Module 5: Automata and formal languages

Example 27. Let M be the finite state machine with state table appearing in Table 17.4

(*a*) Find the input set Σ, the state set S, the output set O, and initial state of M.

(*b*) Draw the state diagram of M

(*c*) Find the output string for the input string *aabbcc*.

	f			g		
S \ Σ	a	b	c	a	b	c
s_0	s_0	s_1	s_2	0	1	0
s_1	s_1	s_1	s_0	1	1	1
s_2	s_2	s_1	s_0	1	0	0

Table 17.4

Example 28. Given the state diagram of a finite state machine M, find (*a*) the input set Σ, the output set O, the state set S and the initial state (*b*) the state table of M.

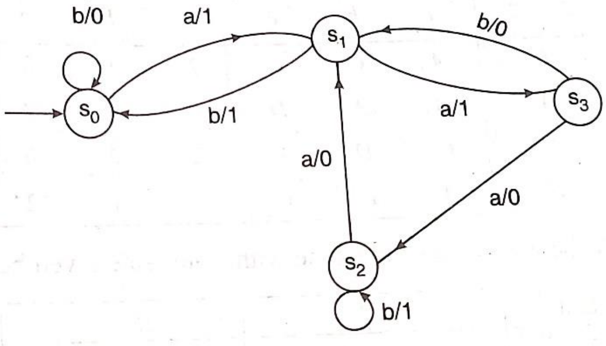
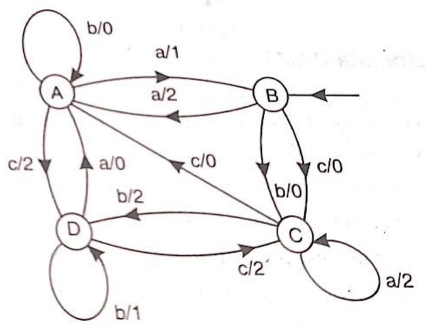


Fig. 17.9

Example 29. Find the set Σ, O, S the initial state and the table defining the next state and output function for each finite-state machine.



Example 30. Let M be a finite-state machine with state table given below

State	f			g		
S \ Σ	a	b	c	a	b	c
s_0	s_0	s_3	s_2	0	1	1
s_1	s_1	s_1	s_3	0	0	1
s_2	s_1	s_2	s_3	1	1	0
s_3	s_2	s_3	s_0	1	0	1

Draw the state diagrams M.

Example 31. A deterministic finite-state automaton M is defined by a transition diagram shown in Fig. 17.10

(a) Find its states
(b) Find its input symbols
(c) Find its initial state
(d) Find its accepting states
(e) Find $f(s_1, 1)$
(f) Write its next-state table.

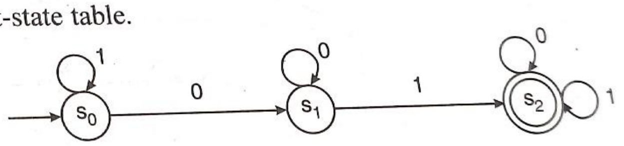


Fig. 17.10

Example 33. Redraw the transition diagram of the finite-state automation of Fig. 17.12 as transition diagram of a finite-state machine.

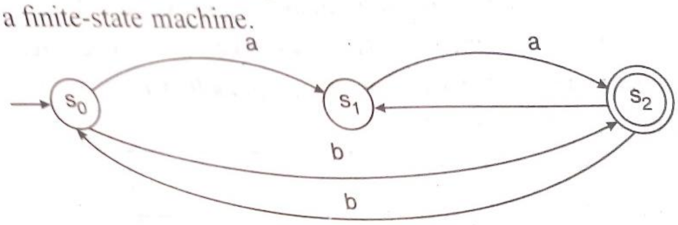


Fig. 17.12

Example 34. Consider the finite-state automaton A shown in Fig. 17.14.

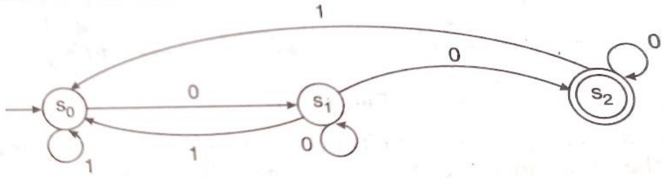


Fig. 17.14

Example 39. For non-deterministic finite-state automation whose transition diagram is shown in Fig. 17.19, find (*a*) initial state (*b*) state set (*c*) input set (*d*) state table defining the next-state function.

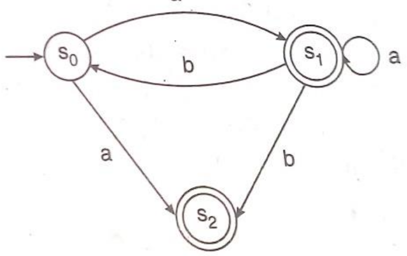


Fig. 17.19

Example 41. Find the language recognized by the given non-deterministic finite-state automaton M whose transition diagram is shown in Fig. 17.21.

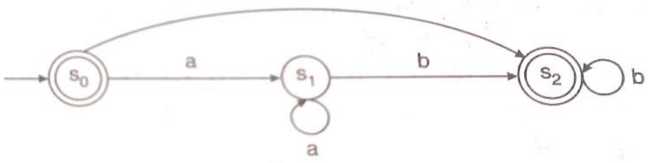


Fig. 17.21

Example 42. Find a state transition table for the given *nfa* of Fig 17.22 obtain a *dfa* equivalent to *nfa*.

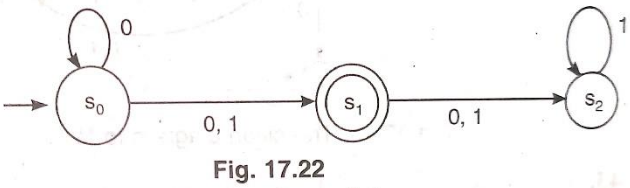


Fig. 17.22

Example 40. Find the transition diagram of the non-deterministic finite-state automaton (*nfa* M with the state table shown below.

$$\Sigma = \{0, 1\},\ S = \{s_0, s_1, s_2\},\ O = \{s_0\}$$

S \ Σ	0	1
s_0	ϕ	$\{s_1, s_2\}$
s_1	$\{s_2\}$	$\{s_0, s_1\}$
s_2	$\{s_0\}$	ϕ

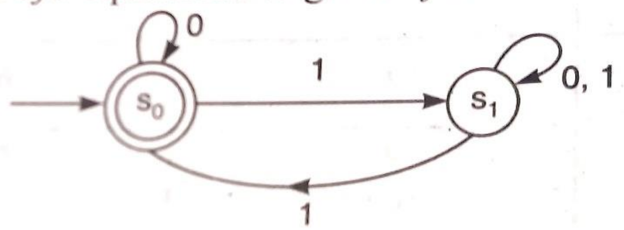
Table 17.9

Example 43. $S = \{s_0, s_1, s_2\}$ $F = \{s_1\}$

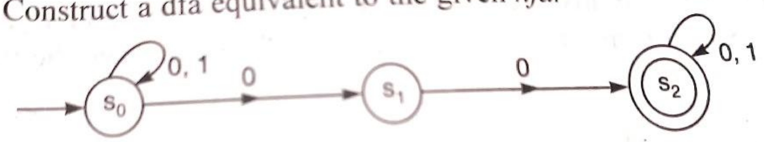
S \ Σ	f: a	f: b
s_0	$\{s_1\}$	$\{s_0\}$
s_1	$\{s_2\}$	$\{s_1, s_2\}$
s_2	$\{s_2\}$	$\{s_2\}$

Contruct a transition diagram for the given nfa and a *dfa* eqivalent to *nfa*.

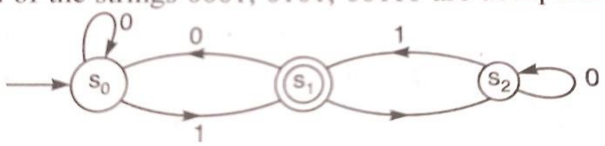
Example 44. Construct a *dfa* equivalent to given *nfa*.



Example 45. Construct a dfa equivalent to the given *nfa*.



Example 46. Which of the strings 0001, 0101, 00110 are accepted by the following *dfa*.



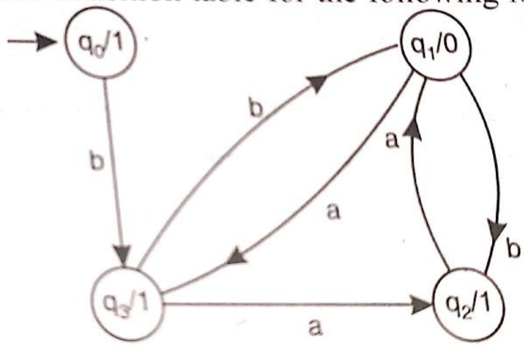
Example 47. For $\Sigma = \{a, b\}$, design dfas that accept the sets consisting of

(*a*) all the strings with exactly one *a*

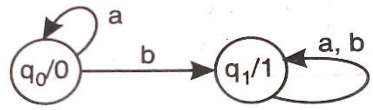
(*b*) all the strings with at least one *a*

(*c*) all strings with at least one a and followed by exactly two *b*'s:

Example 50. Construct state transition table for the following Moore machine.

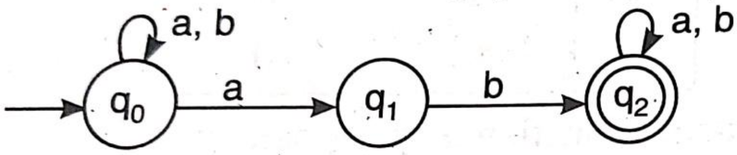


Example 54. Convert the following Moore machine to an equivalent Mealy machine

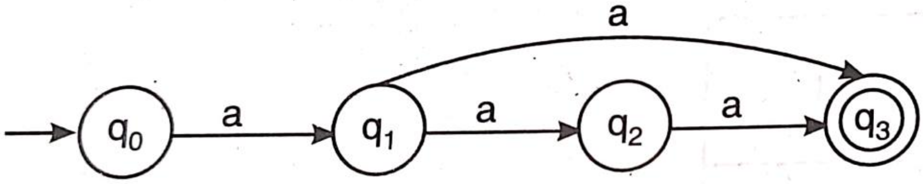


14. Convert each of the following *nfa* to equivalent *dfa*.

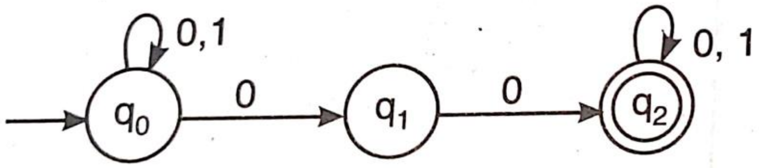
(*a*)



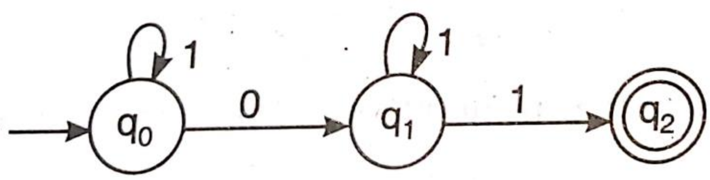
(*b*)



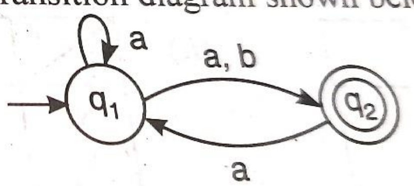
(*c*)



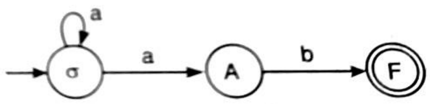
(*d*)



13. Find a *dfa* equivalent to *nfa* of the transition diagram shown below



12. Find the corresponding *dfa* (*a*) transition table (*b*) transition diagram (*c*) simplified transition diagram for the *nfa*



10. Construct a *dfa* equivalent to the *nfa*,

M = $\{S, I, f, s_0, F\}$ where $s = \{s_0, s_1\}$

I = $\{0, 1\}$ $F = \{s_0\}$, f is given by the transition table

State	Input	
S \ I	0	1
s_0	$\{s_0, s_1\}$	$\{s_1\}$
s_1	$\{s_0\}$	$\{s_0, s_1\}$

11. Draw a state transition diagram of the *nfa*,

M = $\{Q, \Sigma, q_0, \delta, F\}$ where $Q = \{q_0, q_1, q_2\}$ $\Sigma = \{a, b\}$

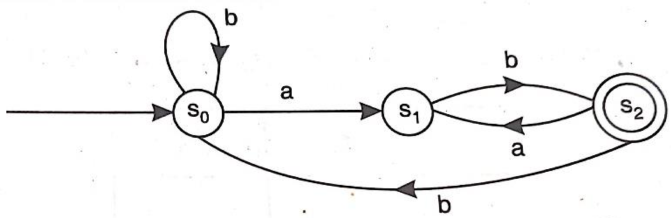
$F = \{q_2\}$ and the transition function $\delta \times \Sigma \rightarrow p(\phi)$ is designed by the transition table

δ	a	b
q_0	$\{q_1\}$	ϕ
q_1	ϕ	$\{q_0, q_2\}$
q_2	ϕ	$\{q_2\}$

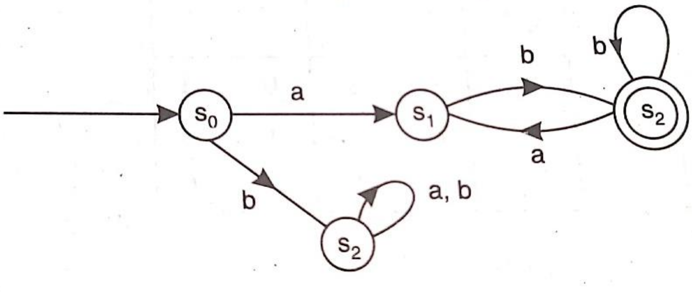
Find out the corresponding *dfa*.

4. Construct a transition table for each FSA

(*i*)



(*ii*)



3. Draw the transition diagram of the non-deterministic finite-state automaton whose next-state function is given below

S \ A	0	1
s_0	$\{s_0, s_1\}$	$\{s_2\}$
s_1	ϕ	$\{s_1\}$
s_2	$\{s_1, s_2\}$	ϕ

Where A = $\{0, 1\}$, $S = \{s_0, s_1, s_2\}$, O = $\{s_1, s_2\}$ show that the string 00100111 is accepted and the string 0110 is not accepted by the automaton.

5. Design an FSA that accepts string over $\{a, b\}$ which
   (*i*) begin with *aa*
   (*ii*) contain *aaa* as a substring
   (*iii*) contain *baab* as a substring
6. Draw the transition diagram of non-deterministie finite outomata (*nfa*), M = (S, A, I, F, S_0) where

(*i*)

S \ I	a	b
s_0	$\{s_1\}$	$\{s_0\}$
s_1	$\{s_1\}$	$\{s_1, s_2\}$
s_2	ϕ	ϕ

(*ii*)

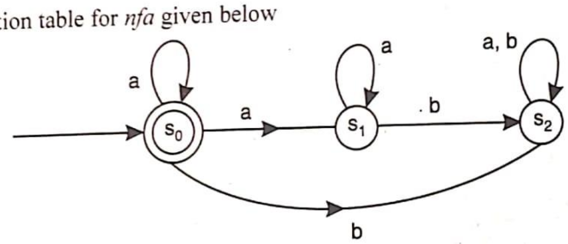
S \ I	a	b
s_0	$\{s_0, s_1\}$	$\{s_3\}$
s_1	$\{s_1, s_2\}$	$\{s_1\}$
s_2	$\{s_2\}$	$\{s_3\}$
s_3	$\{s_3\}$	$\{s_3\}$

7. Draw the transition diagram of the *nfa* whose next-state function is given below

S \ A	0	1
s_0	$\{s_0, s_1\}$	$\{s_2\}$
s_1	ϕ	$\{s_1\}$
s_2	$\{s_1, s_2\}$	ϕ

Where A = {0, 1}, $S = \{s_0, s_1, s_2\}$, O = $\{s_1, s_2\}$ show that the string 00100111 is accepted and the string 0110 is not accepted by the automaton.

8. Is each string accepted by the *nfa* in 6 (*i*). Give a path for accepted strings
   (*i*) $a^2 b$ (*ii*) a^3b^3
9. Construct a transition table for *nfa* given below



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