Technische Universität München
Fakultät für Informatik
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Spring Semester 2012
Problem Set 7
June 19, 2012

Complexity Theory

Due date: June 26, 2012 **before** *class!*

Problem 1 (10 Points)

In the Succinct Set Cover problem we are given a set $S = \{\varphi_1, \ldots, \varphi_m\}$ of 3DNF formulae on n variables, and an integer k. We need to decide if there exists a subset $S' \subseteq \{1, \ldots, m\}$ of size at most k such that $\bigvee_{i \in S'} \varphi_i$ is a tautology.

(i) Show that Succinct Set Cover $\in \Sigma_2^p$ by stating it as a Σ_2^p language.

(ii) Since we know that $\Sigma_2^p = \mathcal{NP}^{\mathcal{NP}}$, give a formulation for Succinct Set Cover that uses an $\mathcal{NP}$ oracle.

Problem 2 (10 Points)

Prove that the following language is **PSPACE**-complete:
In-Place Acceptance: Given a Turing machine M and an input x, does M accept x without ever leaving the first $|x| + 1$ symbols on its string?

Problem 3 (10 Points)

Define the class $\mathbf{E} = \bigcup_c \mathbf{DTIME}(2^{cn})$.

(i) Is **E** closed under polynomial-time reductions?

(ii) Show that $\mathcal{P}^{\mathbf{E}} = \mathbf{EXP}$.

Problem 4 (10 Points)

Prove $\mathbf{AL} = \mathcal{P}$.