Problem Set 3 — Due Tuesday, January 24, 2006

Problem 1. Give minimal-size NFA (size = # of states) for the following languages. Assume $\Sigma = \{0, 1\}$.

1. $\{w : w \text{ contains an even number of 0s, or exactly two 1s.}\}$
2. The language $0^*1^*0$.

Problem 2. Use the construction given in class to convert the following two nondeterministic automata to equivalent deterministic finite automata.

Problem 3. Suppose that $L$ is DFA-acceptable. Show that the following languages are DFA acceptable, too.

**Part A.** Let $\Sigma^* = \{x_1x_2 \cdots x_k : k \geq 1 \text{ and each } x_i \in \Sigma\}$.

$\text{Max}(L) = \{x \in L : \text{there does not exist a } y \in \Sigma^* \text{ for which } xy \in L\}$.

**Part B.** $\text{Echo}(L) = \{a_1a_1a_2a_2 \cdots a_na_n \in \Sigma^* : a_1a_2 \cdots a_n \in L\}$.

**Part C.** $\text{Comb}_{\text{even}}(L) = \{a_2a_4a_6 \cdots a_n \in \Sigma^* : a_1a_2a_3 \cdots a_n \in L\}$, for $n$ is even.

Problem 4. Let $L$ be a language over $\Sigma$ and define the language $\text{PAL}(L) = \{x \in \Sigma^* : xx^R \in L\}$. If $L$ is DFA-acceptable, is $\text{PAL}(L)$ necessarily DFA-acceptable? Prove your answer.