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Final Exam

Department:

Course Title: Knowledge Based Systems
Course Code: CS465
Semester: First
Instructor: Dr. Abeer ElKorany/Dr. Khadeja ElBedwehy
Date: 20/1/2015
Exam Duration: 2 Hours

Question	Mark	Signature
One		
Two		
Three		
Four		
Five		
Six		
Seven		
Eight		
Nine		
Ten		
Total Marks		

60

Total Marks in Writing: _____

Exam is only 10 pages

Question 1 [16 marks]

A. State True/False (Explain) [4 marks]

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

---

2. An instance of a superclass is also an instance of its subclasses.

---

3. The SPARQL keyword "OPTIONA"L enables you to bring data if it exists and ignores it if it does not.

---

4. Knowledge elicitation process is the same as knowledge acquisition process

---

B. Complete the following statements. (10 Marks)

1. During .....cycle, rules are compared to facts in working memory to select the rule to be fired, but if no rule matches then stop.

2. ..... process is often used to designing, building, and installing a knowledge based system

3. .....values are added to rules in order to control the sequence of rule-firing

4. "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: .....

5. .....: is when a specific value in RDF is bound to a variable in a graph pattern.

6. . ..... 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.

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

8. An RDF graph must be ..... and .....

c) Choose the right answer(s) [2 marks]

1. The current web is called "..... web", while the semantic web is referred to as.....
   a. semantic
   b. linked data
   c. web of data
   d. syntactic

2. ..... check if there is at least one result for a given query pattern. The result is true or false, while ..... returns an RDF graph with information about a specific resource.
   a. Describe
   b. Select
   c. Ask
   d. Construct

Question Two (4 marks)

a. Give one use for equivalent classes. You can explain using an example. (1 Mark)

b. The following statement can be written in RDF without giving errors. (1 Mark)

"Discrete Maths is **taught by** Concrete Maths"

a. What is the problem with this statement?

b. How can we solve this problem?

c. Give two limitations in RDFS for which OWL was introduced to overcome (You can give examples of statements we can make in OWL but not in RDFS to support your answer). (2 Marks)

Question3: RDF and OWL (12 Marks)

Read the following statements.

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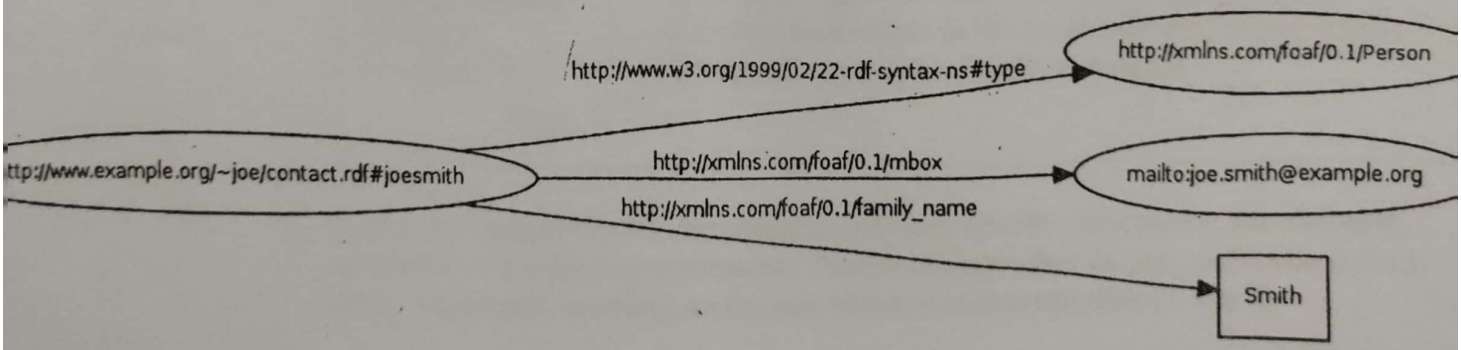
```
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
                  xmlns:foaf="http://xmlns.com/foaf/0.1/"
                  xmlns="http://www.example.org/~joe/contact.rdf#">

<foaf:Person rdf:about=
"http://www.example.org/~joe/contact.rdf#joesmith">

<owl:sameAs rdf:resource="http://www.semanticWeb.org/JSmith" />

<foaf:mbox rdf:resource="mailto:joe.smith@example.org"/>

<foaf:homepage rdf:resource="http://www.example.org/~joe/"/>

<foaf:family_name>Smith</foaf:family_name>

<foaf:givenname>Joe</foaf:givenname>

</foaf:Person>
</rdf:RDF>
```

a. The graph shown below represents these statements. But there are 2 statements that are not shown here. Please add them to the graph. (1 Mark)



b. In this statement: (1 Mark)
<foaf:Person rdf:about=
"http://www.example.org/~joe/contact.rdf#joesmith">
What is the use of "rdf:about"?

c. Give two examples for data properties and two examples of object properties (2 Marks

d. Add to the graph an instance http://www.example.org/~sarah/ and also add the relation "foaf:knows" between "sarah" and "joe". (2 Marks)

e. You are given the URI "http://www.semanticWeb.org/JSmith", in addition to the URI already found in the statements above (http://www.example.org/~joe/contact.rdf#joesmith). Can they refer to the same instance in real world? (Yes/No) Can you make sure they do/don't? If you can, do you need to use RDF, RDFS or OWL? (3 Marks)

f. Match each term with its definition. (2 Marks)

1. Equivalent Class	a) A class that inherits the properties of the first class.
2. Disjoint Classes	b) Classes that cannot have instances in common.
3. Instance	c) A class that refers to the same concept in real world.
4. Subclass	d)A specific example of a given concept.

---

g. Functional properties can be useful in defining specific statements, for example, as used in the following statements. Please explain what do you understand from these statements focusing on the use of functional properties (1 Mark)

```
<owl:ObjectProperty rdf:about="#Typing">
<rdf:type rdf:resource="#owl;FunctionalProperty"/>
<rdfs:domain rdf:resource="#Language"/>
<rdfs:range rdf:resource="#Type"/>
</owl:ObjectProperty>
```

Question 4: SPARQL (8 Marks)

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

```
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:book13 ex:originalLanguage      ex:English.

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

You can assume you have the following prefixes in all the queries. Do not rewrite them.

```
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#>
```

a. Write a SPARQL query to retrieve the title, author, and (if available) the genre of books published by a Brazilian author. (3 Marks)

```
SELECT
WHERE
{




}
```

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) . (2 Marks)

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

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

Question 5 [10 marks]

A) Consider that following values represent (hypothetically) three mutually exclusive and hypotheses that a patient could have a cold ;an allergy; and sensitivity to light with the following probabilities: 0.6, 0.3 and 0.1 respectively. Suppose that an expert provided two conditionally independent evidences E_1, and E_2 (sneeze and cough) which create the above mentioned hypotheses according to the following table:

	H1 (cold)	H2 (allergy)	H3 (light sensitive)
$P(E_1 \mid H_i)$	0.3	0.8	0.3
$P(E_2 \mid H_i)$	0.6	0.9	0.0

If Ahmed is sneezing what is the probability that Ahmed has a cold; allergy; and sensitivity respectively using Bayesian Rule ***[6 marks]***

B)Consider the following set of rules:

R1: If ?X coughs and ?X was observed sneezing and ?X has headache then ?X has cold (CF:0.7)

R2: If ?X has fever then ?X has cold (CF: 0.5)

Assume that we are certain about the following facts:
F1: Ahmed coughs
F2: Ahmed was observed sneezing
F3: Ahmed has headache
with **0.5, 0.6, and 0.3** respectively

1) ***What is the certainty that Ahmed has cold*** ***[2 marks]***

2) ***If the following rule is added to previous set of rules what is the certainty that Ahmed has cold*** ***[2 marks]***

R3 If ?X has pain, then ?X has cold (CF:-0.4)

Question 6 [10 marks]

Given the CLIPS program below:

What is the output of this code, when applying the following commands:

CLIPS > reset

CLIPS > run

Show the status of the working memory when applying the above commands assuming that the watch fact and watch rule commands are activated

```
(defrule rule-1)
(colors red ?col) = >
(assert (rule 1 fires))
(assert (colors ?col red)))

(defrule rule-2)
(colors red white blue)
(colors red blue)=>
(assert (rule 2 fires)))

(defrule rule-3)
(declare (salience 1))
(colors red blue) =>
(assert (rule 3 fire)))

(defrule  rule-4)
(colors red white blue) =>
(assert (rule 4 fire)))
```

```
(deffacts initial-colors)
(colors red blue)
(colors red white blue))
```

Working memory	***Agenda***