

CS 172 Spring 2007 — Discussion Handout 11

1. If truth be told...

True/False:

- (a) A NP Turing machine can only make at most $poly(n)$ nondeterministic transitions on input of lengths n .
- (b) An NL Turing machine can only make at most $O(\log n)$ nondeterministic transitions on input of lengths n .
- (c) When we say a function f is computable in space $O(\log n)$, we think of f as having a read-only input tape, a read-write work tape and an output tape. Here, f is allowed to write once to the output tape, and to read from the output tape.
- (d) PSPACE = coNPSpace.
- (e) NL is closed under the Kleene star operation.

2. Well-behaved reductions

Prove that log-space reductions (through log-space transducers, as defined in class) are transitive i.e. $A \leq_L B$ and $B \leq_L C$ implies $A \leq_L C$.

3. What can be done

Let $ADD = \{\langle x, y, z \rangle \mid x, y, z > 0 \text{ are binary integers and } x + y = z\}$. Show that $ADD \in L$.

4. And what might be hard

We say that a directed graph is strongly connected if every pair of nodes is connected by a directed path in each direction. Let

$$\text{STRONGLY-CONNECTED} = \{\langle G \rangle \mid G \text{ is a strongly connected graph}\}$$

Show that STRONGLY-CONNECTED is NL-complete.