Math 6010 - Assignment 11

Due December 4, 2023

(1) Show NL $\neq$ PSPACE.
(2) Show PSPACE $\neq$ EXPSPACE and P $\neq$ EXPTIME.
(3) Read the proof of the Nondeterministic Time Hierarchy Theorem [1, Theorem 3.2].
(4) A Boolean formula $\Phi(x_1, \ldots, x_n)$ is in *k-conjunctive normal form* (k-CNF) if

$$\Phi(x_1, \ldots, x_n) = \bigwedge_{i=1}^{\ell} (a_{i1} \vee \cdots \vee a_{ik})$$

where all $a_{ij} \in \{x_1, \ldots, x_n, x_1', \ldots, x_n'\}$ are either arguments or negations of arguments.

k-SAT is the problem of deciding satisfiability of a Boolean formula in k-CNF.

Show that 2-SAT is in coNL (the complement of NL).

Hint: Start with assigning a truth value to one variable. What does this imply for the assignment of other variables?

References

[1] Arora, Sanjeev; Barak, Boaz. Computational complexity: a modern approach. Cambridge University Press, 2007