

Theoretical Computer Science II

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Exercise Sheet 2

Due: November 4, 2009

Exercise 2.1 (Propositional Logic, 2.5 + 2.5 marks)

$$\phi = (A \leftrightarrow \neg B) \wedge \neg(C \vee B \rightarrow A)$$
$$I = \{A \mapsto \mathbf{F}, B \mapsto \mathbf{T}, C \mapsto \mathbf{F}\}$$

- (a) Use the definition of *satisfaction* to prove that $I \models \phi$.
- (b) Show that $\phi \equiv \neg A \wedge B$ by using the equivalences from the lectures and the equivalences $\psi \wedge \neg\psi \equiv \perp$ and $\psi \vee \perp \equiv \psi \equiv \perp \vee \psi$. Apply in each step only one of the equivalences with the exception that you *may* implicitly use associativity.

Exercise 2.2 (Propositional Logic, 5 marks)

- (1) Formalize the following as a set KB of propositional formulae:

If the unicorn is a mythological creature, then it is immortal. But if it is not a mythological creature, then it is a mortal mammal. If the unicorn is immortal or a mammal, then it is horned. A unicorn is a magical creature if and only if it is horned.

- (2) The definitions of satisfiability, falsifiability, validity and unsatisfiability can directly be carried over from formulae to sets of formulae. Is KB
 - (a) satisfiable,
 - (b) falsifiable,
 - (c) valid,
 - (d) unsatisfiable?
- (3) Does it follow (logically) from KB that the unicorn is
 - (a) a mythological creature,
 - (b) a magical creature,
 - (c) horned?

Justify your answers to part (2) and (3).