CSE 625, Winter, 2009
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CSE625 Homework 4
Due Friday, Feb. 6

1. Let M be the non-deterministic finite automaton $< Q, \Sigma, \delta, q_0, F >$ where:

$$\begin{array}{rcl} Q & = & \{q_0, q_1, q_2, q_3, q_4\} \\ \Sigma & = & \{a, b\} \\ F & = & \{q_1, q_4\} \end{array} \qquad \begin{array}{rcl} \delta(q_0, a) & = & q_1 \\ \delta(q_0, a) & = & q_3 \\ \delta(q_1, a) & = & q_2 \\ \delta(q_2, b) & = & q_3 \end{array} \qquad \begin{array}{rcl} \delta(q_3, b) & = & q_1 \\ \delta(q_3, b) & = & q_4 \\ \delta(q_4, a) & = & q_0 \end{array}$$

   (a) Draw the transition diagram for M.

   (b) Construct a deterministic finite automaton M' which simulates M and draw the transition diagram for M'. (Label the states of M' with subsets of the states of M.)

   (c) Give the sequence of configurations and moves which causes M to accept $aabbabbaa$.

   (d) Let $\bar{L}$ be the language of strings $w \in \{a, b\}^*$ where w is not accepted by M. Construct a deterministic finite automaton which accepts $\bar{L}$. (Be sure to put in a dead state before forming the complement.)

2. Construct a finite automata (possibly non-deterministic with Λ transitions) which accepts the languages generated by the following regular expressions:

   (a) $(ac^*ba)^*(a + \Lambda)$.

   (b) $((a^* + ab)^*cb)^*$.

   (c) $(ca^*)(c(b + c) + \Lambda)(c^*b + a^*)$.

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

   (a) $\{\ a^iba^i\colon\ i \geq 17\ \}$.

   (b) $\{\ w \in \{a, b, c\}^*$: the number of a's is greater than the number of b's which is greater than the number of c's in $w\ \}$.

   (c) $\{\ a^ib^j$: integer i is a multiple of integer j and $i, j \geq 2\}$.

(The grader will only grade a subset of these problems.)