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9. Exercises for the Course „Complexity and Logic“

Exercise 36:

Prove Theorem 4.6 from the lecture:

(a) $B \in \mathrm{P}$ and $A \leq_p B$ implies $A \in \mathrm{P}$;

(b) $B \in \mathrm{NP}$ and $A \leq_p B$ implies $A \in \mathrm{NP}$;

(c) $A \leq_p B$ and $B \leq_p C$ implies $A \leq_p C$.

Exercise 37:

An *n-time bounded NTM* is a non-deterministic Turing machine that, on input w, makes at most $|w|$ steps. Prove that the following problem is NP-complete: given an n-time bounded NTM M and an input w, decide whether M accepts w.

Exercise 38:

Prove that every propositional formula can be transformed into an equivalent one in negation normal form in linear time.

Exercise 39:

Let φ be a 3-formula. An $\neq$-assignment to the variables in φ is one where each clause contains two literals with unequal truth values. In other words, a $\neq$-assignment satisfies φ without assigning three true literals in any clause. Let $\neq 3SAT$ be the set of 3-formulas that have an $\neq$-assignment. Show that $\neq 3SAT$ is NP-complete.

Exercise 40:

Prove that 2-colorability is in P.