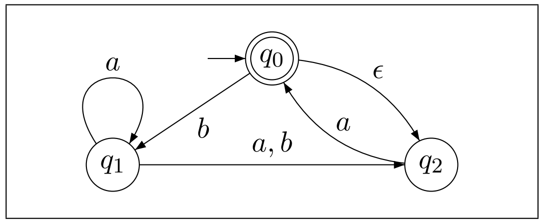
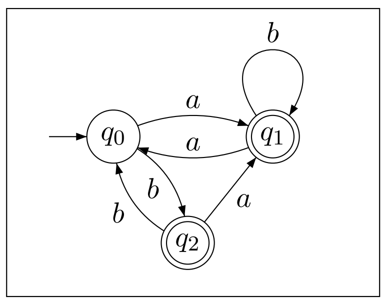
CS81 Spring 2012 REGULAR EXERCISES

1. (REG2NFA) Convert $(ab \cup a)^{\star}$ to a NFA using the general construction (see Rich: Theorem 6.1, page 133).

2. (NFA2DFA) Use the *subset* construction to convert the following NFA to a DFA (see Rich: Theorem 5.3, page 74).



3. (DFA2REG) Convert the following DFA to a regular expression. Use the *Generalized NFA* construction (see Rich: Theorem 6.2, page 139).



4. (MIN-DFA) See Example 5.28 in Rich (page 93) for an application of the minimization algorithm.

5. (NOT-REG) Prove that $L = \{a^n b^n c^n : n \geq 0\}$ is not regular (see Rich: Theorem 8.6, page 170).

   Proof. Assume L is regular. By the Pumping Lemma, there is a constant N so that for any string $w \in L$ with $|w| \geq N$, there are strings x, y, z so that $w = xyz$, $y \neq \epsilon$, $|xy| \leq N$, and $xy^i z \in L$, for any $i \geq 0$. So, we choose $w = a^N b^N c^N \in L$ and let x, y, z be the strings guaranteed to exist by the Pumping Lemma where $w = xyz$. Since $|xy| \leq N$ and $y \neq \epsilon$, we have $y = a^k$, for some k with $0 < k \leq N$. Therefore, $xz = a^{N-k} b^N c^N$ which is clearly not an element of L. This is a contradiction to the third condition $xy^i z \in L$, for any $i \geq 0$, of the Pumping Lemma. Thus, L is **not** regular. $\square$

Some of the above alternate problems are from Sipser.
Suggested exercises from Rich's text:

1. Chapter 5: 2,6,9,11,12.

2. Chapter 6: 2,3,8,9,15,16,20.

3. Chapter 7: 1.
4. Chapter 8: 1,6,7,21.