# Problem Set 6
CS 373: Theory of Computation

Assigned: October 18, 2012   Due on: October 25, 2012

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: Lectures 13 through 15.

Problem 1. [Category: Comprehension] Consider the PDA P over the input alphabet $\{0, 1, \#\}$ shown in the figure below; a, in the transitions below, is either 0 or 1.
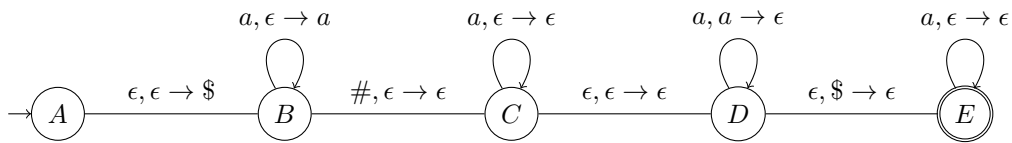
1. Write the formal description of the PDA P listing the states, stack alphabet, transition function, initial state and final states. **[5 points]**

2. For each of the following strings either show that they are accepted by P by describing an accepting computation, or show that they are not accepted by showing the *entire* computation tree on the input: 01#10, 01#01, 01#111000. **[3 points]**

3. Describe the language recognized by the PDA P. Give an informal justification for your answer, by explaining how the PDA works. **[2 points]**

Problem 2. [Category: Design] Design a PDA to recignize the language

$$L = \{xy \mid x, y \in \{0, 1\}^*, \ |x| = |y|, \text{ but } x \neq y\}$$

You need not formally prove the correctness of your construction, but your construction should be clear and understandable, giving the intuition behind the states and the stack symbols and how the PDA works. **[10 points]**

Problem 3. [Category: Proof] Let $G = (V, \Sigma, R, S)$ be a CFG in Chomsky Normal Form. For $w \in \Sigma^*$, with $|w| \geq 2^n$, and $A \in V$, if there is a parse tree with yield w and root labeled A, prove that the height is at least $n + 1$. **[10 points]**