

Knowledge Modelling and Management - Assessed Assignment 1

20th January 2011

This exercise should be submitted by 4pm on Thursday 17th February 2011. You should submit your answers to the questions below in hardcopy to the ITO, and submit an OWL file using electronic submission. Please quote your Matriculation Number on the first page of your hardcopy submission.

This exercise is worth 50% of the total marks assigned to the coursework component of Knowledge Modelling and Management. The assessment weightings for Knowledge Modelling and Management are 25% for coursework and 75% for the examination.

Level 10 students should answer question 1 and then select either question 2 or question 3. Level 11 students should answer all three questions.

Question 1.

A clothing manufacturer is exploring the use of ontologies to describe the clothes it produces, their component parts, and the faulty goods returned by retailers. The ontology contains top-level terms for garments and for descriptors of faulty garments. As an example, one line of colourful men's shirts (the retro line of Beatles-inspired 'Sgt. Pepper' shirts) is represented, as are some of the parts of these items. The ontology is only partially complete, however, it should allow the features of Description Logic to be evaluated by the manufacturer.

Download the `clothing.owl` file from the KMM website and open it in Protégé 4.1 (build 213). Ensure that version 1.3.2 of the HermiT reasoner is installed (this may require installing a new version using the update function provided by Protégé). Answer the following questions in your hardcopy submission, saving the changes requested in the OWL file which should be submitted electronically once all parts of question 1 have been completed.

Explore the ontology and run the classifier by selecting Reasoner/Start Reasoner. The ontology should be consistent, and the reasoner should run without error. Use Synchronise Reasoner after making changes to the ontology to rerun the classifier.

- i. Add short textual definitions for the concepts *Shirt*, *Collar*, *Cuff* and *Sleeve*. Use the *comment* field in the annotations window, and save the modified OWL file. In your written answer, explain the existing Description Logic definitions of *Shirt*, *ShirtCollar*, and *ShirtSleeve* in plain English.

Marks: 10%

- ii. Extend the ontology by adding 6 types of *Fabric*. Ensure that the appropriate axioms are added. Describe the new concepts and axioms in your written answer, and save the modified OWL file.

Marks: 10%

- iii. Explain why a *RingoShirtSleeve* must have a *Cuff* and at least one *Button* by referring to the definitions of these concepts, and those of the relations used in the definitions. Show that the reasoner can make these inferences by adding a superclass to *RingoShirtSleeve* that asserts the contrary and then classifying the ontology. State the class restriction used in each case, and describe the result of classification. Return the ontology to its state on completion of part ii. before answering the following questions. Note that the parts of a garment may have a specific design that is reflected in their name (e.g. *RingoShirtSleeve*), or may be generic (e.g. *Cuff* and *Button*).

Marks: 10%

- iv. Add a logical definition for a *RingoShirt* to require that these items have some *RingoShirtSleeve* and lack a *Collar*. Modify any conflicting definitions to ensure that the ontology remains consistent when it is classified. Extend the definition of *RingoShirt* once more to specify the *Fabric* to be used (use one of the classes introduced in part ii.). Define any new relationships required, and save the ontology once more.

Marks: 10%

- v. Consider the concept *Quality* and its subclasses. These classes are descriptors that can be found in (*inheresIn*) *Garments*. In this application, qualities are used to describe faulty manufacturing. It is intended that qualities be combined with the objects they apply to in a compositional manner. Rather than creating classes for *Small-RingoShirt*, *Large-RingoShirt*, *Creased-RingoShirt*, *Creased-PaulShirt*, and so on, manufacturing defects are described as a composition of a *Quality* that *inheresIn* a *PhysicalObject*. In the clothing ontology, manufacturing defects are represented as individuals: *Defect1*, *Defect2* and *Defect3* (see the Individuals tab in Protégé).

Introduce a subclass of *Quality* for defects in a *SgtPepperShirt*, or a part thereof, by giving a necessary and sufficient definition. This class might be named *SgtPepperShirtDefect*. Ensure that all three defect individuals are instances of this class on classification of the ontology. Explain how your definition works, explain the reasoning used to classify the defects as members of this class, and save this version of the ontology for submission. Note that it is not acceptable to define this class as the enumeration:

{ *Defect1*, *Defect2*, *Defect3* }.

Finally, consider the situation in a large ontology of thousands of items and parts, and where there are many hundreds of possible flaws or abnormalities in these items. State two advantages of the compositional approach over the enumerated approach in such a case.

Marks: 10%

Level 10 students should answer question 1 and either question 2 or question 3 (but not both).

Question 2.

Choose an ontology that is publicly available, preferably one that is covered in the course notes, and summarise its development process, level of formalisation and applications. Make sure to cover the domain, purpose, scope and granularity when discussing the design, and to give examples of concept definitions.

You may select the DOLCE Ontology, Cyc Ontology, Gene Ontology, Foundational Model of Anatomy, or the Enterprise Ontology, but you are not required to do so. However, ensure that the ontology you do select can be cited (i.e. there are papers published about it) and ensure that you can access the class definitions. Include the citations, examples and diagrams in your answer.

Marks for level 10: 50% Level 10 students should submit an answer of approximately 750 words (excluding citations).

Marks for level 11: 25% Level 11 students should submit an answer of approximately 500 words (excluding citations).

Question 3.

Describe the proposals made by Carl Linnaeus for organising living things into a taxonomy, and the legacy of his work. Academic review articles should be cited; begin with those on the Nature website:

<http://www.nature.com/nature/focus/linnaeus300/> Include the citations in your answer.

Marks for level 10: 50% Level 10 students should submit an answer of approximately 750 words (excluding citations).

Marks for level 11: 25% Level 11 students should submit an answer of approximately 500 words (excluding citations).

Submission Submit your written answers on paper to the ITO, and submit the edited clothing.owl file electronically:

submit msc kmm-5 1 clothing.owl

or:

submit ai4 kmm-4 1 clothing.owl