLobe :OccipitalLobe :LimbicLobe :InsularLobe*)

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10. [3 PT] Which OWL constructs support the encoding of the following statements?

a) **If x is brother of y and y is son of z then x is son of z.**
b) **If y is brother of z and z is father of x, then y is uncle of x.**
c) **If disease x is located in body part y which is part of body part z, then x is located in z.**

Represent all three statements provided above in OWL.

SubPropertyOf and ObjectPropertyChain support the encoding of such statements.

a) **SubPropertyOf(ObjectPropertyChain(:brotherOf :sonOf) :sonOf)**

b) **SubPropertyOf(ObjectPropertyChain(:brotherOf :fatherOf) :uncleOf)**

c) **SubPropertyOf(ObjectPropertyChain(:locatedIn :part of) :locatedIn)**

11. [2 PT] Suppose that an RDF model represents information about real world entities of unknown types. The entities can be companies, research centers, research projects, universities, etc.

a) **Write a SPARQL query that can return all possible information about all kinds of entities.**
b) **Write a SPARQL query that can return at most 10 triples representing information**

a)
```
SELECT ?x ?y ?z
WHERE { ?x ?y ?z }
```

b)
```
SELECT ?x ?y ?z
WHERE { ?x ?y ?z }
LIMIT 10
```