ASSIGNMENT #3
Due Wednesday, September 23, 2015

1. Find the minimum state finite automaton for the language specified by the deterministic finite automaton given as a solution to Assignment #2, problem 3.

2. Consider the deterministic finite automaton $M = (\{q_0, q_1, q_2, q_3, q_4\}, \{a, b\}, \delta, q_0, \{q_1, q_3\})$ where $\delta$ is defined as follows:

   $\delta(q_0, a) = q_1$
   $\delta(q_0, b) = q_3$
   $\delta(q_1, a) = q_1$
   $\delta(q_1, b) = q_2$
   $\delta(q_2, a) = q_1$
   $\delta(q_2, b) = q_2$
   $\delta(q_3, a) = q_4$
   $\delta(q_3, b) = q_3$
   $\delta(q_4, a) = q_4$
   $\delta(q_4, b) = q_3$

   (a) Write an equivalent regular expression.
   (b) Describe in English the language identified by this DFA/regular expression.

3. Prove that the following languages are not regular sets:

   (a) $L = \{a^i b^j c^k \mid i = j \lor j = k, \ i, j, k \geq 0\}$. Example strings include abccc, abbcc, aaa ($j = k = 0$), etc.
   (b) $L = \{w \mid w \in \{a, b, c, d\}^+, \ w \text{ contains an equal number of } a\text{'s and } c\text{'s and an equal number of } b\text{'s and } d\text{'s}\}$. Example strings include aabbcddd, dabacbcd, and dabcac.
   (c) $L = \{w \mid w \in \{0, 1\}^+, \ w = w^R\}$. Example strings include 0, 11, 010, 0101010, etc.
   (d) $L = \{w \mid w \in \{0, 1\}^+, \ w \text{ is of the form } (0^n1)^n, \ for \ i = 1, 2, ..., n, n \geq 0\}$. The strings of this language are $\varepsilon, 01, 001001, 000100010001, ...$