Computational Complexity

11.12.2018

Problem 1. (0.5 pt) Let $bin(a)$ be the binary encoding of a number in a string over $\{0,1\}$. Prove that the set of words of the form $bin(a)\#bin(b)\#bin(a \cdot b)$ (where $a, b \in \mathbb{N}$) is in AC^1.

Problem 2. (0.5 pt) Prove that if $\mathsf{NTIME}(n^{100}) \subseteq \mathsf{DTIME}(n^{1000})$, then $\mathsf{P} = \mathsf{NP}$.

Problem 3. (0.5 pt) Prove that the following problem is NL-complete: given two regular expressions, decide whether there is a word that matches both of them.
Hint. Given a regular expression, a nondeterministic finite automaton recognizing its language can be computed in logarithmic space.