SI472 6-Week Exam

1. Label as accept or reject:
   a) bccaabb
   b) cbaacqabb
   c) caaabqacc

2. Label as accept or reject:
   a) abbaa bcc
   b) ccc cbb
   c) bbaadee

3. Draw the diagram for $M_3 = (\{q_0, q_1, q_2\}, \{0, 1\}, \delta, q_0, \{q_2\})$

4. Draw the diagram for $M_4 = (\{q_0, q_3\}, \{0, 1\}, \{(0, q_0), (1, q_1), (1, q_2)\}, 0, \{0, q_3\})$

5. Give the 5-tuple for the deterministic finite automaton

6. Give the 5-tuple for the non-deterministic finite automaton

7. Give a concise English language description of the language accepted by this machine:

8. Give a concise English description of the language accepted by this machine:

9. Mystery Algorithm I
   Input: $M = (Q, \Sigma, \delta, s, W)$ and $x \in \Sigma$
   Output: $M' = (Q \cup \{\#\}, \Sigma, \delta', s', \{\#\}, W)$ where $\# \notin Q$
   $\delta'(q, \#) = \delta(q, \#)$ if $q \neq \#$
   $\delta'(q, \#) = \delta(\#, \#)$ if $q = \#$ and $z = x$
   $\#$ otherwise

   a) Show the 5-tuple produced for input $M = (\{q_0, q_1, q_2, q_3\}, \{0, 1\}, \{(0, q_0), (1, q_1), (1, q_2)\}, 0, \{q_3\})$ and $x = c$.
   b) Draw the machine $M'$ from part a).
   c) Give a concise English description of what this algorithm accomplishes. Not just for the example input, but for any machine $M$ and character $x$.

10. Mystery Algorithm II
    Input: $M = (Q, \Sigma, \Delta, s, W), x \in \Sigma$
    Output: $M' = (Q \cup \{\#\}, \Sigma, \Delta', s', \{\#\}, W)$ where $\# \notin Q$
            $\Delta'(q, x) = \Delta(q, x) \cup \{x \# x \# \}$

    a) Draw the machine $M'$ for input $x = c$
    b) Give a concise English description of what this algorithm accomplishes. Not just for the example input, but for any machine $M$ and character $x$. 