CS 109
Spring 2010
Theory of Computation: Advanced

Homework 3
Due Wed Apr 21, 5:00pm

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General Instructions: Same as in Homework 1.
Honor Principle: Same as in Homework 1.

7. Is $\text{DTIME}(2^n) = \text{DTIME}(2^{0.9n})$? Why or why not (give clear reasons)? Prove that there is a constant $\alpha < 1$ such that $3\text{SAT} \in \text{DTIME}(2^{\alpha n})$. [You need to answer all parts of this question to receive credit.] [2 points]

8. Imagine it is 1980: Savitch's Theorem is common knowledge, but no one knows yet how $\text{NSPACE}(f(n))$ relates to $\text{coNSPACE}(f(n))$. Despite this, a clever padding argument, together with the deterministic space hierarchy theorem, suffices to establish a somewhat weak nondeterministic space hierarchy theorem. Prove this. Specifically, give a proof that if α and β are real-valued constants with $0 < \alpha < \beta$, then $\text{NSPACE}(n^\alpha) \neq \text{NSPACE}(n^\beta)$. [2 points]