Lab: Ontology and Ontology Development in OWL

After this lab you should get a good understanding of ontology, OWL and ontology development, and the ontology development tool, Protégé.

Reading Materials

- Lecture slides

- Guarino, N., Oberle, D., & Staab, S. (2009). What is an ontology?. Handbook on ontologies, 1-17.

- OWL 2 Web Ontology Language Primer.

Submission

You should submit a document containing the answers to the questions in task 1, 2 and 4. For Task 5, please submit the document with the outcomes from steps 1 and 2, document the steps of the conceptualization process, and the file of the OWL ontology. **Note:** Any form of plagiarism, including using AI to generate answers, will result in failing the lab.

1. Ontology Definition

Explain this definition of ontology: *An ontology is an explicit, formal specification of a shared conceptualization.*

2. Web Ontology Language (OWL)

Describe the OWL 2 DL and OWL 2 Full, and the profiles OWL 2 EL, OWL 2 QL, and OWL 2 RL.

3. Using Protégé

Download Protégé. *Note*: no need to do the registration. Choose "No, thanks. I'm already registered".
How to use Protégé, please check the document Protégé 5 documentation, especially the introduction and guides on the tabs and views in the tool.

4. The Family Ontology

In this task you will get familiar with the ontology editor, Protégé, and also ontology in OWL, by looking at a family ontology, which the sample ontology used in OWL 2 Web Ontology Language Primer.

Download the *families.owl* in Canvas. Go to the tab `Entities`, take some time to browse the classes, object properties, datatype properties and individuals, understand the ontology and solve the exercises below:

1) Find the classes HappyPerson, JohnsChildren, NarcisticPerson, Orphan and Grandfather in the ontology, give the descriptions of the classes using DL syntax and natural language.

2) Find the classe Teenager in the ontology, give the description of the class in natural language.

3) Find the object properties hasFather, hasGrandparent and hasUncle, give the descriptions of the object properties using DL syntax and natural language.

4) Find the individual John, give its description using natural language.

5) Choose the `HermiT` reasoner, then click on `Start Reasoner` in the Reasoner menu. Once the reasoning is done, browse through the classes, properties, and individuals in the ontology to observe the changes (highlighted in yellow). Select one change each from a class, an object property, and an individual. For each, describe what the change is and explain why it was generated by the reasoning process.

5. An Ontology for Educational Resources in European Universities

In this task you will develop an ontology from scratch. You can imagine that the ontology will be used to support the systems that integrate the data from different European universities about their educational resources. The system will serve students to look for courses and programs and/or create recommendations on courses/programs based on students' preferences.

1) Write a text describing the typical information that should be managed by the systems. In this step you define the purpose and scope of the ontology.

2) You can reuse the knowledge base created in the task 4 of the DL lab.

3) Prepare a list of competency questions (CQs), additional restrictions, and potential reasoning requirements that could be elicited from there. In this step you define the

requirements on the ontology. *Note*: For this lab, it is reasonable to prepare around 10 CQs. Of course, in real-world scenario, you will need have more CQs to specify the requirements on the ontology.

4) Work as an ontologist and develop the ontology:

- Follow the steps during the conceptualization: enumerate terms, define classes, defined class hierarchy, define properties (both object properties and datatype properties), define axioms and add a few instances.
- You should keep it in mind that the ontology is built using OWL 2 DL. Be careful about what can be or cannot be expressed in OWL 2 DL.
- As always in a typical modeling, there is no one correct solution.
- Create the ontology in OWL using Protégé:
  - The IRI of the ontology does not matter, use any "example" IRI you can think of or the one suggested by the tool.
  - Reasoning over your ontology to check its satisfiability and consistency.
  - Choose any syntax when you save the ontology.
  - You do not need to comment your ontology or the elements inside it, although that would normally be a good ontology development practice.