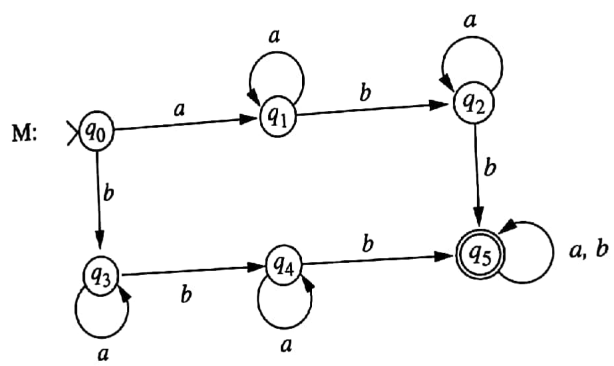
36. Build an NFA M_1 that accepts $(aba)^+$ and an NFA M_2 that accepts $(ab)^*$. Use λ transitions to obtain a machine M that accepts $(aba)^+ \cup (ab)^*$. Give the input transition function of M. Use Algorithm 6.6.3 to construct the state diagram of a DFA that accepts L(M).

37. Assume that q_i and q_j are equivalent states (as in Definition 6.7.1) and $\hat{\delta}(q_i, u) = q_m$ and $\hat{\delta}(q_j, u) = q_n$. Prove that q_m and q_n are equivalent.

38. Show that the transition function δ' obtained in the process of merging equivalent states is well defined. That is, show that if q_i and q_j are states with $[q_i] = [q_j]$, then $\delta'([q_i], a) = \delta'([q_j], a)$ for every $a \in \Sigma$.

39. Let M be the DFA

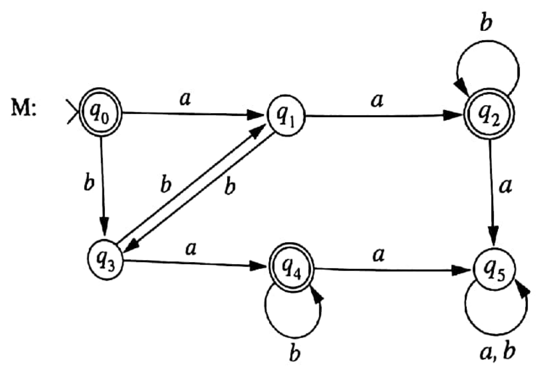


a) Trace the actions of Algorithm 6.7.2 to determine the equivalent states of M. Give the values of $D[i, j]$ and $S[i, j]$ computed by the algorithm.

b) Give the equivalence classes of states.

c) Give the state diagram of the minimal state DFA that accepts L(M).

40. Let M be the DFA



a) Trace the actions of Algorithm 6.7.2 to determine the equivalent states of M. Give the values of $D[i, j]$ and $S[i, j]$ computed by the algorithm.

b) Give the equivalence classes of states.

c) Give the state diagram of the minimal state DFA that accepts L(M).

Bibliographic Notes

Alternative interpretations of the result of finite-state computations were studied in Mealy [1955] and Moore [1956]. Transitions in Mealy machines are accompanied by the generation of output. A two-way automaton allows the tape head to move in both directions. A proof that two-way and one-way automata accept the same languages can be found in Rabin and Scott [1959] and Sheperdson [1959]. Nondeterministic finite automata were introduced by Rabin and Scott [1959]. The algorithm for minimizing the number of states in a DFA was presented in Nerode [1958]. The algorithm of Hopcroft [1971] increases the efficiency of the minimization technique.

The theory and applications of finite automata are developed in greater depth in the books by Minsky [1967]; Salomaa [1973]; Denning, Dennis, and Qualitz [1978]; and Bavel [1983].