CIS 262 Fall 2009: Homework 2, Due October 8

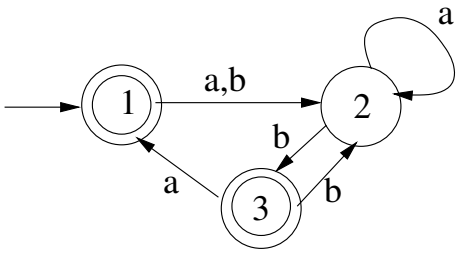
Please write your answers succinctly and rigorously.

1. Let $\Sigma = \{0, 1\}$. Consider the regular expression $0(01 + 10)^*0$. 10pts

   (a) Construct an ε-NFA for the above regular expression using the systematic construction discussed in class (or textbook).

   (b) Convert the above ε-NFA to a DFA using the subset construction (you need to show only the states that are reachable from the initial state).

2. Convert the DFA below into an equivalent regular expression using the procedure to eliminate states one by one. The one discussed in class is described in Sec 1.3 of Sipser's textbook. Section 3.2.2 of Hopcroft, Motwani, Ullman, has a very similar construction (the only difference is in initialization). You can use either of these two. 10pts



3. Prove that the following languages are not regular using the pumping lemma. 16pts

   (a) $\{ 0^m 1^n \mid m < n \}$.

   (b) $\{ 0^n \mid n \text{ is a power of } 2 \}$.

4. Given two languages L and M, the language $alt(L, M)$ contains words w of even length of the form $a_1a_2...a_n$ such that $a_1a_3a_5 \ldots a_{n-1}$ is in L and $a_2a_4a_6 \ldots a_n$ is in M. That is, a word w is in the language $alt(L, M)$ if the word obtained from w by retaining only its odd positions is in L and the word obtained from w by retaining only its even positions is in M. Prove that the class of regular languages is closed under the operation alt. That is, given a DFA A for L and a DFA B for M, show how to construct a DFA that accepts the language $alt(L, M)$. 14pts