School of Computing and Information Technology

ISIT315
Semantic Web

Examination Paper, Spring Session 2020

Exam Duration and Weighting

- 3 hours 60% (60 marks)
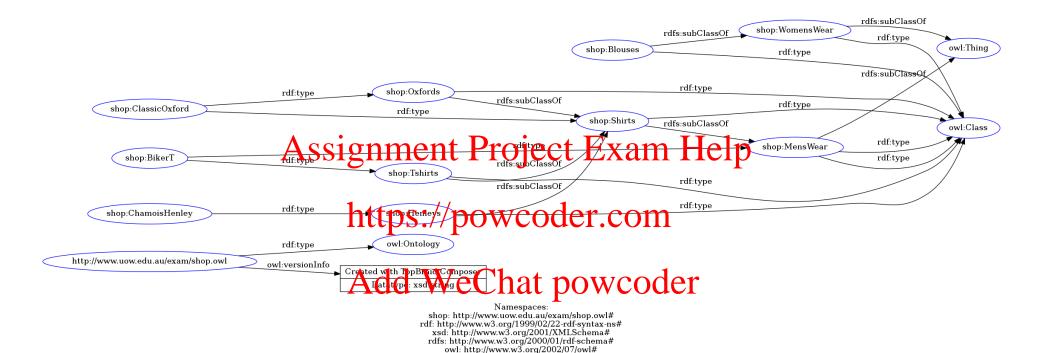
Directions to students

- This paper includes 9 questions.
- Clearly mark the question numbers.
- Submit your answers in <u>one single</u> Word or PDF file via the submission link on Moodle.
- <u>Do not include any pictures/snapshots</u> in your submission.
- Syntax error in RDF/RDFS/OWL/SPARQL statements will result in <u>loss of mark</u>.
- Submission must be made by the exam end time (additional 15 mins for technical issues).
- The exam shall be completed independently; you shall not discuss, collude, or share you work.
- When you submit, you acknowledge that it is your own work. Plagiarism and other academic misconducts may result in a Fail grade and are subject to the University Academic Misconduct Procedures.

Part 1 (18 marks)

Question 1) Write an XML/RDF description for the following graph. (10 marks)

Namespaces:
shop: http://www.uow.edu.au/exam/shop.owl#
rdf: http://www.w3.org/1999/02/22-rdf-syntax-ns#
xsd: http://www.w3.org/2001/XMLSchema#
rdfs: http://www.w3.org/2000/01/rdf-schema#
owl: http://www.w3.org/2002/07/owl#

Question 2) Add the following semantics to the XML/RDF description of Question 1 using OWL vocabulary. You can define any resources (classes/properties) needed. (8 marks)

2.1)   Each Tshirt has at least 1 product line ("ShirtProductLine") but not more than 3 product lines. (2 marks)
2.2)   Each shirt has a unique serial number ("ShirtSerialNo"). (3 marks)
2.3)   "NonSportMensWerar" is a "MensWear" that is not used for "Sports". (3 marks)

Part 2 (22 marks)

The attached RDF document ("items.ttl") contains data about the items sold by (shipped from) different countries: item:Country and item:Region denote the country that has sold (shipped) the item and the region of that country respectively. Using "items.ttl", write SPARQL queries that return the correct results for Questions 3-7. A partially correct query may receive up to half of the allocated mark.

Question 3) Find the difference between the average of the total revenue (item:Total_Revenue) made by the European countries from "Offline" sales of "Beverages" and "Online" sales of "Beverages"; use "abs" function (https://www.w3.org/TR/sparql11-query/#func-abs) to ensure the result is always a positive number. (4 marks)

Question 4) Find the country in "Central America and the Caribbean" that has not sold "Baby Food" online, but it has earned the second highest profit (sum of item:Total_Profit), among all countries, from selling "Fruits" and "Vegetables". (4 marks)

Question 5) List the top 3 countries with the highest sales volume (sum of item:Units_Sold), where the average of the total revenue (item:Total_Revenue) made from selling "Cosmetics" is higher than the average of the total revenue made from selling "Household" and "Fruits". (4 marks)

Question 6) List the order ID (item: Order_ID) of the item with the highest total profit (item:Total_Profit) for which there exists at least one item of the same type (item:Item_Type) and same priority (item:Order_Priority) that has been shipped on the same date (Ship_Date) but from a different region (item:Region). (5 marks)

Question 7) For each region, find the ID (item:ID) and type (item:Item_Type) of the best seller item with the minimum unit price (item:Unit_Price) of 500. Sort the results based on item:Units_Sold in descending order. (5 marks)

Part 3 (20 marks)

Question 8) Write the semantic of the following OWL statements in plain English. (6 marks)

#	OWL Statements	Marks	Semantic

8.1	`<owl:Class rdf:ID="SportShoes">`
	`  <owl:intersectionOf rdf:parseType="Collection">`
	`    <owl:Class rdf:about="#Shoes" />`
	`    <owl:Restriction>`
	`      <owl:onProperty rdf:resource="#usedFor" />`
	`      <owl:hasValue rdf:resource="#Sport" />`
	`    </owl:Restriction>`
	`  </owl:intersectionOf>`
	`</owl:Class>`
		2	

8.2	`<owl:Class rdf:ID="DramaMovie">`
	`    <rdfs:subClassOf rdf:resource="#Movie" />`
	`</owl:Class>`
	`<owl:Class rdf:ID="ActionMovie">`
	`    <rdfs:subClassOf rdf:resource="#Movie" />`
	`    <owl:disjointWith rdf:resource="#DramaMovie" />`
	`</owl:Class>`
		2	

8.3	`<owl:ObjectProperty rdf:ID="adjacentNetwork">`
	`  <rdf:type rdf:resource="&owl;SymmetricProperty" />`
	`  <rdfs:domain rdf:resource="#Network" />`
	`  <rdfs:range rdf:resource="#Network" />`
	`</owl:ObjectProperty>`
	`<Network rdf:ID="NetworkA">`
	`  <locatedIn rdf:resource="#NetworkB" />`
	`  <adjacentNetwork rdf:resource="#NetworkC" />`
	`</Region>`
		2	

Question 9) Using OWL vocabulary, develop an ontology, in RDF/XML format, for the following scenario. Add instances to the ontology when appropriate. Also, specify cardinalities of object and datatype properties. <u>Do not</u> provide any visualization for the ontology. (14 marks)

FancySchool has three employees: the two teachers Mr. Maier and Mrs. Schmidt, and the schoolmaster Mrs. Powers. In addition to their administrative duties, Mrs. Powers also does some teaching. In particular, Mr. Maier is assigned to the first-graders, while Mrs. Schmidt and Mrs. Powers together teach the second-, third-, and fourth-graders. Mr. Maier has specialized in sports and therefore is assigned to physical education for all four grades of school. Each grade has a class representative and at least one pupil. Marie is a fourth-grader. Her favorite subjects are mathematics and physics.