Due September 25, 9:00 a.m.

Problem 1

Sipser, 1.8a, 1.9b, 1.10c.

Problem 2

Sipser, 1.14.

Problem 3

Give regular expressions for the following languages over $\Sigma = \{a, b\}$:

a. $L = \text{all strings do not contain the substring } ba$

b. $L = \{a^n b^m \mid n \geq 1, m \geq 1, nm \geq 3\}$ ($nm$ is $n$ times $m$)

c. $L = \text{all strings containing a number of } a\text{s that is a multiple of 3}$.

Problem 4

Are the regular expressions over $\Sigma = \{a, b, c\}$ in each pair equivalent? Explain your answer. If the two are not equivalent, show a string that is in one language and not the other.

a. $(a \cup b)^* a^*$ and $((a \cup b) a)^*$

b. $((a \cup b) c)^*$ and $(ac \cup bc)^*$

c. $b(ab \cup ac)$ and $(ba \cup ba)(b \cup c)$

Problem 5

Let $L$ be the language denoted by the regular expression $((ba)^* \cup bb)(\varepsilon \cup b)$. Construct an NFA that recognizes $L$ using the procedure outlined in class. Show your steps.
Problem 6

Use the state elimination method to convert the following finite automaton to a regular expression. Please eliminate the states in this order: $q_3, q_1, q_2, q_0$. 

![Finite Automaton Diagram]