PROBLEM SET 5
CS 373: THEORY OF COMPUTATION

Assigned: February 21, 2013   Due on: February 28, 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 9, 10 and 11.

Problem 1. [Category: Proof] Let $C = \{1^k x \mid x \in \{0,1\}^*, \ k \geq 1,$ and x contains at most k 1s$\}$. Using the pumping lemma, prove that C is not regular.   **[10 points]**

Problem 2. [Category: Comprehension+Design] Let $L = \mathbf{L}(1^*0(00 \cup 01 \cup 1)(0 \cup 1)^*)$.

1. List all the equivalence classes of $\equiv_L$. Prove that your answer is correct.   **[5 points]**

2. Draw the minimum state DFA M^L accepting L.   **[5 points]**

Problem 3. [Category: Comprehension+Proof] For a language $L \subseteq \Sigma^*$, define an equivalence $\simeq_L$ on Σ^* as follows

$$x \simeq_L y \text{ iff } \forall z. \ zx \in L \leftrightarrow zy \in L$$

Notice that this is a slightly different equivalence than $\equiv_L$ defined in Lecture 11. Prove that L is regular iff $\simeq_L$ has finitely many equivalence classes. *Hint:* Can you see a connection between $\simeq_L$ and $\equiv_{L^R}$, where L^R refers to the reverse of L?   **[10 points]**