Section 12.5 Finite State Automata

1.  [12.14] Let $M$ be the automaton with the input set $A = \{a,b\}$, state set $S = \{s_0, s_1, s_2\}$, and accepting state set $Y = \{s_2\}$.

    The next-state function is given by:

    $$F(s_0,a) = s_0, F(s_0,b) = s_1, F(s_1,a) = s_1, F(s_1,b) = s_2, F(s_2,a) = s_2, F(s_2,b) = s_2.$$

    a)  Draw the state (transition) diagram $D = D(M)$ of $M$.
    b)  Describe the language $L = L(M)$ accepted by $M$.

2.  For the previous problem, which of the following words would be accepted by $M$: *aaba,aaa,bb,aabbaba,abab,λ*?

Section 13.2 Finite State Machines

3.  [13.1] Let $M$ be the finite state machine with the state table shown below.

| $F$ | $a$ | $b$ |
|-----|-----|-----|
| $s_0$ | $s_1,x$ | $s_2,y$ |
| $s_1$ | $s_3,y$ | $s_1,z$ |
| $s_2$ | $s_1,z$ | $s_0,x$ |
| $s_3$ | $s_0,z$ | $s_2,x$ |

    a)  Find the input set $A$, the state set $S$, the output set $Z$, and the initial state.
    b)  Draw the state diagram $D = D(M)$ of $M$.
    c)  Suppose $w = aababaabbab$ is an input word (string). Find the corresponding output word $v$.

4. [13.2] Let $M$ be the finite state machine with input set $A = \{a,b\}$, output set $Z = \{x,y,z\}$, and state diagram $D = D(M)$ shown in figure 1.
   a) Construct the state table of $M$.
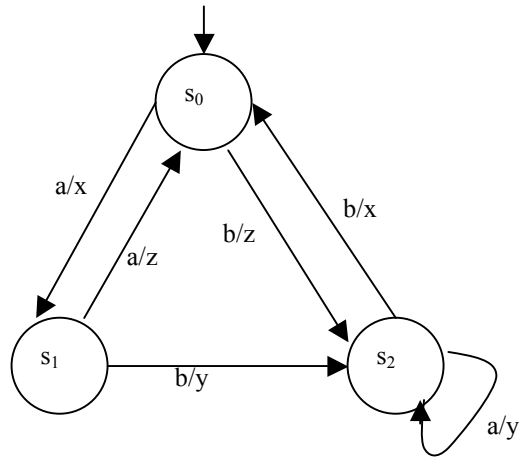   b) Find the output word $v$ for the input words: $w = a^2b^2abab$ and $w = abab^3a^2$.



Figure 1

5. [13.10] Let $M$ be the finite state machine with the state table shown below.

| $F$ | $a$ | $b$ |
|-----|-----|-----|
| $s_0$ | $s_2,y$ | $s_1,z$ |
| $s_1$ | $s_2,x$ | $s_3,z$ |
| $s_2$ | $s_2,y$ | $s_1,z$ |
| $s_3$ | $s_3,z$ | $s_0,x$ |

   a) Find the input set $A$, the state set $S$, the output set $Z$, and the initial state of $M$.
   b) Draw the state diagram $D = D(M)$ of $M$.
   c) Find the output word $v$ for the input words: $w = ab^3a^2ba^3b$ and $w = a^2b^2ab^2a^2b$.

6. [13.13] Let $M$ be the finite state machine with input set $A = \{a,b\}$, output set $Z = \{x,y,z\}$, and state diagram $D = D(M)$ shown in figure 2. Find the output word $v$ for the input words: $w = ab^3a^2ba^3b$ and $w = aba^2b^2ab^2a^2ba^2$.
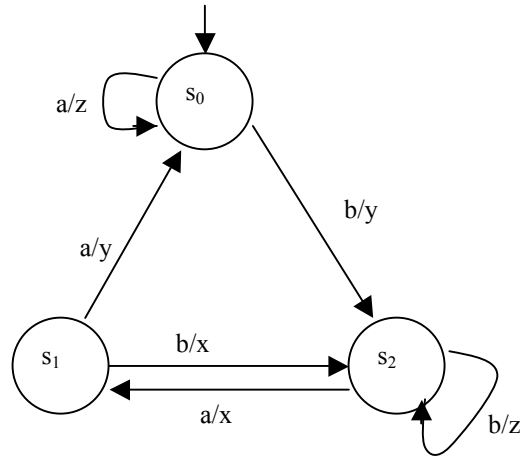


Figure 2