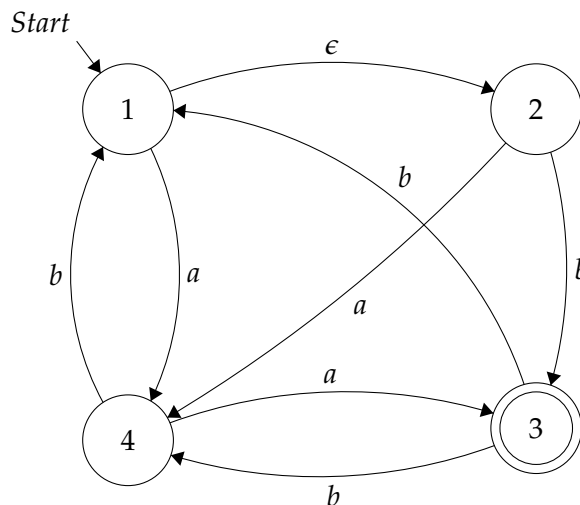


**Reading:** Next Tuesday's lecture will finish the conversion of finite automata to equivalent regular expressions. I have decided to reference the "code-style" presentation at <https://cse.buffalo.edu/~regan/cse396/CSE396.regexpalg> on the course webpage after all. Then I will move on to the subject of nonregular languages in section 1.4, but covering the Myhill-Nerode Theorem (MNT) instead of the Pumping Lemma from the notes <https://cse.buffalo.edu/~regan/cse396/CSE396MNT.pdf> also on the course webpage. The text covers MNT in the chapter 1 exercises but with more mathematical sophistication than required to apply it from my notes. So read section 1.4 but refer to my notes for ideas on how to use MNT in place of the applications of the "Pumping Lemma." (We will later cover a stronger pumping lemma that works for non-context-free languages as well.)

**Homework**—part online and all *individual work*—due **Thu. 2/28, 11:59pm**:

(1) Using *TopHat*, the "Worksheet" titled **Spr'19 HW3.1**. There are 10 questions for 20 total; Q6 is worth 5.

(2) Convert the following NFA into an equivalent DFA. The components are  $\Sigma = \{a, b\}$ ,  $Q = \{1, 2, 3, 4\}$ ,  $s = 1$ ,  $F = \{3\}$ , and  $\delta = \{(1, \epsilon, 2), (1, a, 4), (2, a, 4), (2, b, 3), (3, b, 1), (3, b, 4), (4, a, 3), (4, b, 1)\}$ .



Also answer the following questions:

- Find a string  $x$ , of the shortest possible length such that for each of its four states  $q$ ,  $N$  can process  $x$  from  $s$  to  $q$ .
- Find the shortest string that  $N$  cannot process from  $s$  at all.
- Is there a string  $y$  such that regardless of what state  $q$   $N$  starts in,  $N$  cannot process  $y$ ?

You may find your DFA most helpful to answer those questions with. (Points are 18 for the DFA and 6+3+3 for the questions, making 30.)

(3) Use the FA-to-regexp algorithm to convert  $N$  (not your DFA) from problem 2 into an equivalent regular expression  $r$ . Eliminating state 2 should be easy, but eliminating 4 will take more work. Either the pictorial form at the end of the Thu. 2/21 lecture or the "code-y" form to come Tuesday will be fine. Then getting your final  $r$  from the two-state formula given in lecture will save more work (or pre-work) than the text would have you do. You must show your steps, not just give the final  $r$ . (18 pts., for 68 on the set)