Intro to Theory of Computing	**481 Homework 8**
CS481 Fall 2005	**October 21**

1. Give a PDA for the following language. No need to give a formal proof of correctness, but include a brief explanation of the construction.

$$\{a, b, c\}^* - \{a^n b^n c^n \mid n \geq 0\}$$

2. Let $\Sigma = \{0, 1\}$. Let $\overline{x}$ denote the boolean complement of x; that is, the string obtained from x by converting all the 0's to 1's and all the 1's to 0's. For instance, if $x = 110$, $\overline{x} = 001$. Let x^r denote the reverse of the string x.

   (a) Give a CFG for the language $L = \{x \in \Sigma^* | \ x^r = \overline{x}\}$. For instance 011001 and 010101 are in L but 101101 is not.

   (b) Give a PDA for the language L. You do not need to give a proof.

3. Consider a deterministic FA $M = (Q, \Sigma, \delta, F, s)$. Define a configuration of a DFA to be an element $c = (w_1, q, w_2)$ of $\Sigma^* \times Q \times \Sigma^*$. Define the following language

$$L = \{c_1^R \ \$ \ c_2 \mid c_1 = (w_1, q, aw_2), c_2 = (w_1 a, \delta(q, a), w_2\}$$

   Intuitively, the language L captures two consecutive configurations of the machine. Suppose that c_1 describes a possible configuration of the DFA in terms of three things: w_1 is the part of the input string that has already been read, q is the current state and aw_2 the part of the input left to read. c_2 is then the next configuration that the machine reaches, after reading one more symbol from the portion left to read. Note that you do *not* have to check whether c_1 is a valid configuration, that is, we are *not* verifying whether $\widehat{\delta}(s, w_1)$ equals q or not.

   (a) Show that L is not regular.

   (b) Prove that L is context free either by giving a CFG or a PDA. You need to prove that your grammar/PDA works.

4. Prove that the intersection of a context-free and a regular language is context free.