

Intelligent Systems

Exercise sheet 4

Reasoning

Exercise 1 (10 points)

Answer the following questions (Description Logics):

- (a) What are constructors? How do the different description logics differ?
- (b) Provide the constructors for the description logic ALC and explain their meaning.
- (c) In which components is a knowledge base separated to? What does each component contain? Please describe the different types of axioms the components contain.

Exercise 2 (10 points)

Please familiarize yourself with the description logic SHOIN(D) and represent the following natural language sentences using it. Please use the vocabulary from Exercise 3 to describe it.

- (a) An opera is a musical performance.
- (b) All actors of an opera are singer.
- (c) At least one musical ensemble of an opera is an orchestra.
- (d) A rock concert is another musical performance.
- (e) Rock concerts and operas are disjoint to each other.

Exercise 3 (10 points)

Please check all Description Logics statements which are entailed by your statements from Exercise 2. Please answer if the following statements are entailed or not:

- (a) Musical Performance \sqsubseteq Opera
- (b) Opera \sqsubseteq MusicalPerformance
- (c) $\forall \text{hasActor.Singer} \sqsubseteq \text{Opera}$
- (d) Opera \sqsubseteq Musical Performance $\sqcap \forall \text{hasActor.Singer} \sqcap \exists \text{hasMusicalEnsemble.Orchestra}$
- (e) Opera \sqsubseteq MusicalPerformance $\sqcap \geq 1 \text{ hasMusicalEnsemble} \sqcap \forall \text{hasActor.Singer}$

- (f) $\text{hasMusicalEnsemble} \sqsubseteq \text{Opera}$
- (g) $\text{Opera} \sqsubseteq \text{MusicalPerformance} \sqcap \exists \text{hasMusicalEnsemble.Orchestra}$
- (h) $\text{Opera} \sqsubseteq \text{MusicalPerformance} \sqcap =1 \text{hasMusicalEnsemble} \sqcap \forall \text{hasActor.Singer}$
- (i) $\text{Opera} \sqsubseteq \text{MusicalPerformance} \sqcap \forall \text{hasMusicalEnsemble.Orchestra} \sqcap \exists \text{hasActor.Singer}$
- (j) $\text{Opera} \sqsubseteq \text{RockConcert}$
- (k) $\text{RockConcert} \sqsubseteq \sqsupset \text{Opera}$