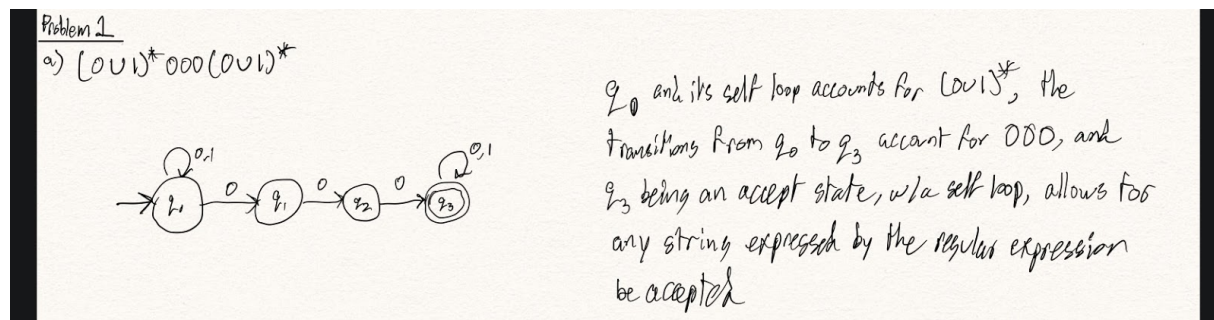Simrun Heir and Michael Sanchez
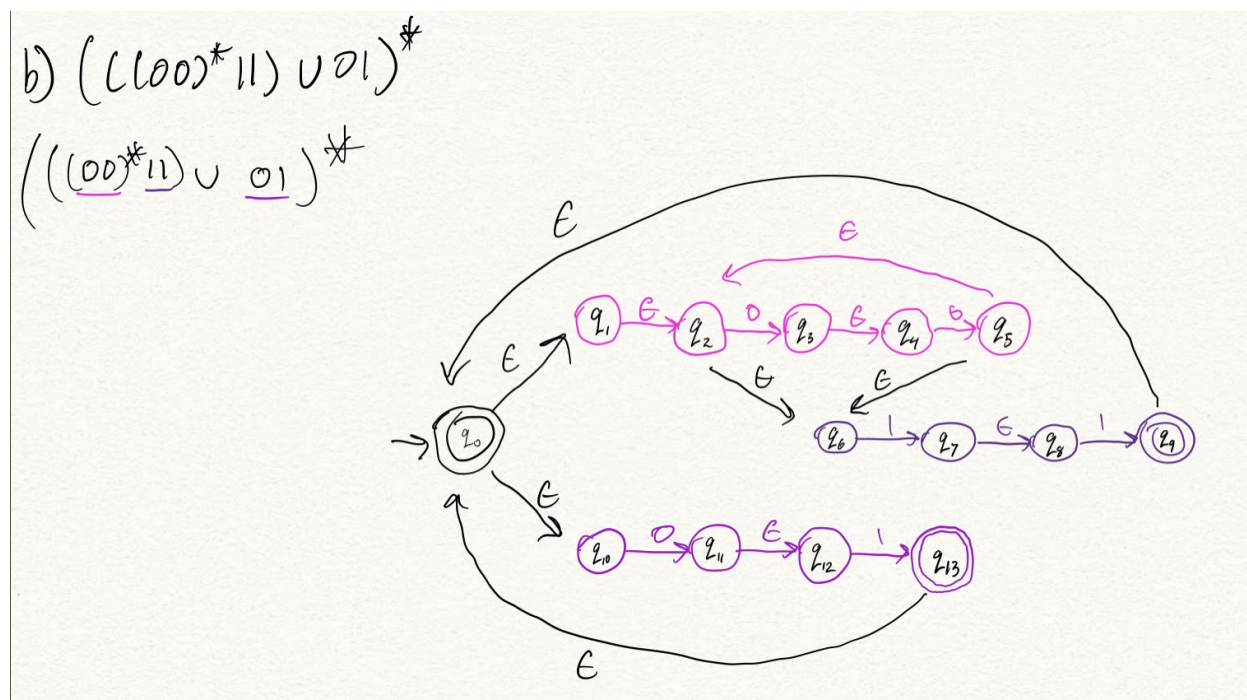I pledge my honor that I have abided by the Stevens Honor System.
Problem 1:

a.

a) $(0 \cup 1)^* 000 (0 \cup 1)^*$

q_0 and its self loop accounts for $(0 \cup 1)^*$, the transitions from q_0 to q_3 account for 000, and q_3 being an accept state, w/a self loop, allows for any string expressed by the regular expression be accepted

b.

b) $\left(\left((00)^* 11 \right) \cup 01 \right)^*$

$\left(\left((00)^* 11 \right) \cup 01 \right)^*$

Explanation: The entire regular expression is starred, which means it accepts the empty string, so the NFA start in an accept state. Because the regular expression is also starred, there are epsilon transitions from the accept state on each branch back to the start state. The top branch represents the NFA for (00)*11, where there are epsilon transitions from the states that represent an even number of 0s to the NFA for 11. Because the expression contains an union operation, the branch that processes (00)*11 ends in an accept state, and also transitions to the start state. The branch on the bottom accounts for 01, and because 01 is unioned with (00)*11, as well as starred, that branch ends in an accept state and has an epsilon transition back to the start state.

c.

c) $\emptyset^*$

Since it only accepts the language that contains no strings, it has no accept states, and is only one state. If the language has anything in it, even the/empty string, the NFA would have to reject

Problem 2:

a.

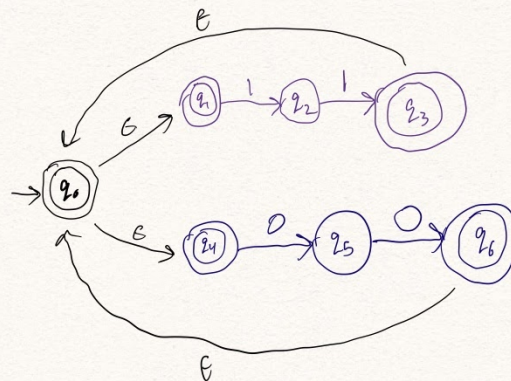a) $\{w \in \{a,b\}^* : w \text{ does not end in } ba\}$ $\Sigma = \{a,b\}$

$$\Sigma^* a^* \cup b^* \cup (ab)^*$$

b.

b) $\{w \in \{0,1\}^* : w = a \circ B, a \text{ has an even number of } 1\text{'s and } B \text{ has an even number of } 0\text{'s}\}$

a NFA   B NFA

$$\left((11)^* \cup (00)^* \right)^*$$

Problem 3:

Let C be the language of all valid delimited comment strings.
  — must begin with "/#" and end with "#/" and have no intervening "#/"

$$\Sigma = \{a, b, /, \#\}$$

/# ------ #/
⌐ $\in \Sigma$, but no #/

$$/\#(a \cup b \cup / \cup (\#^*(a \cup b)))^* \#/$$

Problem 4:
  a.

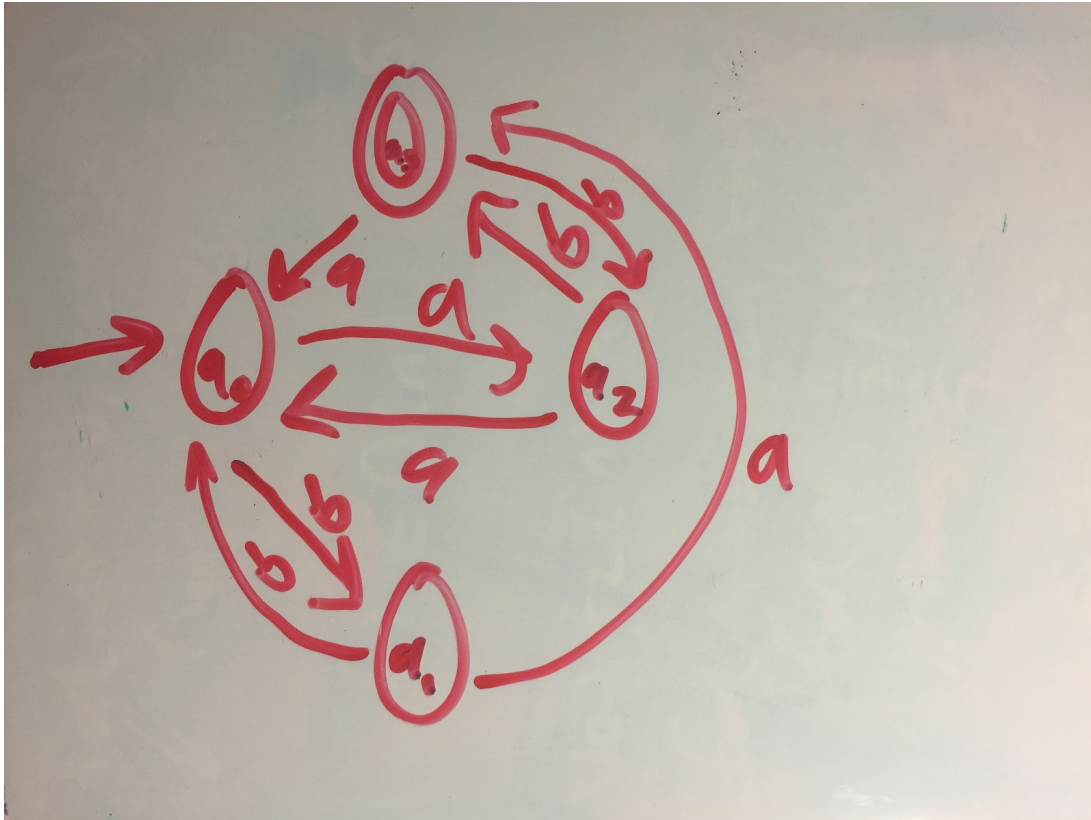$$a \cup b \cup a \Sigma^* a \cup b \Sigma^* b$$

  b.

b) Let $\Sigma = \{a, b, c, d\}$. The language L consists of all strings in which at least one symbol of Σ is missing
  a,b,c   b,c,d   a,b,d   a,c,d

$$(a \cup b \cup c)^* \cup (b \cup c \cup d)^* \cup (a \cup b \cup d)^* \cup (a \cup c \cup d)^*$$

  c.

Explanation: The start state, q_0, and the bottom state, q_1, are only accessible in the case that the input string w has an even number of a's and an even number of b's. In the case that w has an even length and an odd number of a's, the string will always find itself in the accept state after the input is processed.