

CSC 2401F 2008, Assignment 2
Due: November 4 at start of class

1. (a) Suppose that $STCON \in DSPACE(S')$ for (say) some space constructible $S' = O(\log^a n)$. (We know this is true for $S' = \log^2 n$, so the interest in this result is for $a < 2$.) Show $NSPACE(S) \subseteq DSPACE(S^a)$ for any space constructible $S = \Omega(\log n)$.
(b) Show $NSPACE(S) = \text{co-NSPACE}(S)$ for any space constructible $S = \Omega(\log n)$.
2. We want to show that $2SAT$ is complete for \mathcal{NL} . That is, we want to show:
 - $2SAT \in \mathcal{NL}$
 - For all $L \in \mathcal{NL}$, $L \leq_{\log} 2SAT$.

Hint: Use $\overline{2SAT}$ for the first part and \overline{STCON} for the second part and note that $u \vee v \equiv \neg u \rightarrow v \equiv \neg v \rightarrow u$.

3. Consider regular expressions with squaring as defined in the text and discussed in class.
 - (a) Show how to “succinctly” represent (i.e. within a small polynomial bound of n) the following languages:
 - $L_1^n = \{w \in \Gamma^* : |w| = 2^n\}$
 - $L_2^n = \{w \in \Gamma^* : |w| > 2^n\}$
 - $L_3^n = \{w \in \Gamma^* : |w| < 2^n\}$
 - (b) We indicated (and the text shows) that \overline{TSRE} is complete for EXPSPACE. Using the first part of this question, deduce a specific lower bound on the space complexity of \overline{TSRE} .