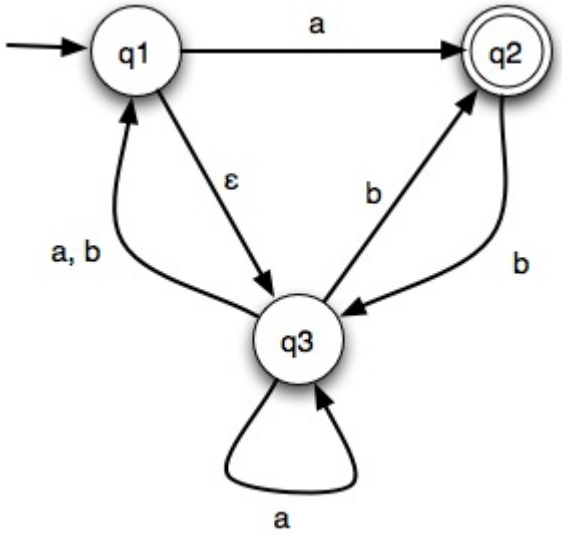
COSC 440
Exam 1 Review
Fall 2016

Assume that $\Sigma = \{0, 1\}$ unless otherwise noted. In all cases you should show *all* steps.

1. Give the RE, NFA, and DFA for the language $A = \{w|w$ contains an even number of 0s, or contains exactly two 1s$\}$. The NFA can have at most six states.
2. Is the language over $\Sigma = \{a, b, c\}$ containing at least one a and at least one b regular? Prove it.
3. Prove that the language $D = \{a^n b^n c^i | n <= i <= 2n\}, \Sigma = \{a, b, c\}$ is not regular.
4. Provide the DFA for the language that is the set of all strings of 0s and 1s whose number of 0s is divisible by 4 and the number of 1s is even. Convert that DFA to an RE using the GNFA method.
5. Convert this NFA to a DFA:



6. Show that the class of regular languages is closed under union, concatenation, and Kleene star.
7. For languages A and B, let the shuffle of A and B be the language

   $\{w|w = a_1 b_1 \cdots a_k b_k$, where $a_1 \cdots a_k \in A$ and $b_1 \cdots b_k \in B$, each $a_i, b_i \in \Sigma^*\}$.

   Show that the class of regular languages is closed under shuffle.
8. Give the CFG in CNF and PDA for the language that is the set of strings with more a's than b's.
9. Give a context-free grammar that generates the language L, the complement of the language $\{0^n 1^n | n \geq 1\}$