Problem Set 7
CS 373: Theory of Computation

Assigned: March 7, 2013   Due on: March 14, 2013

Instructions: This homework has 3 problems that can be solved in groups of size at most 3. Please follow the homework guidelines given on the class website; submitions not following these guidelines will not be graded.

Recommended Reading: Lecture 13, 14, and 15.

Problem 1. [Category: Design] Design a PDA to recognize the language

$$C = \{x\#y \mid x, y \in \{0,1\}^*, \ x \neq y\}$$

You need not prove the correctness of your construction but you should provide the intuition behind the states and stack symbols used, that makes your construction clear and understandable.   **[10 points]**

Problem 2. [Category: Comprehension+Design+Proof] A CFG G will be said to *right-linear* if every rule in G is either of the form $A \to \epsilon$ or $A \to aB$, where a is a terminal symbol, and B is a variable. Prove that if G is right-linear then $\mathbf{L}(G)$ is regular. *Hint:* Construct an NFA that accepts a string iff it is generated by G.   **[10 points]**

Problem 3. [Category: Proof] Let G be a CFG in Chomsky normal form that contains b variables. Show that if G generates some string with a derivation having at least 2^b steps, $\mathbf{L}(B)$ is infinite.   **[10 points]**