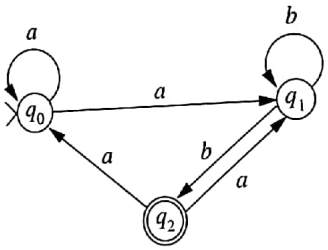
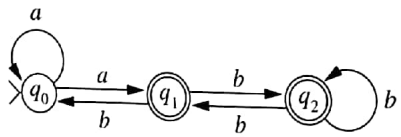
12. The set of strings over $\{a, b\}$ in which every a is either immediately preceded or immediately followed by b, for example, $baab$, aba, and b.
13. The set of strings of odd length over $\{a, b\}$ that contain the substring bb.
14. The set of strings of even length over $\{a, b, c\}$ that contain exactly one a.
15. The set of strings over $\{a, b, c\}$ with an odd number of occurrences of the substring ab.
16. For each of the following languages, give the state diagram of a DFA that accepts the languages.
    a) $(ab)^*ba$
    b) $(ab)^*(ba)^*$
    c) $aa(a \cup b)^+bb$
    d) $((aa)^+bb)^*$
    e) $(ab^*a)^*$
17. Let M be the nondeterministic finite automaton whose state diagram is given below.



    a) Construct the transition table of M.
    b) Trace all computations of the string $aaabb$ in M.
    c) Is $aaabb$ in L(M)?
    d) Give a regular expression for L(M).
18. Let M be the nondeterministic finite automaton whose state diagram is given below.



    a) Construct the transition table of M.
    b) Trace all computations of the string $aabb$ in M.
    c) Is $aabb$ in L(M)?
    d) Give a regular expression for L(M).
    e) Construct a DFA that accepts L(M).
    f) Give a regular expression for the language accepted if both q_0 and q_1 are accepting states.
19. For each of the following languages, give the state diagram of an NFA that accepts the languages.
    a) $(ab)^* \cup a^*$
    b) $(abc)^*a^*$
    c) $(ba \cup bb)^* \cup (ab \cup aa)^*$
    d) $(ab^+a)^+$

For Exercises 20 through 27 give the state diagram of an NFA that accepts the given language. Remember that an NFA may be deterministic.

20. The set of strings over $\{1, 2, 3\}$ the sum of whose elements is divisible by six.
21. The set of strings over $\{a, b, c\}$ in which the number of a's plus the number of b's plus twice the number of c's is divisible by six.
22. The set of strings over $\{a, b\}$ in which every substring of length four has at least one b.
23. The set of strings over $\{a, b, c\}$ in which every substring of length four has exactly one b.
24. The set of strings over $\{a, b\}$ whose third-to-the-last symbol is b.
25. The set of strings over $\{a, b\}$ that contain an even number of substrings ba.
26. The set of strings over $\{a, b\}$ that have both or neither aa and bb as substrings.
27. The set of strings over $\{a, b\}$ whose third and third-to-last symbols are both b. For example, $aababaa$, $abbbbbbbb$, and $abba$ are in the language.
28. Construct the state diagram of a DFA that accepts the strings over $\{a, b\}$ ending with the substring $abba$. Give the state diagram of an NFA with six arcs that accepts the same language.
29. Let M be the NFA-λ