

LOGICS FOR DATA AND KNOWLEDGE REPRESENTATION
Written Exam Session I - Monday 08-06-2009

SURNAME: **NAME:** **N.**

1. What are the most typical reasoning tasks, or services, provided by logic? Explain and elaborate.
2. Draw the “fundamental diagram” of modeling, and explain each component in the details of one of the logics we have seen so far (i.e., PL, ClassL, FOL).
3. Consider the problem of deciding whether a propositional logic sentence is true in a given model. Give three examples of sentences that can be determined to be true or false in a partial model that does not specify a truth value for some of the symbols.

4. Represent the following sentence in first-order logic, using a consistent vocabulary (which you must define): “Italian politicians can fool some of the Italians all of the time, and they can fool all of the Italians some of the time, but they can’t fool all of the Italians all of the time”.

5. Represent the following proposition in description logic: “All mother having only sons.”

6. Is the following ontology \mathcal{O} consistent?

{FlightSeat $\sqsubseteq \leq 1$ hasPassenger, FlightSeat(SEAT1),
hasPassenger(SEAT1, PAOLO), hasPassenger(SEAT1, JOHN)} yes no

7. Let TBox \mathcal{T} be the following set of axioms about documents secured according to internal or external policy on members of an university.

{ICT \sqsubseteq U, Student \sqsubseteq ICT, Faculty \sqsubseteq ICT, PhD \sqsubseteq Student, Teach \sqsubseteq Faculty, Tech \sqsubseteq Faculty, DIT \sqsubseteq O, Public \sqsubseteq DIT, Internal \sqsubseteq DIT, Internal $\equiv \neg$ Public, ICT $\sqsubseteq \exists$ read.DIT, Student $\sqsubseteq \forall$ read.Public}.

Is $\mathcal{T} \models \text{PhD} \sqsubseteq \forall \text{read.Public}$? yes no

8. An AL-concept C is coherent if there is an interpretation (Δ, I) such that $I(C) \neq \emptyset$. Let τ be the mapping from any language in the AL* family of attributive languages to a first-order language we have seen in class. Prove that every AL*-concept C is coherent iff $\tau(C)$ is satisfiable.

9. Let default theory $\Delta = (D, W)$ be defined as follows:

$$D = \left\{ \frac{MA}{\neg B}, \frac{MB}{\neg A} \right\} \quad W = \{ \neg A \rightarrow E \}.$$

Define Δ 's extensions, if any. Motivate in details your answer.

10. Define a *complete default theory* to represent the inheritance hierarchy with exception depicted below (“almost all sheep are white, in particular all sheep are white with the exception of genetically modified, i.e. GM, sheep”).

