Problem Set 7 — Due February 21, 2002

Problem 1. Prove that the following languages are not context free.

Part A. $L_a = \{b_i \# b_{i+1} : b_i \text{ is } i \text{ in binary}, i \geq 1\}$

Part B. $L_b = \{ww^R w : w \in \{a, b\}^*$

Problem 2. Prove that $L = \{x \sharp y : \ x, y \in \{\mathtt{0}, \mathtt{1}\}^* \text{ and } x \neq y\}$ is context free by exhibiting an NPDA for this language.

Problem 3. Describe, in full, a Turing machine that decides the language $L = \{\sharp a^{2^n} \sharp : \ n \geq 0\}$. Try to use a simple strategy and a small number of states.