Semantic Web

Assignment 2

Dr. Jandson S Ribeiro
jandson@uni-koblenz.de

Isabelle Kuhlmann
iskuhlmann@uni-koblenz.de

Institute of Web Science and Technologies
Department of Computer Science
University of Koblenz-Landau

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Please submit your solutions to your group's OLAT folder.
Always list all group members contributing to the solution!
Do not plagiarize from others!

For all the assignment questions that require you to code, make sure to include the code in the answer sheet, along with a separate Python file.

Please mention your team name and members here:

Team Name: XXXX

1.
2.

1 Modelling Ontologies via $\mathcal{ALC}$ — 10 points

Consider the following domain specification of a company which sells some products:

From a company point of view, a person is either a staff member or a customer. The company staff consists of salespersons and bosses. Each salesperson works for a boss. Bosses don't work for anyone. A customer is served by at least one staff member. Although a customer can be served by any staff member, only salespersons can sell products. A salesperson sells at least one product.

You are also given the following pieces of information: Anna is the boss of the to salespeople Barbara and Carl. David is a customer served by Barbara. Edna sells a car.

In this task, you shall formalize the company specification domain above in $\mathcal{ALC}$. Follow the guidelines below to perform this task.

1.1 — 2 points

Define a set N_C of concepts, a set N_R of roles, and a set N_O of individual names for the company domain above.

1.2 — 5 points

Using the sets N_C and N_R you defined on the previous step, and only those, define a *TBox* in $\mathcal{ALC}$ for the company domain. Your specification must contemplate all information provided above.

1.3 — 3 points

Using N_C, N_R and N_O, define an *ABox* in $\mathcal{ALC}$ to the company scenario above.

2 Interpretations in $\mathcal{ALC}$ — 10 points

Consider the following list of statements that describe a hospital:

1. A *Staff Member* is either a *Nurse*, a *Physician* or a *Janitor*.
2. The concepts *Nurse*, *Physician* and *Janitor* are pairwise disjoint.
3. A *Patient* is a *Person* who *gets treated* for at least one *Illness*.
4. A *Nurse* is a *Person* who *takes care of* at least one *Patient*.
5. A *Janitor* cannot *take care of* any *Patients*.
6. Only *Physicians* can treat *Illnesses*.

The following *TBox* $\mathcal{T}_1$ is an attempt to formalize the statements (4) - (6) in $\mathcal{ALC}$:

$$\begin{array}{lllll} \mathcal{T}_1 = \{ & \mathsf{Nurse} & \sqsubseteq & \forall \mathsf{takesCareOf.Patient} & \\ & \neg\exists \mathsf{takesCareOf.Patient} & \sqsubseteq & \mathsf{Janitor} & \\ & \forall \mathsf{canTreat.Illness} & \sqsubseteq & \mathsf{Physician} & \} \end{array}$$

2.1 — 4 points

Does $\mathcal{T}_1$ capture the statements (4) - (6) above? If yes, define a model for $\mathcal{T}_1$; otherwise:

- show 2 rules from $\mathcal{T}_1$ that violates some of the statements (4) - (6), and indicate which statements each of the rules you identified violates;
- for each rule you pointed out, give a brief explanation of why it violates the respective statement; and
- provide a model for $\mathcal{T}_1$ that fails such statements.

You must briefly explain why your model satisfies or does not satisfy $\mathcal{T}_1$.

2.2 — 3 points

Formalize each of the statements above in $\mathcal{ALC}$. If you have answered that $\mathcal{T}_1$ satisfies the statements (4) - (6) in the previous question, you still must formalize them here: you can reproduce $\mathcal{T}_1$ here. Give your answer in form of a list, where the nth element of your list corresponds to the formalization of the nth statement of the list above.

1.
2.
3.
4.

5.

6.

2.3 3 points

Define a model for the *TBox* you defined in the previous step. Your interpretation must have at least one instance for each concept, and each relation must have at least one pair.

Important Notes

Submission

- Solutions have to be submitted to your group's OLAT folder.
- The name of the group and the names of all participating students must be listed on each submission.
- Solution format: all solutions as *one* PDF document. Programming code has to be submitted as Python code to the OLAT folder. Upload *all* `.py` files of your program! Use `UTF-8` as the file encoding. *Other encodings will not be taken into account!*
- Check that your code compiles without errors.
- Make sure your code is formatted to be easy to read.
  - Make sure you code has consistent indentation.
  - Make sure you comment and document your code adequately in English.
  - Choose consistent and intuitive names for your identifiers.
- Do *not* use any accents, spaces or special characters in your filenames.

Acknowledgment

This pdfLaTeX template was adapted by Isabelle Kuhlmann based on the LuaLaTeX version by Lukas Schmelzeisen.

LaTeX

Use `pdflatex assignment_X.tex` to build your PDF.