Technische Universität München
Fakultät für Informatik
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Spring Semester 2012
Problem Set 8
June 26, 2012

Complexity Theory

Due date: July 3, 2012 **before** *class!*

Problem 1 (10 Points)

Show that every function $F : \{0,1\}^n \to \{0,1\}$ can be computed by a boolean circuit of size $1000 \cdot 2^n/n$.

Problem 2 (10 Points)

Describe a decidable language in $\mathbf{P_{/poly}}$ that is not in $\mathcal{P}$.

Problem 3 (10 Points)

Prove the Non-uniform Hierachy Theorem:
For functions $T, T' : \mathbb{N} \to \mathbb{N}$ with $n < T(n) < T'(n) < \frac{2^n}{100n}$ and $T \log T = o(T')$, it follows that $\mathbf{SIZE}(T(n)) \subsetneq \mathbf{SIZE}(T'(n))$.
Hint: The proof idea for a linear and a quadratic function is given in the textbook.

Problem 4 (10 Points)

Show that $\mathbf{NC}^1 \subseteq \mathbf{L}$. Conclude that $\mathbf{PSPACE} \neq \mathbf{NC}^1$.