

Beschreibungslogik | Übung 06

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Aufgabe 1

1. (20%) Wendet das konsequenzbasierte Verfahren (Regeln **R1–R4**) für Subsumtion in \mathcal{EL} mit TBoxen an, um folgende Frage zu entscheiden:

Wird A_1 subsumiert von A_2 bzgl. \mathcal{T} , wobei

$$\mathcal{T} = \{A_1 \sqsubseteq \exists r.A_3, A_2 \sqsubseteq A_3, \top \sqsubseteq \exists s.A_2, \exists s.A_3 \sqsubseteq A_1, \exists r.A_1 \sqsubseteq A_2\}$$

$\begin{array}{l} \text{R1} \frac{}{A \sqsubseteq A} \text{ wenn } A \text{ in } \mathcal{T} \text{ vorkommt} \quad \text{R2} \frac{}{A \sqsubseteq \top} \text{ wenn } A \text{ in } \mathcal{T} \text{ vorkommt} \\ \text{R3} \frac{A \sqsubseteq A_1 \quad \dots \quad A \sqsubseteq A_n \quad A_1 \sqcap \dots \sqcap A_n \sqsubseteq B}{A \sqsubseteq B} \\ \text{R4} \frac{A \sqsubseteq \exists r.A_1 \quad A_1 \sqsubseteq B_1 \quad \exists r.B_1 \sqsubseteq B}{A \sqsubseteq B} \end{array}$	<p>Aussprache</p> <p>$\mathcal{T} \models C \sqsubseteq D$ D wird von C subsumiert bezüglich der T-Box?</p> <p>$C \sqsubseteq D$ C impliziert D</p>
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Wird A_2 subsumiert von A_1 bezüglich TBox \mathcal{T} ?

Frage: $\mathcal{T} \models A_2 \sqsubseteq A_1$? Wobei \mathcal{T} wie folgt definiert ist:

$$\mathcal{T} = \{ \begin{array}{ll} A_1 \sqsubseteq \exists r.A_3, & (1) \\ A_2 \sqsubseteq A_3, & (2) \\ \top \sqsubseteq \exists s.A_2, & (3) \\ \exists s.A_3 \sqsubseteq A_1, & (4) \\ \exists r.A_1 \sqsubseteq A_2, & (5) \end{array} \}$$

Die TBox \mathcal{T} ist bereits in NF.

Algorithmus: Subsumtion mit TBox

$$\text{R1} \quad A_1 \sqsubseteq A_1 \quad A_2 \sqsubseteq A_2 \quad A_3 \sqsubseteq A_3 \quad \top \sqsubseteq \top \quad (6)$$

$$\text{R2} \quad A_1 \sqsubseteq \top \quad A_2 \sqsubseteq \top \quad A_3 \sqsubseteq \top \quad (7)$$

R3 Zunächst nicht anwendbar auf (1) – (7)

$$\text{R4} \quad \text{auf (3) } \top \sqsubseteq \exists s.A_2, (2) A_2 \sqsubseteq A_3, (4) \exists s.A_3 \sqsubseteq A_1 \\ \top \sqsubseteq A_1 \quad (8)$$

$$\text{R3} \quad \text{auf (7) } A_2 \sqsubseteq \top, (8) \top \sqsubseteq A_1 \\ A_2 \sqsubseteq A_1 \quad (9)$$

$$\mathcal{T}^* = \{$$

$$\begin{aligned} &A_1 \sqsubseteq \exists r. A_3, \\ &A_2 \sqsubseteq A_3, \\ &\top \sqsubseteq \exists s. A_2, \\ &\exists s. A_3 \sqsubseteq A_1, \\ &\exists r. A_1 \sqsubseteq A_2, \\ &A_1 \sqsubseteq A_1, \\ &A_2 \sqsubseteq A_{2m} \\ &A_3 \sqsubseteq A_3, \\ &\top \sqsubseteq \top, \\ &\top \sqsubseteq A_1, \\ &A_2 \sqsubseteq A_1 \end{aligned}$$

$$\}$$

Durch Regelanwendung **R4** kam heraus, dass gilt: $\mathcal{T} \models \top \sqsubseteq A_1$.

Durch die anschließende Anwendung von **R3** kam heraus, dass gilt: $\mathcal{T} \models A_2 \sqsubseteq A_1$.

Daher ist die Frage ob $\mathcal{T} \models A_2 \sqsubseteq A_1$ gilt, eindeutig mit "Ja" zu beantworten.

Aufgabe 2 - Java Log Output

Testfall 0:

C:\Users\Dennis\development\DescriptionLogic\blatt6\java_bl_reasoner\tests\test0in.owl

OK. (Ontologie ist nicht in EL-Normalform)

Testfall 1:

C:\Users\Dennis\development\DescriptionLogic\blatt6\java_bl_reasoner\tests\test1in.owl

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test1in#A>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test1in#A>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test1in#A>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test1in#B>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test1in#B>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test1in#B>
owl:Thing)

OK.

Testfall 2:

C:\Users\Dennis\development\DescriptionLogic\blatt6\java_bl_reasoner\tests\test2in.owl

R1 Add: SubClassOf(owl:Thing owl:Thing)

R2 Add: SubClassOf(owl:Thing owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test2in#A>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test2in#A>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test2in#A>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test2in#B>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test2in#B>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test2in#B>
owl:Thing)

R3 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test2in#A>
owl:Thing)

R3 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test2in#B>
owl:Thing)

OK.

Testfall 3:

C:\Users\Dennis\development\DescriptionLogic\blatt6\java_bl_reasoner\tests\test3in.owl

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#A>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#A>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#A>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#A1>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#A1>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#A1>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#B>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#B>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#B>
owl:Thing)

R3 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#A>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#A1>)

R3 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#A>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#B>)

R3 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#A1>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test3in#B>)

OK.

Testfall 4:

C:\Users\Dennis\development\DescriptionLogic\blatt6\java_bl_reasoner\tests\test4in.owl

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A1>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A1>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A1>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A3>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A3>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A3>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#B>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#B>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#B>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A2>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A2>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A2>
owl:Thing)

R3 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A1>)

R3 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A3>)

R3 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test4in#A2>)

FEHLER:

Folgende Subsumtion wird vom Reasoner fälschlicherweise nicht erzeugt:

SubClassOf(<A>)

Testfall 5:

C:\Users\Dennis\development\DescriptionLogic\blatt6\java_bl_reasoner\tests\test5in.owl

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test5in#B>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test5in#B>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test5in#B>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test5in#A1>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test5in#A1>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test5in#A1>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test5in#A>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test5in#A>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test5in#A>
owl:Thing)

FEHLER:

Folgende Subsumtion wird vom Reasoner fälschlicherweise nicht erzeugt:

SubClassOf(<A>)

Testfall 6:

C:\Users\Dennis\development\DescriptionLogic\blatt6\java_bl_reasoner\tests\test6in.owl

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#A>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#A>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#A>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#B>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#B>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#B>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#B1>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#B1>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#B1>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#A1>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#A1>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#A1>
owl:Thing)

R3 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#A1>
<http://www.semanticweb.org/schneider/ontologies/2019/6/test6in#B1>)

FEHLER:

Folgende Subsumtion wird vom Reasoner fälschlicherweise nicht erzeugt:

SubClassOf(<A>)

Testfall 7:

C:\Users\Dennis\development\DescriptionLogic\blatt6\java_bl_reasoner\tests\test7in.owl

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/7/test7in#A1>
<http://www.semanticweb.org/schneider/ontologies/2019/7/test7in#A1>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/7/test7in#A1>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/7/test7in#A2>
<http://www.semanticweb.org/schneider/ontologies/2019/7/test7in#A2>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/7/test7in#A2>
owl:Thing)

R1 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/7/test7in#A3>
<http://www.semanticweb.org/schneider/ontologies/2019/7/test7in#A3>)

R2 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/7/test7in#A3>
owl:Thing)

R3 Add: SubClassOf(<http://www.semanticweb.org/schneider/ontologies/2019/7/test7in#A2>
<http://www.semanticweb.org/schneider/ontologies/2019/7/test7in#A1>)

FEHLER:

Folgende Subsumtionen werden vom Reasoner fälschlicherweise nicht erzeugt:

SubClassOf(<A1> <A2>)

SubClassOf(<A2> <A3>)

SubClassOf(<A1> <A3>)

Testfall 8:

C:\Users\Dennis\development\DescriptionLogic\blatt6\java_bl_reasoner\tests\test8in.owl

FEHLER: Testontologie

C:\Users\Dennis\development\DescriptionLogic\blatt6\java_bl_reasoner\tests\test8out.owl
fehlt!

Process finished with exit code 0