

Semantic Web

Assignment 2B

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

Submission by: May 9, 2021

Tutorial on: May 14, 2021

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.

Team Name: XXXX

- 1.
- 2.

1 Interpretations

5 points

Consider the following knowledge base $\mathcal{K}_1 = (\mathcal{T}_1, \mathcal{A}_1)$ in \mathcal{ALC} :

$$\begin{aligned}\mathcal{T}_1 &= \{\exists R.A \sqsubseteq B, \\ &\quad A \sqcap D \equiv E, \\ &\quad A \sqsubseteq \neg \exists Q.D\} \\ \mathcal{A}_1 &= \{y : A, (x, y) : R, (y, z) : Q\}\end{aligned}$$

1.1

2 points

Formally define an interpretation I that satisfies \mathcal{K}_1 .

1.2

3 points

Demonstrate that I satisfies \mathcal{K}_1 .

2 Tableau Algorithm

5 points

Consider the following Knowledge base $\mathcal{K}_2 = (\mathcal{T}_2, \mathcal{A}_2)$, where

$$\begin{aligned}\mathcal{T}_2 = \{ & A \sqsubseteq D, \\ & \neg(B \sqcup \neg D) \sqsubseteq E, \\ & D \sqsubseteq \neg\exists R.E, \\ & B \sqcap E \sqsubseteq \perp, \\ & \neg\neg D \sqsubseteq E\} \\ \mathcal{A}_2 = \{ & x : \neg(\neg D \sqcap \neg E), y : A \sqcap B, (y, x) : R\}\end{aligned}$$

2.1**2 points**

Transfer both \mathcal{T}_2 and \mathcal{A}_2 to NNF.

2.2**3 points**

Is \mathcal{K}_3 consistent or not? In either case, apply the tableau algorithm for your answer. Document and explain each step you take when applying the tableau algorithm.

3 Consistency and Inference

10 points

Let $\mathcal{S}_1 = (N_C, N_R, N_O)$ be a signature where

$$N_C = \{A, B, D, E, F, G\}$$

$$N_R = \{P, Q\}$$

$$N_O = \{x, y\}$$

Consider the following *Tbox* and *Aboxes*:

$$\begin{aligned} \mathcal{T}_3 = \{ & A \quad \quad \quad \equiv \neg(E \sqcup F), \\ & B \sqcup D \quad \quad \sqsubseteq A, \\ & E \quad \quad \quad \sqsubseteq \exists P.G, \\ & A \sqcap \exists P.G \quad \sqsubseteq \perp, \\ & E \sqcup F \quad \quad \sqsubseteq \neg \exists Q.G \} \end{aligned}$$

$$\mathcal{A}_3 = \{ \begin{array}{ll} x & : G, \\ (y, x) & : Q \end{array} \}$$

$$\mathcal{A}_4 = \{ \begin{array}{ll} x & : G, \\ y & : B, \\ (y, x) & : P \end{array} \}$$

3.1

2 points

Is the knowledge base $\mathcal{K}_3 = (\mathcal{T}_3, \mathcal{A}_3)$ consistent? If your answer is positive, then define an interpretation I that satisfies \mathcal{K}_3 . Otherwise, prove that \mathcal{K}_3 is inconsistent.

3.2

4 points

Is the knowledge base $\mathcal{K}_4 = (\mathcal{T}_3, \mathcal{A}_4)$ consistent? If your answer is positive, then define an interpretation I that satisfies \mathcal{K}_4 . Otherwise, prove that \mathcal{K}_4 is inconsistent.

3.3

4 points

Prove that $(\mathcal{T}_3, \mathcal{A}_3) \models y : A$.

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.