Übung zur Lehrveranstaltung

Grundlagen Semantic Web

Seminar für Computerlinguistik, Universität Heidelberg

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http://semantic-web-grundlagen.de

Übung 2: Logik und RDF(S)-Semantik

Aufgabe 2.1 Decide for every of the following formulae whether it is a tautology, satisfiable, refutable or unsatisfiable. Prove your answers by giving truth tables carrying the truth values of every subformula (including the formula itself).

Example: the formula $(q \rightarrow (p \wedge q))$ is satisfiable and refutable. The corresponding truth table is:

$\mathcal{I}(p)$	$\mathcal{I}(q)$	$\mathcal{I}((p \wedge q))$	$\mathcal{I}((q \rightarrow (p \wedge q)))$
t	t	t	t
t	f	f	t
f	t	f	f
f	f	f	t

(a) $(p \vee \neg p)$

(b) $((p \vee q) \rightarrow (\neg p \vee \neg q))$

(c) $\neg((p \rightarrow q) \leftrightarrow (\neg p \vee q))$

(d) $(((p \rightarrow q) \rightarrow p) \rightarrow p)$

(e) $(((p \wedge q) \rightarrow r) \leftrightarrow (p \rightarrow (q \rightarrow r)))$

(f) $((p \wedge \neg p) \rightarrow q)$

Aufgabe 2.2 Recap the notions "theory", "logical consequence", and "equivalence" and decide whether the following statements are true. Provide an (informal) explanation for your claim.

For arbitrary theories $\mathcal{T}$ and $\mathcal{S}$ holds:

(a) If a formula F is a tautology then $\mathcal{T} \models F$ holds, i.e. every theory entails at least all tautologies.

(b) The bigger a logical theory is, the more models it has. This means, if $\mathcal{T} \subseteq \mathcal{S}$, then every model of $\mathcal{T}$ is also a model of $\mathcal{S}$.

(c) The larger a theory is, the more logical consequences it has. This means, if $\mathcal{T} \subseteq \mathcal{S}$, then every consequence of $\mathcal{T}$ is also a consequence of $\mathcal{S}$.

(d) If $\neg F \in \mathcal{T}$, then $\mathcal{T} \models F$ cannot hold.

(e) Two distinct theories ($\mathcal{T} \neq \mathcal{S}$), can always be distinguished by some logical consequence (e.g., by a formula F such that $\mathcal{T} \models F$ but $\mathcal{S} \not\models F$).

Aufgabe 2.3 Describe a very simple RDFS-interpretation that is a model of the example ontology from Exercise 1.3.

Aufgabe 2.4 Again, consider the ontology from Exercise 1.3 and find

- a simply entailed triple,
- an RDF-entailed triple, which is not simply entailed,
- an RDFS-entailed triple, which is not RDF-entailed.

Aufgabe 2.5 As you know, the *unique name assumption* does not hold in RDF(S), i.e. in a model, several URIs might be assigned to the same resource. Contemplate whether (and if so, how) it is possible to specify in RDFS that two given URIs refer to the same resource.

Aufgabe 2.6 The *empty graph* does not contain any triples (i.e. it corresponds to the empty set). Give derivations showing that the empty graph RDFS-entails the following triples:

```
rdfs:Resource rdf:type rdfs:Class .
rdfs:Class rdf:type rdfs:Class .
rdfs:Literal rdf:type rdfs:Class .
rdf:XMLLiteral rdf:type rdfs:Class .
rdfs:Datatype rdf:type rdfs:Class .
rdf:Seq rdf:type rdfs:Class .
rdf:Bag rdf:type rdfs:Class .
rdf:Alt rdf:type rdfs:Class .
rdfs:Container rdf:type rdfs:Class .
rdf:List rdf:type rdfs:Class .
rdfs:ContainerMembershipProperty rdf:type rdfs:Class .
rdf:Property rdf:type rdfs:Class .
rdf:Statement rdf:type rdfs:Class .
rdfs:domain rdf:type rdf:Property .
rdfs:range rdf:type rdf:Property .
rdfs:subPropertyOf rdf:type rdf:Property .
rdfs:subClassOf rdf:type rdf:Property .
rdfs:member rdf:type rdf:Property .
rdfs:seeAlso rdf:type rdf:Property .
rdfs:isDefinedBy rdf:type rdf:Property .
rdfs:comment rdf:type rdf:Property .
rdfs:label rdf:type rdf:Property .
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