CS 254 Midterm

Grading

- Due 2014-02-20 @ 2pm. (Right before class).
- Please send all submissions (both LaTeXed and *neatly* handwritten) to cs254-win1314-hw@lists.stanford.edu

Problem 1

Show that there is an oracle A and a language $L \in \mathrm{NP}^A$ such that L is not polynomial time reducible to 3SAT even when the machine computing the reduction is allowed access to A.

Problem 2

Prove that $\mathrm{EXP} \cap \mathrm{P}_{/\mathrm{poly}} \not\subseteq P$.

Problem 3

Show that if $\mathrm{P} = \mathrm{NP}$, then there is a language in EXP that requires circuits of size $\frac{2^n}{10n}$.

Problem 4

Show that $\mathrm{Size}(O(n^{\log n})) \not\subset \mathrm{BPP}$.

Problem 5

$P^{\mathrm{NP}[k]}$ is the set of languages decidable by a polynomial time TM that makes k adaptive queries to an NP oracle. $P_{\|}^{\mathrm{NP}[k]}$ is the set of languages decidable by a polynomial time TM that makes k parallel queries to an NP oracle. (The TM does some computation, writes down k queries, queries the oracle, receives k responses, does some more computation, and terminates.)

Prove: $P^{\mathrm{NP}[k]} \subseteq P_{\|}^{\mathrm{NP}[2^k-1]}$ and $P_{\|}^{\mathrm{NP}[2^k-1]} \subseteq P^{\mathrm{NP}[k+1]}$