Coláiste na Tríonóide, Baile Átha Cliath
Trinity College Dublin
Ollscoil Átha Cliath | The University of Dublin

Faculty of Engineering, Mathematics and Science
School of Computer Science & Statistics

Engineering **Semester 2 2024**
Senior Sophister

CSU44D02/CS4D2b – Knowledge Engineering

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Instructions to Candidates:
Attempt **both** questions. Both questions carry equal marks. Each question is scored out of a total of 50 marks.

Please pay attention to the following:

- The deadline for submission is the 28th April 2024 at 11:59pm (Irish Time).
- This is an individual assignment. Text similarity will be assessed via TurnItIn. Please include a declaration of individual work (template available on Blackboard) as part of your submission.
- Please use a 12pt font (Calibri, Helvetica or similar) and 1.5 line spacing in your submission.
- Please upload your submission as a single file in PDF format via Blackboard.
- The combined effort to complete both questions should take no more than 7 hours.
- Please observe word limits (where applicable) as excess words will incur a penalty.
- If you use external sources in completing these assessments, please reference them appropriately.

Q1

(a) Develop an XSD to describe a new XML vocabulary of your choosing, e.g. the composition of an orchestra (but please choose a different example!). The XSD should specify both elements and attributes. Element nesting and cardinality of some elements should also be included. Illustrate and describe the use of as many features of XSD as you deem appropriate.

[10 Marks]

(b) Create an example XML document that is valid against your XSD (from part (a)) that illustrates as many features as possible.

[5 Marks]

(c) Design and development of an XSLT that can transform documents that correspond to your XSD (from part (a)) into RDFS (encoded in XML). Clearly describe how the XSLT is created and how it would function.

[10 Marks]

(d) What is Resource Description Framework? Describe its origin, derivatives and their relative importance in realising the Semantic Web. Illustrate different features and limitations of RDFS using example outputs from when the XML document (from part (b)) is transformed using your XSLT (part (c)). (500 word limit)

[15 Marks]

(e) Illustrate as many features of the XPATH specification as possible, using XPATH expressions used in your XSLT templates (from part (c)).

[10 Marks]

Q2

(a) Model an Ontology that expands upon the concepts and relationships implied in the XSD created in Q1 part (a). The final Ontology should be expressed in OWL and leverage its robust features. It should include appropriate classes (at least 10), their hierarchy, properties/relationships (both object and data; at least 15) and axioms (at least 2). Give a detailed discussion of the rationale behind your modelling of these and how this advances beyond the capabilities of RDFS, citing examples from your answer to Q1 part (c) if you wish. The Ontology may be created in Protégé or a similar tool. Screenshots and associated commentary should be used to illustrate your answer.

[25 Marks]

(b) Web search using tools such as Google and Bing, has been the dominant means of discovering information online, but semantic-based approaches are becoming increasingly important in making sense of such information. Discuss this statement in reference to the emergence of the Semantic Web and its evolving interaction with web search. Illustrate how the Ontology created in part (a) might support semantic search. What are the current technical limitations of how the Semantic Web is realised that restrict these semantic-based approaches? (1200 word limit)

[25 Marks]