

CS5230 Tutorial 3

1. Suppose $S(n)$ is fully space constructible, and $S(n) \geq \log n$. Then show that $NSPACE(S(n)) = coNSPACE(S(n))$.
2. Show that context sensitive languages are closed under complementation.
Note: Recall that context sensitive languages are the languages which can be generated by grammars (S, N, Σ, P) , where N is the set of non-terminals, Σ is the alphabet set, S is the starting symbol (member of N) and P is the set of productions.
The productions are of the form $\alpha \rightarrow \beta$, where α contains at least one non-terminal and $|\alpha| \leq |\beta|$. (The only exception is generation of ϵ , which is generated separately, if needed.)
The language generated by the grammar is the set of all $w \in \Sigma^*$ such that $S \Rightarrow^* w$.
3. Show the translation lemma for deterministic time/space and nondeterministic time.
4. Show that $NSPACE(n^2)$ is a proper subset of $NSPACE(n^5)$.
5. Show that $NSPACE(n^3)$ is a proper subset of $NSPACE(n^5)$.