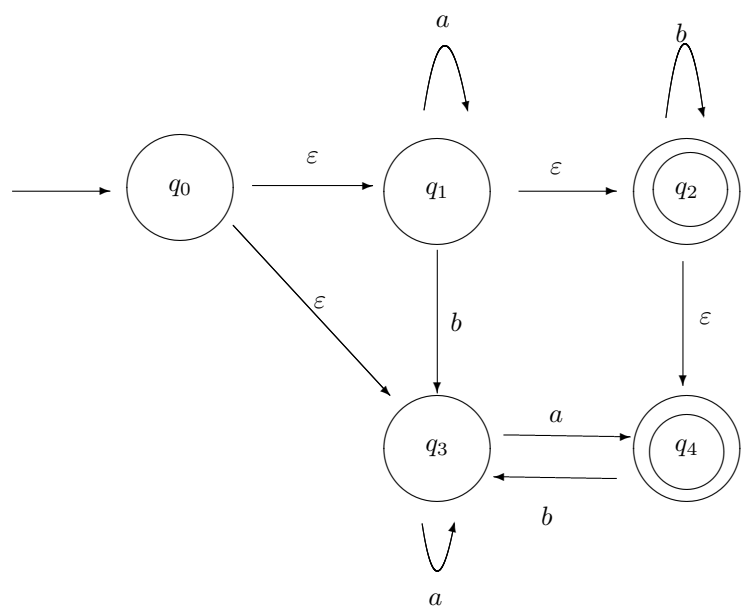
CS 420 Spring 2019
Homework 3

Due February 20

1. Convert the regular expression $(ab \cup c)^*$ into an NFA using the method from class (which is the same as the method from the book and is different from the method in JFLAP).

2. Let N be the following NFA:



   Convert N into a regular expression using the method from class (which is the same as the method in the book, and is not the same as the method in JFLAP).

3. Problem 1.31

4. (a) Let M be the NFA given in the solution to Problem 2(b) on Homework 2. Give an NFA N with two states and no ε-transitions that recognizes the same language. (Your NFA can have more than one accept state.)

   (b) Generalize what you did in Part (a) of this problem by proving the following theorem:

   Theorem: If M is an NFA, then there is an NFA N with the following properties

(1) N has the same number of states as M.
(2) N has no ε-transitions.
(3) $L(N) = L(M)$.

5. Use the Pumping Lemma to show that the following languages are not regular:

   (a) $\{a^n b^m c^r | n, m \geq 0 \text{ and } r = n + m\}$;
   (b) $\{0^n 1 0^m | n \leq m\}$
   (c) $\{c^4 a^n b^m | n \geq m\}$;
   (d) $\{a^n b^m c^{2m} | n, m \geq 0\}$.