Assignmnet 12

13.1

1.Use the set of productions to show that each of these sentences is a valid sentence.

a) the happy hare runs

b) the sleepy tortoise runs quickly

c) the tortoise passes the hare

d) the sleepy hare passes the happy tortoise

3.Show that the *hare runs the sleepy tortoise* is not a valid sentence.

4.Let $G = (V, T, S, P)$ be the phrase-structure grammar with $V = \{0, 1, A, S\}, T = \{0, 1\}$, and set of productions P consisting of $S \to 1S$, $S \to 00A$, $A \to 0A$, and $A \to 0$.

a) Show that 111000 belongs to the language generated by G.

b) Show that 11001 does not belong to the language generated by G.

c) What is the language generated by G ?

6.Let $V = \{S, A, B, a, b\}$ and $T = \{a, b\}$. Find the language generated by the grammar (V, T, S, P) when the set P of productions consists of
a) $S \to AB, A \to ab, B \to bb$.
b) $S \to AB, S \to aA, A \to a, B \to ba$.
c) $S \to AB, S \to AA, A \to aB, A \to ab, B \to b$.
d) $S \to AA, S \to B, A \to aaA, A \to aa, B \to bB, B \to b$.

7.Construct a derivation of $0^3 1^3$ using the grammar given in Example 5.

24.Let G be the grammar with $V = \{a, b, c, S\}; T = \{a, b, c\}$; starting symbol S; and productions $S \to abS, S \to bcS, S \to bbS, S \to a$, and $S \to cb$. Construct derivation trees for

a) $bcbba$.
b) $bbbcbba$.
c) $bcabbbbbcb$.

13.2

1.Draw the state diagrams for the finite-state machines with these state tables.

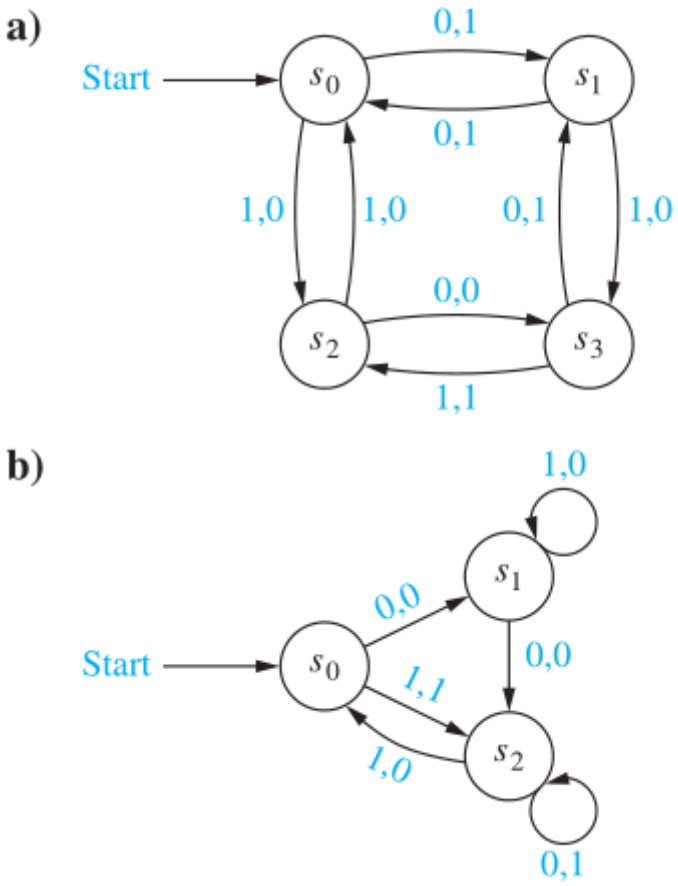
a)

State	f Input 0	f Input 1	g Input 0	g Input 1
s_0	s_1	s_0	0	1
s_1	s_0	s_2	0	1
s_2	s_1	s_1	0	0

b)

State	f Input 0	f Input 1	g Input 0	g Input 1
s_0	s_1	s_0	0	0
s_1	s_2	s_0	1	1
s_2	s_0	s_3	0	1
s_3	s_1	s_2	1	0

2.Give the state tables for the finite-state machines with these state diagrams.



3.Find the output generated from the input string 01110 for the finite-state machine with the state table in

a) Exercise 1(a).

b) Exercise 1(b).

4.Find the output generated from the input string 10001 for the finite-state machine with the state diagram in

a) Exercise 2(a).

b) Exercise 2(b).

5.Find the output for each of these input strings when given as input to the finite-state machine in Example 2.

a) 0111

b) 11011011

c) 01010101010

6.Find the output for each of these input strings when given as input to the finite-state machine in Example 3.

a) 0000

b) 101010

c) 11011100010

13.3

1.Let $A = \{0, 11\}$ and $B = \{00, 01\}$. Find each of these sets.
a) AB
b) BA
c) A^2
d) B^3

5.Describe the elements of the set A^* for these values of A.
a) $\{10\}$
b) $\{111\}$
c) $\{0, 01\}$
d) $\{1, 101\}$

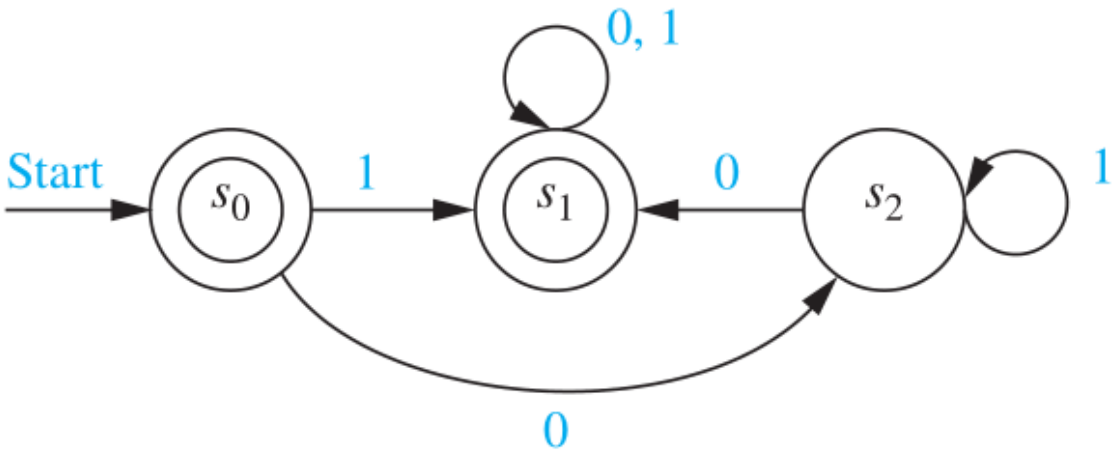
9.Determine whether the string 11101 is in each of these sets.
a) $\{0, 1\}^*$
b) $\{1\}^*\{0\}^*\{1\}^*$
c) $\{11\}\{0\}^*\{01\}$
d) $\{11\}^*\{01\}^*$
e) $\{111\}^*\{0\}^*\{1\}$
f) $\{11, 0\}\{00, 101\}$

11.Determine whether each of these strings is recognized by the deterministic finite-state automaton in Figure 1.
a) 111
b) 0011
c) 1010111
d) 011011011

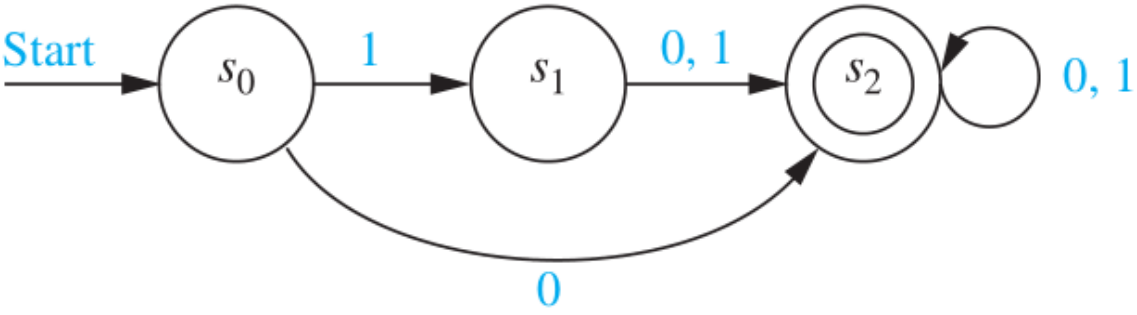
12.Determine whether each of these strings is recognized by the deterministic finite-state automaton in Figure 1.
a) 010
b) 1101
c) 1111110
d) 010101010

In Exercises 16–17 find the language recognized by the given deterministic finite-state automaton.

16.



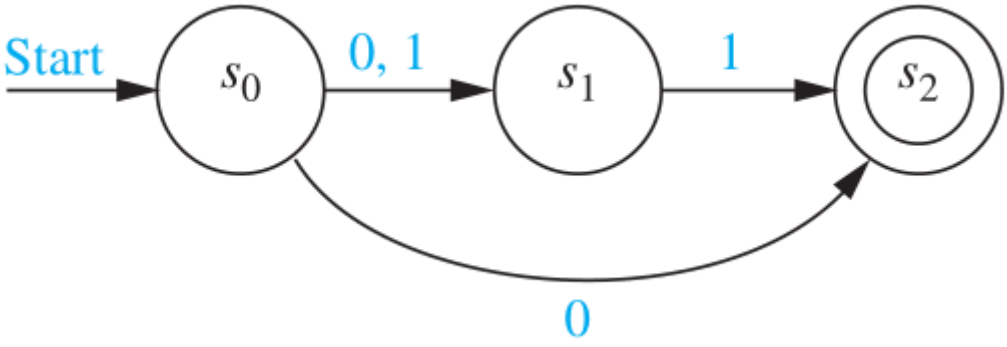
17.



23.Construct a deterministic finite-state automaton that recognizes the set of all bit strings beginning with 01.

24.Construct a deterministic finite-state automaton that recognizes the set of all bit strings that end with 10.

43.find the language recognized by the given nondeterministic finite-state automaton.



50.Find a deterministic finite-state automaton that recognizes the same language as the nondeterministic finite-state automaton in Exercise 43.

13.4

1.Describe in words the strings in each of these regular sets.
a) $\mathbf{1 * 0}$
b) $\mathbf{1 * 00^*}$
c) $\mathbf{111 \cup 001}$

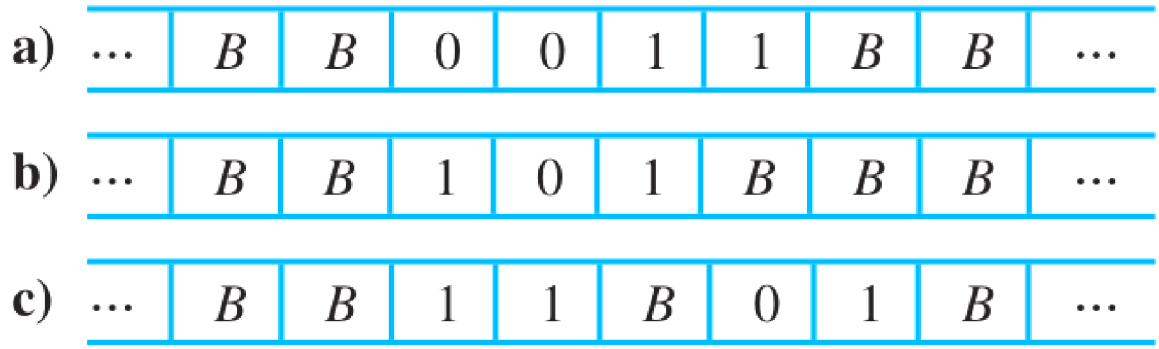
2.Describe in words the strings in each of these regular sets.
a) 001*
b) (01)*
c) $01 \cup 001^*$

4.Determine whether 1011 belongs to each of these regular sets.
a) 10^*1^*
b) $\mathbf{0^*(10 \cup 11)^*}$
c) $1(01)^*1^*$

6.Express each of these sets using a regular expression.
a) the set containing all strings with zero, one, or two bits
b) the set of strings of two 0s, followed by zero or more 1s, and ending with a 0
c) the set of strings with every 1 followed by two 0s

13.5

1.Let T be the Turing machine defined by the five tuples: (s0, 0,s1, 1,R), (s0, 1,s1, 0,R), (s0,B, s1, 0,R), (s1, 0,s2, 1,L), (s1, 1,s1, 0,R), and (s1,B, s2, 0,L). For each of these initial tapes, determine the final tape when T halts, assuming that T begins in initial position.



3.What does the Turing machine described by the five-tuples (s0, 0,s0, 0,R), (s0, 1,s1, 0,R), (s0,B, s2,B, R),
(s1, 0,s1, 0,R), (s1, 1,s0, 1,R), and (s1,B, s2,B, R)do when given

a) 11 as input?

4.What does the Turing machine described by the five-tuples (s0, 0,s0, 1,R), (s0, 1,s0, 1,R), (s0,B, s1,B, L), (s1, 1,s2, 1,R), do when given

a) 101 as input?

5.What does the Turing machine described by the five-tuples (s0, 1,s1, 0,R), (s1, 1,s1, 1,R), (s1, 0,s2, 0,R), (s2, 0,s3, 1,L), (s2, 1,s2, 1,R),(s3, 1,s3, 1,L), (s3, 0,s4, 0,L), (s4, 1,s4, 1,L), and (s4, 0,s0, 1,R)do when given
a) 11 as input?

Test1

1.The productions of a phrase-structure grammar are $S \to S1, S \to 0A, and A \to 1$. Find a derivation of
0111.

2.What language is generated by the phrase-structure grammar if the productions are
$S \to S11, S \to \lambda$where S is the start symbol?

4.Suppose that $A = 1, 11, 01$ and $B = 0, 10$.Find AB and BA.

7.Which strings belong to the set represented by the regular expression $0 * \cup 11$?

Test2

1.What is the language generated by the grammar with productions $S \to SA, S \to 0, A \to 1A$,and $A \to 1$,
where S is the start symbol?

3.Construct a finite-state machine with output that produces a 1 if and only if the last three input bits read are all 0s.

7.Which strings belong to the regular set represented by the regular expression $(1 * 01 * 0)*$?