Faculty of Computers and Information
Cairo University

Final Exam

Program: Software Engineering
Course Name: Knowledge Engineering
Course Code: SCS465
Examiner(s): Prof.Abeer Mohamed ElKorany

Date: 24-5-2018
Duration: 2 hours
Total Marks: 60

Question 1 [16 marks]

A. *State True/False (Explain) [6 marks]*

1. We can perform reasoning and infer new statements from a database schema like we do from an ontology structure.

2. The head part of Inference rules for OWL only contain disjunction form

3. Every individual in OWL world is a member of the class owl:Thing.

4. Every class is OWL IS a super class of owl:NoThing

5. The SPARQL keyword "OPTIONAL" enables you to bring data if it exists and ignores it if it does not.

6. A functional property is a property that can have only unique value for each individual

B. Complete the following statements. (10 Marks)

1. "Ahmed hasPet Leo". The type of Ahmed is 'Person' and the type of Leo is 'Animal'. Then:
   a. Domain of the property 'hasPet' is: …….
   b. Range of the property 'hasPet' is: …….

2. ……is when a specific value in RDF is bound to a variable in a graph pattern.

3. . …… was introduced to represent data and their meaning for the Semantic Web when XML was not sufficient, while ……was introduced to allow defining vocabulary and class hierarchies.

4. …….. is a solution modifier used in SPARQL to specify the maximum number of rows that should be returned.

5. Any RDF graph must be ……

6. In SPARQL …… is used to check if there is at least one result for a given query pattern and if the result is true or false

Question 2: SPARQL (10 Marks)

Read the following data and answer the questions based on this data:

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX ex: <http://www.semanticweb.org//ontologies/book_ontology#>

```
ex:book1    ex:hasTitle              "Lord of the Rings".
ex:book1    ex:writtenBy             ex:JRRTolkien.
ex:book1    ex:publishedInYear       "1954".
ex:book1    ex:originalLanguage      ex:English.
ex:book1    ex:hasGenre              ex:Fantasy.

ex:book2    ex:hasTitle              "Alquimista".
ex:book2    ex:writtenBy             ex:PauloCoelho.
ex:book2    ex:publishedInYear       "1988".
ex:book2    ex:originalLanguage      ex:Portugese.

ex:book3   ex:hasTitle               "Harry Potter and the Prisoner of Azkaban".
ex:book3   ex:writtenBy              “ex: J. K. Rowling”
ex:book3    ex:publishedInYear       "1999".
ex:book3    ex:originalLanguage      ex:English.

ex:JRRTolkien ex:hasNationality      ex:British.
ex:JRRTolkien ex:hasNationality      ex:British.
ex:PauloCoelho ex:hasNationality     ex:Brazilian.
```

a. Write a SPARQL query to retrieve the title, author, and (if available) the genre of books published by a Brazilian author. (4 Marks)

b. What is the output of the following query? Do not explain in your own words. Only provide the output if this query was executed (e.g. in Protégé). (3 Marks)

```
CONSTRUCT
{       ?book rdf:type newEx:OldEnglishBooks.
        ?book newEx:hasAuthor ?author.
        ?book newEx:hasName ?title.
}

WHERE
{       ?book ex:publishedInYear ?year.
        ?book ex:hasTitle ?title.
        ?book ex:writtenBy ?author.
        ?book ex:originalLanguage ex:English.
        Filter (?year<1960).
```

c. Will the following SPARQL queries give the same result? (Yes/No). Write down the results of both queries. (If they have the same results, write it only once). (3 Marks)

1. SELECT ?book ?author ?year
WHERE
{
?book ex:writtenBy ?author .
?book ex:publishedInYear ?year.
}
ORDER BY DESC(?year)
LIMIT 1

2. SELECT ?book ?author ?year
WHERE
{
?book ex:writtenBy ?author .
?book ex:publishedInYear ?year.
Filter (?year>1990).
}

Question 3 (6 Mark)

Which of the basic primitives of ontology is suitable to represents the following:

I. Earth ,Wind , Fire ,Water
II. Elephant, animal, eats, plant
III. Driver, Car, Motor, SteelBody_of_car, Mechanical -engineer

Describe relationships between them using owl primitives such as : type , sub-class , disjointness, cardinality, domain, range, or add appropriate relationships (if necessary).

Question 4 (8 Mark)

a) The following statement can be written in RDF without giving errors.
"Discrete Maths is **taught by** Concrete Maths"

I. Explain problem with this statement ?
II. How can we solve this problem?
III. Give two limitations in RDFS for which OWL was introduced to overcome
IV. (Give examples of statements we can make in OWL but not in RDFS to support your answer).

b) Consider the property *eats* with domain *animal* and range *animal or plant*. Suppose we define a new sub-class *vegetarian of animal.* Name a desirable restriction on *eats* for this class. Do you think that this restriction can be expressed in RDF by using rdfs : range ? Expalin your answer by representing this property with its resstriction.

Question 5 [10 marks]

Give an OWL-ontology that describes the following:

There are courses and laboratory courses. Homework's are part of courses. Courses are organized by teachers. Teachers are either professors or assistants. Professors teach courses while assistants only teach laboratory courses.

1. Draw a diagram for that ontology
2. Write OWL statement that describe the following:
    - classes , property, relationships , restrictions

Question6 (10 Marks)

Consider the following OWL ontology

```
<rdf:RDF xmlns:owl ="http://www.w3.org/2002/07/owl#"
 xmlns:rdf ="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
 xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#">

<owl:Class rdf:ID="A" />
<owl:Class rdf:ID="B" /> <rdfs:subClassOf rdf:resource="#A" /> </owl:Class>
<owl:ObjectProperty rdf:ID="C" />
<owl:ObjectProperty rdf:ID="D"> <rdfs:subPropertyOf rdf:resource="#C" /> </owl:ObjectProperty>
<owl:DatatypeProperty rdf:ID="E" />
<owl:ObjectProperty rdf:ID="F">
<rdf:type rdf:resource="&owl;TransitiveProperty" />
</owl:ObjectProperty>
<owl:Class rdf:ID="G"> <owl:equivalentClass> <owl:Restriction>
<owl:onProperty rdf:resource="#C" />
<owl:minCardinality rdf:datatype="&xsd;nonNegativeInteger"> 1</owl:minCardinality>
 </owl:Restriction>
 </owl:equivalentClass>
</owl:Class>
</rdf:RDF>
```

Identify which of the following identifiers could be used to replace **A,B,C,D,….G** respectively that are used by the above ontology to make it more descriptive of family relationship and then draw the ontology graphically

Person, has-child, is-taller-than, Man, age, has-daughter, Parent

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