

Theoretical Computer Science II

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Exercise Sheet 2

Due: November 7, 2011

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) 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.
- (b) Consider a vocabulary with only four atomic propositions A, B, C, D . How many models are there for the following formulae? Explain.
- $(A \wedge B) \vee (B \wedge C)$
 - $(A \Leftrightarrow B) \wedge (B \Leftrightarrow C)$

Exercise 2.2 (Propositional Logic, 5 marks)

Determine the validity or invalidity of the following argument:

“If Alice is elected class-president, then either Betty is elected vice-president, or Carol is elected treasurer. Betty is elected vice-president. Therefore if Alice is elected class-president, then Carol is not elected treasurer.”

Please explain every formal step.