

Theoretical Computer Science II

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Exercise Sheet 3

Due: November 14, 2011

Exercise 3.1 (Contradiction Theorem, 2 marks)

Prove the contradiction theorem: $KB \cup \{\varphi\}$ is unsatisfiable iff $KB \models \neg\varphi$.

Exercise 3.2 (Derivation, 3 marks)

Give a derivation of $\phi = B \wedge C$ from the knowledge base

$KB = \{A, B, A \vee C, K \wedge E \leftrightarrow A \wedge B, \neg C \rightarrow D, E \vee F \rightarrow \neg D\}$,

using the inference rules for propositional logic from the lecture slides (handout slide 34). Write your derivation down like the examples from the lecture (stating which rule is applied with which formulae).

Exercise 3.3 (Resolution, 5 marks)

Consider the formula

$$\Delta = \neg(\neg p \wedge \neg r) \wedge (r \rightarrow q) \wedge \neg q \wedge (p \rightarrow t) \wedge \neg s \wedge (s \leftarrow t)$$

- (a) Transform the formula into a clause set using the CNF transformation rules. Write down the steps.
- (b) Afterwards, use Resolution to prove whether the formula is satisfiable or not.