CSE 200
Computability and Complexity
Homework 5
Space Complexity and Probabilistic Time Complexity Due March 10

March 2, 2016

Give proofs for each problem. Proofs can be high-level, but be precise. You may use without giving a proof any result proved in class or in the textbook.

2-SAT: The 2-SAT problem is to decide Satisfiability for CNF formulas with at most 2 literals per clause. Prove that $2 - SAT$ is $co - NL$-complete (under deterministic logspace many-one reductions). You can use without proof that $PATH$ is NL-complete.

One-sided vs. two-sided error in probabilistic complexity : Prove that $RP = BPP$ if and only if $BPP = ZPP$.

Probabilistic Complexity Consider the following additive error approximate circuit probability problem (AEACP): given a circuit C with n inputs, compute $Pr_{x \in \{0,1\}^n}[C(x) = 1]$ to within an additive error of $1/4$. In other words, an algorithm A solves the problem if for every circuit C, $|A(C) - Pr_x[C(x) = 1]| \leq 1/4$. First, give a probabilistic polynomial-time algorithm A that solves AEACP with probability at least $7/8$ on every circuit. (Hint: use standard tail bounds from probability, such as Chebyshev bounds or Chernoff bounds. You can look these up in a probability textbook, if you cite the textbook.) Second, show that if there is a deterministic polynomial time algorithm that solves $AEACP$, then $P = BPP$.