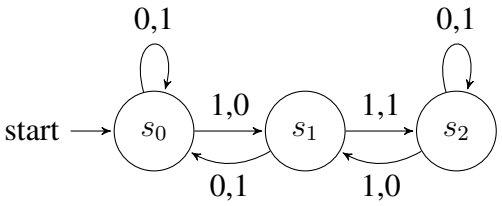
13.2 Finite-State Machines with Output

A *finite-state machine* $M = (S, I, O, f, g, s_0)$ consists of

- a finite set S of *states*
- a finite *input alphabet* I
- a finite *output alphabet* O
- a *transition function* f $(f : S \times I \to S)$
- an *output function* g $(g : S \times I \to O)$
- an *initial state* s_0

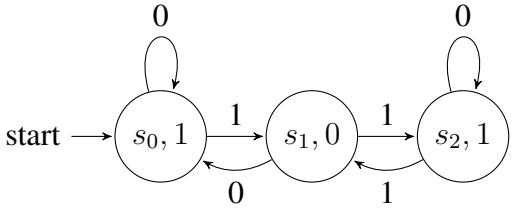


State	Input	
	0	1
s_0	s_0, 1	s_1, 0
s_1	s_0, 1	s_2, 1
s_2	s_2, 1	s_1, 0

Types of Finite-State Machines

- *Mealy machines:* outputs correspond to transitions between states
- *Moore machine:* output is determined only by the state

Example of a Moore Machine



Language Recognizer

Let $M = (S, I, O, f, g, s_0)$ be a finite-state machine and $L \subseteq I^*$. We say that M *recognizes* (or *accepts*) L if an input string x belongs to L if and only if the last output bit produced by M when given x as input is a 1.

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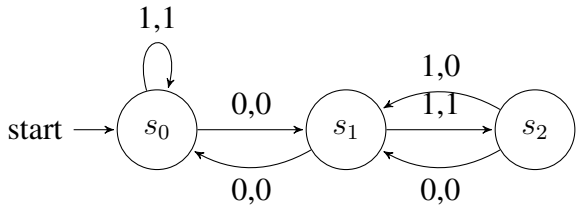
Draw the state diagrams for the finite-state machines with these state tables.

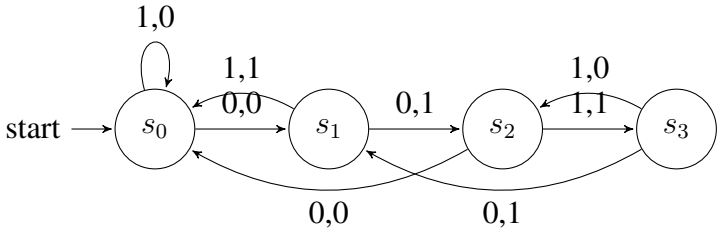
a)

State	Input	
	0	1
s_0	s_1, 0	s_0, 1
s_1	s_0, 0	s_2, 1
s_2	s_1, 0	s_1, 0



b)

State	Input	
	0	1
s_0	s_1, 0	s_0, 0
s_1	s_2, 1	s_0, 1
s_2	s_0, 0	s_3, 1
s_3	s_1, 1	s_2, 0



13.2 pg. 863 # 3

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

a) Exercise 1(a).

The state transition sequence is:
$s_0 \to s_1 \to s_2 \to s_1 \to s_2 \to s_1$
Our output is: 01010

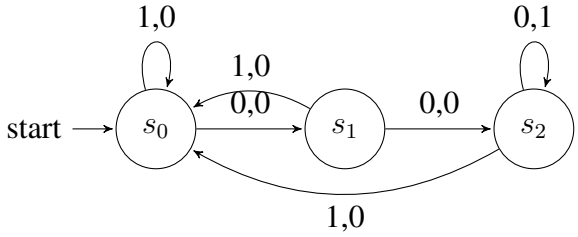
b) Exercise 1(b).

The state transition sequence is:
$s_0 \to s_1 \to s_0 \to s_0 \to s_0 \to s_1$
Our output is: 01000

Lecture Notes 25 Exercise

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

State	Input	
	0	1
s_0	s_1, 0	s_0, 0
s_1	s_2, 0	s_0, 0
s_2	s_2, 1	s_0, 0



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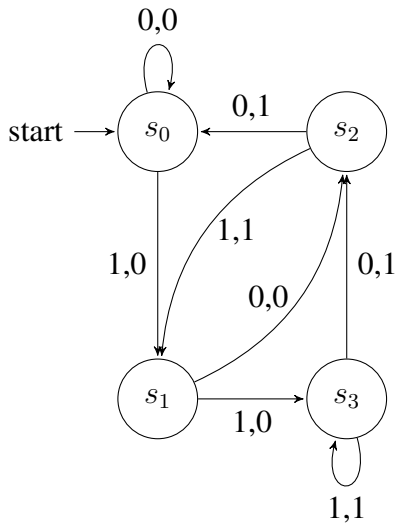
Construct a finite-state machine that delays an input string two bits, giving 00 as the first two bits of output.



s_0 corresponds to the last two bits having been 00, s_1 corresponds to the last two bits having been 01, s_2 corresponds to the last two bits having been 10, s_3 corresponds to the last two bits having been 11.