CS646: Example Exam Questions

The Lab exercise at `http://www.cs.man.ac.uk/~horrocks/Teaching/cs646/Labs/` `dlreasoning.pdf` illustrates the kind of question that might be asked in the exam. Below is another example of the kind of exam question you can expect from the Logic and Reasoning part of the course.

DL Reasoning

1. Given a knowledge base $\mathcal{K}$, explain how would you use a reasoner capable of deciding knowledge base satisfiability to determine if:

    (a) $\mathcal{K} \not\models C = \bot$ (i.e., if C is satisfiable with respect to $\mathcal{K}$);

    (b) $\mathcal{K} \models x : C$ (i.e., if x is an instance of C with respect to $\mathcal{K}$);

    (c) $\mathcal{K} \models \langle x, y \rangle : R$ (i.e., if x is related to y by role R with respect to $\mathcal{K}$).

2. Explain the basic principals of a tableau algorithm for $\mathcal{ALC}$, illustrating your answer by showing how such an algorithm would prove the satisfiability or unsatisfiability of the following concept:

$$C \sqcap \exists R.A \sqcap \exists R.B \sqcap \neg \exists R.(A \sqcap B)$$

3. For each of the following DL concepts, say if they are satisfiable and, in the case that they are satisfiable, give an interpretation in which the extension of the concept is non-empty (assume that all roles are **not** transitive:

    (a) $\exists R.(\forall S.C) \sqcap \forall R.(\exists S.\neg C)$

    (b) $(\exists S.C \sqcap \exists S.D) \sqcap \forall S.(\neg C \sqcup \neg D)$

    (c) $\exists S.(C \sqcap D) \sqcap (\forall S.\neg C \sqcup \forall S.\neg D)$

    (d) $\forall R.(C \sqcup D) \sqcap \exists R.(C \sqcup \neg D) \sqcap \exists R.(\neg C \sqcup D) \sqcap \exists R.(\neg C \sqcup \neg D)$

    (e) $\exists R.(C \sqcup D) \sqcap \forall R.(C \sqcup \neg D) \sqcap \forall R.(\neg C \sqcup D) \sqcap \forall R.(\neg C \sqcup \neg D)$