

Homework Assignment #3

Due: Nov 27, 2007

1. Let $2SAT$ be a restriction of SAT in which every clause has at most two variables (is in 2CNF form). For example, $(\neg x \vee y) \wedge (y \vee \neg z) \wedge (\neg y \vee \neg w)$ is in 2CNF, and since it is satisfiable, it is in 2SAT. In this question you will show that 2SAT is NL-complete. More precisely, you will show that 2SAT is complete for coNL, from which it follows by Immerman's theorem that it is also complete for NL.
[10] (a) Show that 2SAT is in coNL.
[10] (b) Show that 2SAT is hard for coNL.
- [10] 2. Prove that $NL \subseteq AC^1$.
- [10] 3. Show that if $PH = PSPACE$ then polynomial-time hierarchy has only finitely many distinct levels.
- [20] 4. Define a ZPP-machine to be a probabilistic TM which is permitted three types of the output, *accept*, *reject* and *?*. A ZPP machine M decides a language A if M outputs the correct answer on every input string w with probability at least $2/3$ and M never outputs a wrong answer. Furthermore, the average running time over all branches of M on w must be bounded by a polynomial in the length of w . Show that $RP \cap coRP = ZPP$.