# B501 Assignment 2 Part I
## Enrique Areyan

## Due Date: Friday, January 27, 2012
## Due Time: 11:00pm

1. (15 points) Let $M$ be the finite automaton $(Q, \Sigma, \delta, q_0, F)$. Define the function
   $\delta^* : Q \times \Sigma^* \to Q$ as follows:

   - $\delta^*(q, \varepsilon) = q$
   - $\delta^*(q, wa) = \delta(\delta^*(q, w), a)$, where $w \in \Sigma^*$ and $a \in \Sigma$

   (Recall that $L(M) = \{w \in \Sigma^* | \delta^*(q_0, w) \in F\}$, so $\delta^*$ is the recursive transition function of $M$.)
   Prove that for each $x$ and $y$ in $\Sigma^*$,

   $$\delta^*(q, xy) = \delta^*(\delta^*(q, x), y)$$

   Hint: Use structural induction.

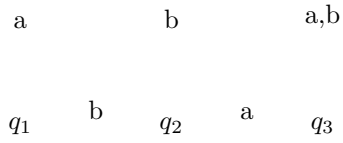
2. (15 points) Give deterministic finite automata accepting the following languages over the alphabet (0,1).

   (a) The set of all strings ending in 011.

   (b) The set of all strings with "011" as a substring.

   (c) The set of all strings such that every block of 4 consecutive symbols contains at least two 1's.

3. (5 points) Describe in English the sets accepted by the following DFA.

4. (15 points) Let $\Sigma = \{0, 1\}$, and let L be the set of strings that contain an even number of 0's and an odd number of 1's. Use the product construction to design a DFA that accepts L. (Draw appropriate diagrams)

5. (15 points) Give nondeterministic finite automata accepting the languages given in problem 2. Make sure that when possible, you should design simpler automata than what you have for problem 2.

   (a) NFA accepting the set of all strings ending in 011.

   (b) NFA accepting the set of all strings with "011" as a substring.

   (c) NFA accepting The set of all strings such that every block of 4 consecutive symbols contains at least two 1's.

6. (10 points) Give nondeterministic finite automaton accepting the following language: The set of strings in $(\mathbf{0} + \mathbf{1})^*$ such that some two 1's are separated by a string whose length is $3i$, for some $i \geq 0$.