Course: CSC707, Automata, Computability and Computational Theory
Homework 4: Finite automata (FA), DFA, NFA, regular expressions, Pumping lemma, and closure properties
Submission: Use Wolfware
File Format: LaTeX and PDF
NOTE: If you create imaages, make sure you submit them as well.

Due Date: 11:00 AM, Saturday, March 13, 2010

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1. Given the set of all of strings in $(0+1)^*$ such that some two zeros are separated by a string whose length is $4i$, for some some $i \geq 0$,
   (a) Give a nondeterministic finite automata accepting this set.
   (b) Provide a regular expression for L.
2. Given a language L of all strings over $\{0,1\}$ with an equal number of zeros and ones such that no prefix has two more zeros than ones nor has two more ones than zeros:
   (a) Construct a DFA that accepts all strings from L.
   (b) Provide a regular expression for L.
3. Which of the following languages are regular? Prove your answers.
   (a) $L = \{0^j | j \bmod 3 \equiv 0\}$
   (b) $L = \{0^j 1^k | \gcd(j,k) \equiv 1\}$, where $gcd()$ is the greatest common denominator.
   (c) $L = \{0^i 1^j 0^k | k \geq i + j\}$
4. Assuming $L_1, L_2, ...$ are regular, which of the following languages are regular. Prove your answers.
   (a) $\bigcup_{i=1}^{n} L_i$
   (b) $\bigcup_{i=1}^{\infty} L_i$
   (c) $\bigcap_{i=1}^{n} L_i$
   (d) $\bigcap_{i=1}^{\infty} L_i$
5. Prove that the following languages are regular:
   (a) $MIN(L) = \{x \in L |$ no prefix of x is in $L\}$
   (b) $L^R = \{x |$ reverse of x is in $L\}$