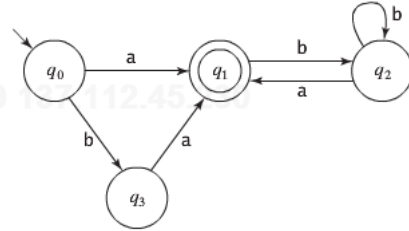


474 HW 7 problems (highlighted problems are the ones to turn in)

6.7a

1 (9)

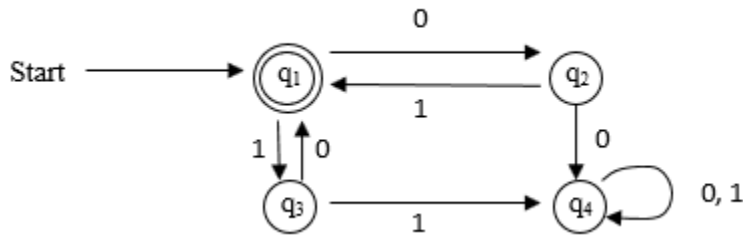
7. Use the algorithm presented in the proof of Kleene's Theorem to construct an FSM to accept the language generated by each of the following regular expressions:
 - a. $(b(b \cup \epsilon)b)^*$.
 - b. $bab \cup a^*$.
8. Let L be the language accepted by the following finite state machine:



6.8 (#2)

DFSM to
Reg
expression
problem
3 (18)

(t-18) Consider the DFSM M below. Use the algorithm from class/video 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. [The proof of the "video" 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)

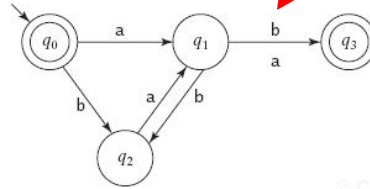
13. Show a possibly nondeterministic FSM to accept the language defined by each of the following regular expressions:

- a. $((a \cup ba) b \cup aa)^*$.
- b. $(b \cup \epsilon)(ab)^*(a \cup \epsilon)$.
- c. $(babb^* \cup a)^*$.

- d. $(ba \cup ((a \cup bb) a^*b))$.
- e. $(a \cup b)^* aa (b \cup aa) bb (a \cup b)^*$.

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 $\neg L(M)$.

18. Let $\Sigma = \{a, b\}$. Let $L = \{\epsilon, a, b\}$. Let R be a relation defined on Σ^* as follows: $\forall xy (xRy \text{ iff } y = xb)$. Let R' be the reflexive, transitive closure of R . Let $L' = \{x : \exists y \in L (yR'x)\}$. Write a regular expression for L' .

6.18
7 (9)

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. $(a \cup b)^* b (a \cup b)^* = a^* b (a \cup b)^*$.
- c. $(a \cup b)^* b (a \cup b)^* \cup (a \cup b)^* a (a \cup b)^* = (a \cup b)^*$.
- d. $(a \cup b)^* b (a \cup b)^* \cup (a \cup b)^* a (a \cup b)^* = (a \cup b)^+$.
- e. $(a \cup b)^* b a (a \cup b)^* \cup a^* b^* = (a \cup b)^*$.
- f. $a^* b (a \cup b)^* = (a \cup b)^* b (a \cup b)^*$.
- g. If α and β are any two regular expressions, then $(\alpha \cup \beta)^* = \alpha (\beta \alpha \cup \alpha)$.
- h. If α and β are any two regular expressions, then $(\alpha \beta)^* \alpha = \alpha (\beta \alpha)^*$.