**474 HW 7 problems   (highlighted problems are the ones to turn in)**

6.7a
1 (9)

6.8 (#2)

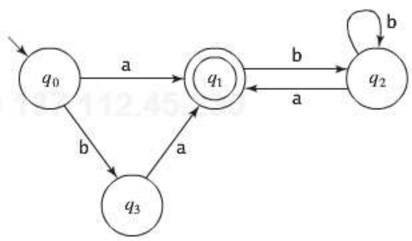
DFSM to Reg expression problem
3 (18)

**7.** Use the algorithm presented in the proof of Kleene's Theorem to construct an FSM to accept the language generated by each of the following regular expressions:

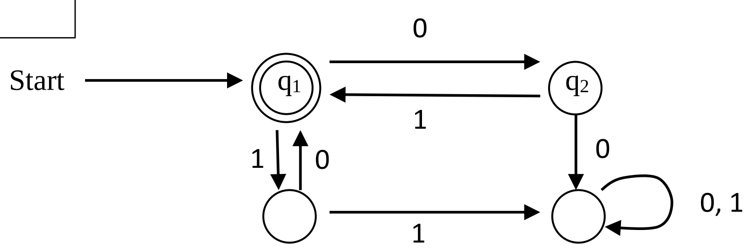
**a.** $(b(b \cup \varepsilon)b)^*$.

**b.** $bab \cup a^*$.

**8.** Let $L$ be the language accepted by the following finite state machine:




(t-18) Consider the DFSM M below. Use the algorithm from class to find a regular expression r such that L(R) = L(M). You should calculate all of the $r_{ijk}$ for k=0 and k=1. For k>1, you are only required to calculate as many of the $r_{ijk}$ as needed to do the recursive steps that the algorithm actually needs to get the answer. Be explicit about the ones that you do calculate. [This link is primarily for summer students for which there is no "in-class", but it may be helpful to winter term students as well. The proof of the "in-class" algorithm and a complete example are given in the proof of Theorem 3.4 on the bottom of p33 and on pages 34-35 from [this document](), taken from "introduction to *Automata Theory, Languages, and Computation* by Hopcroft and Ullman (Addison-Wesley, 1979). ]



6.13d
(#4)

13. Show a possibly nondeterministic FSM to accept the language defined by each of the following regular expressions:

a. (((a ∪ ba) b ∪ aa)*.

b. (b ∪ε)(ab)*(a ∪ ε).

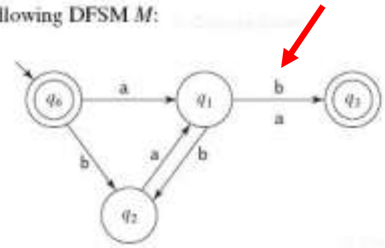
c. (babb* ∪ a)*.

d. (ba ∪ ((a ∪ bb) a*b)).

e. (a ∪ b)* aa (b ∪ aa) bb (a ∪ b)*.

6.15
(#5)

15. Consider the following DFSM $M$:




**There is an error in this diagram in the book. The b-transition from $q_1$ to $q_3$ should not be there. Remove it before doing the problem.**

a. Write a regular expression that describes $L(M)$.

b. Show a DFSM that accepts $\neg L(M)$.

6.18
7 (9)

18. Let Σ = {a, b}. Let $L$ = {ε, a, b}. Let $R$ be a relation defined on Σ* as follows: ∀$xy$ ($xRy$ iff $y$ = $x$b). Let $R'$ be the reflexive, transitive closure of $R$. Let $L'$ = {$x$ : ∃$y$ ∈ $L$ ($yR'x$)}. Write a regular expression for $L'$.

Note on 6.18 Transitive and reflexive closures are introduced in Section A.5 Closures under various operations are also mentioned on pages 17, 57, and 72.

6.20
(#14)

Good practice problems for exams (no proof necessary)

20. For each of the following statements, state whether it is *True* or *False*. Prove your answer.

a. (ab)*a = a(ba)*.

b. (a ∪ b)* b (a ∪ b)* = a* b (a ∪ b)*.

c. (a ∪ b)* b (a ∪ b)* ∪ (a ∪ b)* a (a ∪ b)* = (a ∪ b)*.

d. (a ∪ b)* b (a ∪ b)* ∪ (a ∪ b)* a (a ∪ b)* = (a ∪ b)$^+$.

e. (a ∪ b)* b a (a ∪ b)* ∪ a*b* = (a ∪ b)*.

f. a* b (a ∪ b)* = (a ∪ b)* b (a ∪ b)*.

g. If $\alpha$ and $\beta$ are any two regular expressions, then $(\alpha \cup \beta)^* = \alpha(\beta\alpha \cup \alpha)$.

h. If $\alpha$ and $\beta$ are any two regular expressions, then $(\alpha\beta)^*\alpha = \alpha(\beta\alpha)^*$.