Problem Set 5
CS 373: Theory of Computation

Assigned: September 29, 2013   Due on: October 10, 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. Solutions not following these guidelines will not be graded.

Recommended Reading: Lectures 9, 10, and 11.

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

Problem 2. [Category: Comprehension+Proof] Consider the language $F = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and if } i = 1 \text{ then } j = k\}$

1. Prove that F is not regular. **[5 points]**

2. Prove that F satisfies the pumping lemma. *Hint:* Take the pumping length to be $p = 3$ and show that F satisfies the pumping lemma for this length. **[5 points]**

Problem 3. [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]**