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Webbasierte Informationssysteme
Winter Term 2010/2011
October 27, 2010

2. Exercise Set: Logic and RDF(S)

Exercise 1 (Modelling in RDF(S))
Decide whether the following statements can be modelled with the help of RDF(S). If yes, give a graphical representation of the respective statement.

a) Every pizza is a dish.
b) Every pizza has at least two toppings.
c) Every pizza in the class PizzaMargarita has tomatoes as a topping.
d) Everything that has a topping is a pizza.
e) No pizza in the class PizzaMargarita has a topping from the class Meat.

Exercise 2 (Connection RDFS - First-order Logic)
Formulate the RDFS semantics in first-order logic. E.g. the transitivity of the subclass relationship can be written as $\forall x \forall y \forall z(((x,\text{rdfs:subClassOf}, y) \wedge (y,\text{rdfs:subClassOf}, z)) \rightarrow (x,\text{rdfs:subClassOf}, z))$.

Exercise 3 (Propositional Logic)
Decide for each of the following formulas whether they are valid, satisfiable or unsatisfiable. Justify your answer by giving a truth table, in which the truth values for every subformula are listed.

a) $(p \vee \neg q)$
b) $((p \vee q) \rightarrow (\neg p \vee \neg q))$
c) $\neg((p \rightarrow q) \leftrightarrow (\neg q \vee q))$
d) $(((p \rightarrow q) \rightarrow p) \rightarrow p)$
e) $(((p \wedge q) \rightarrow r) \leftrightarrow (p \rightarrow (q \rightarrow r)))$
f) $((p \wedge \neg p) \rightarrow q)$

Exercise 4 (First-order Logic)
Let T and S be finite sets of first-order sentences. Decide whether the following statements are true or false.

a) If a first-order formula F is valid, then $T \models F$ holds for every set of first-order sentences T.

b) If $T \subseteq S$, then every model of T is also a model of S.

c) If $T \subseteq S$, then every logical consequemnce of T is also a logical consequence of S.

d) If $\neg F \in T$, then $T \models F$ can never hold. (F is an arbitrary first-order sentence)

e) If $T \neq S$, then there is a first-order sentence F such that $T \models F$ and $S \models \neg F$.

f) Given T and S as input, it is decidable whether $T \models S$. I.e. there is an algorithm that decides logical implication (for an arbitrary input).

Due by: November 3, 2010 before the tutorial starts.