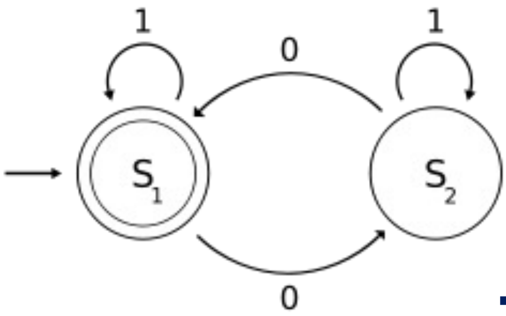
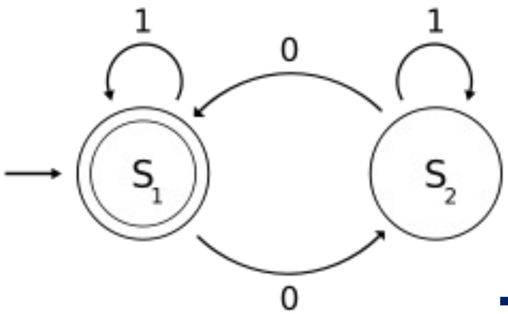
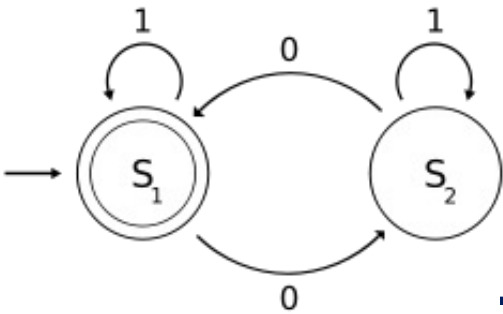


Finite State Machines

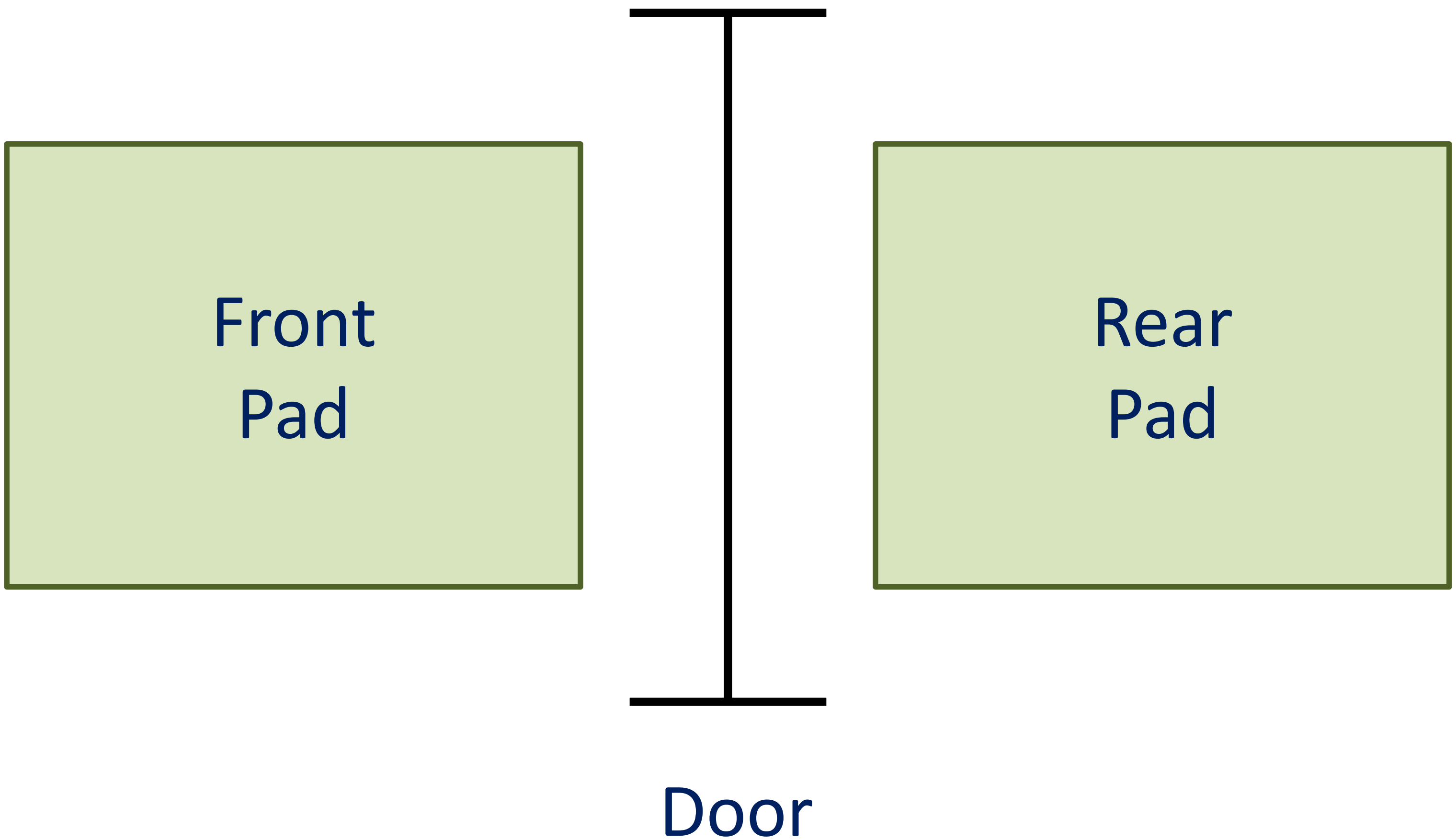
Sipser: Chapter 0 pages 1 - 28, Section 1.1 pages 31 - 40

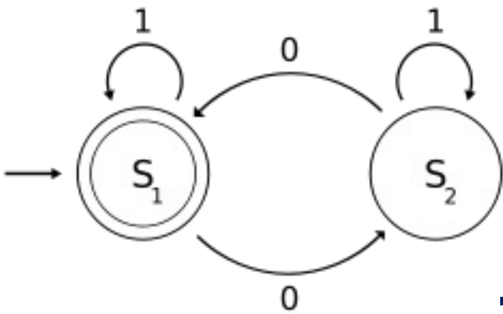


Course Information

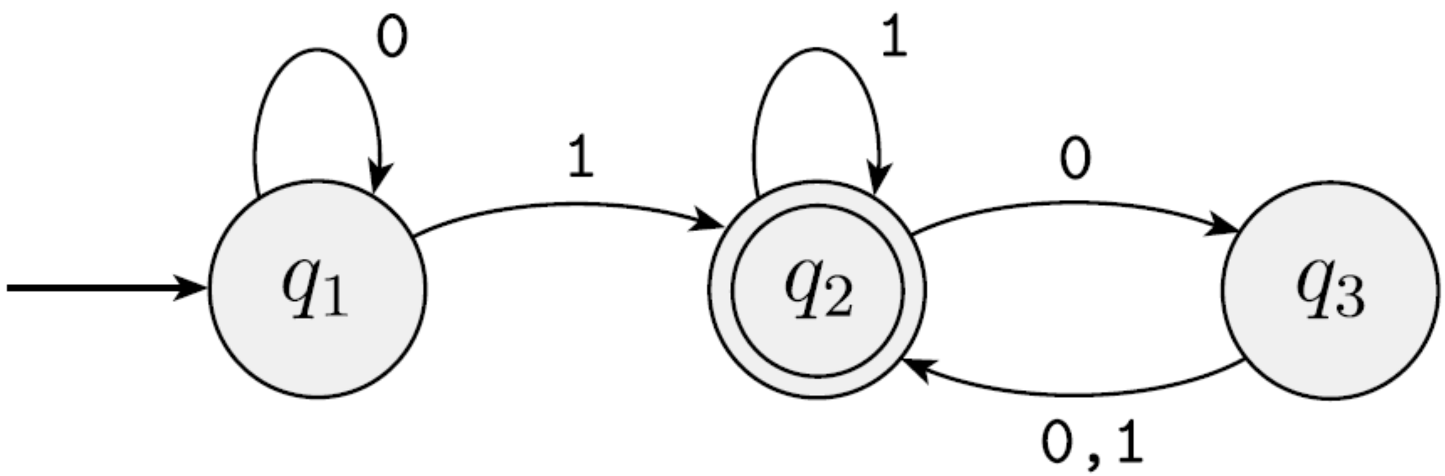


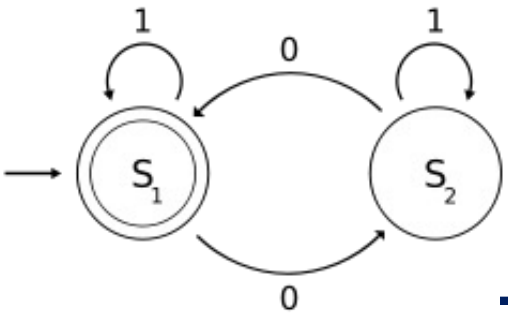
Finite Automata



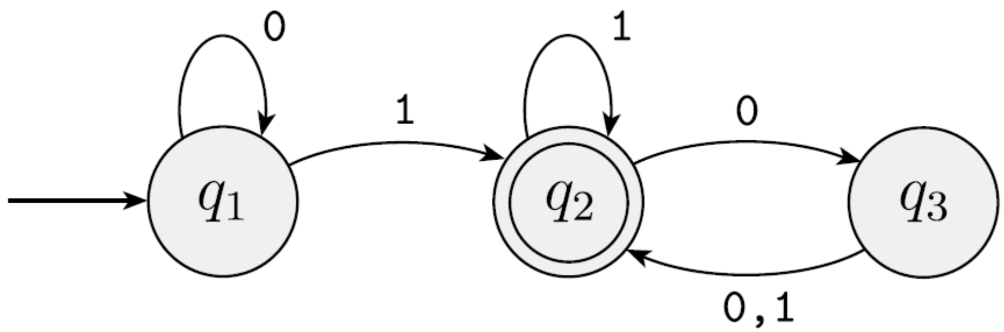


Language Recognition Devices



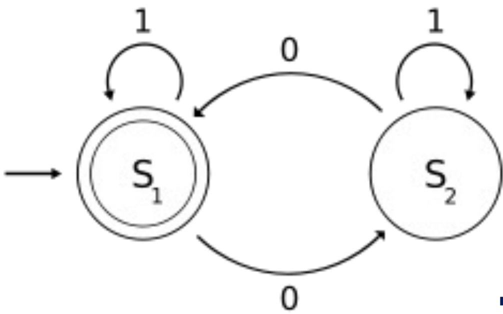


Finite Automaton



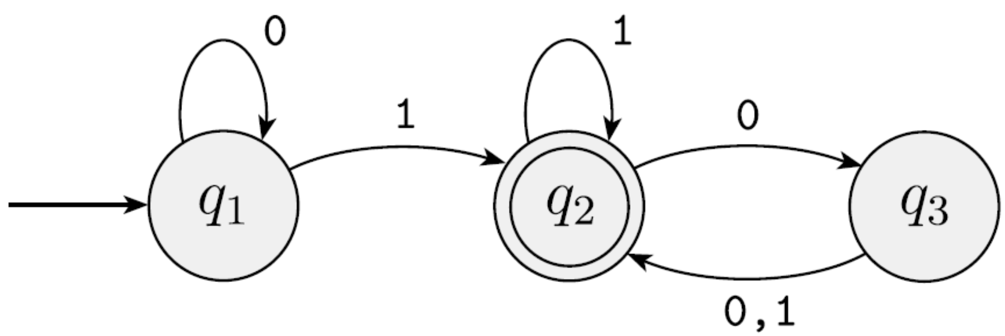
A **finite automaton** is a 5-tuple $(Q, \Sigma, \delta, q_0, F)$, where

1. Q is a finite set called the **states**,
2. Σ is a finite set called the **alphabet**,
3. $\delta: Q \times \Sigma \rightarrow Q$ is the **transition function**,
4. $q_0 \in Q$ is the **start state**, and
5. $F \subseteq Q$ is the **set of accept states**.

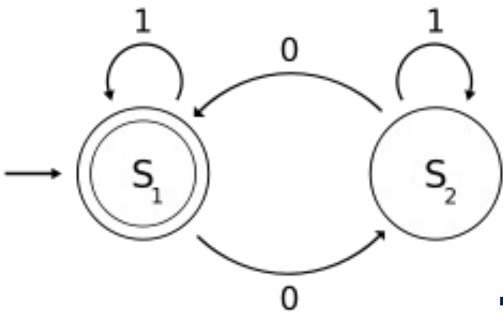


Languages

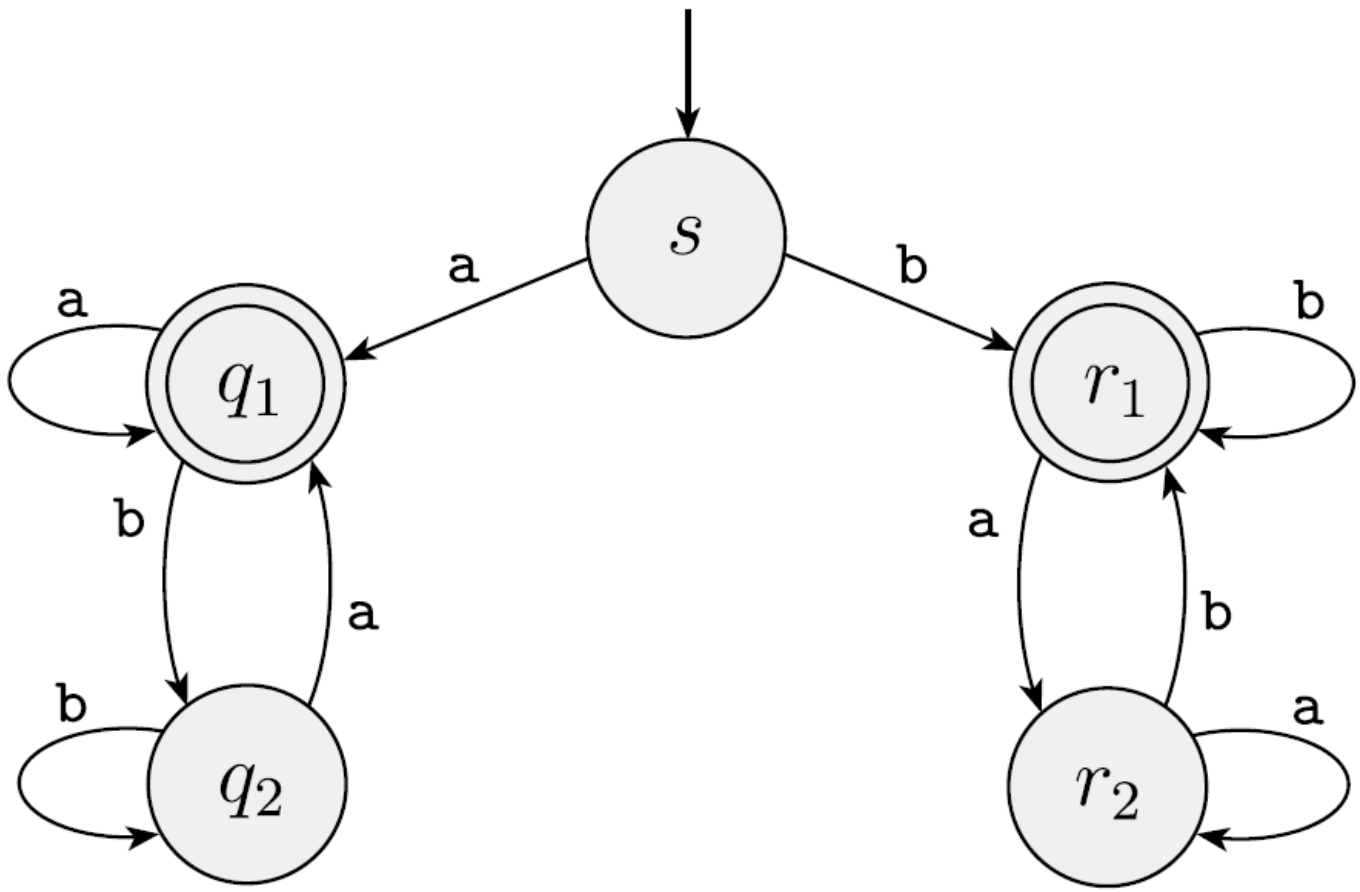
The set of all strings accepted by a finite automaton M is called **the language of machine M**, and is written *L(M)*.

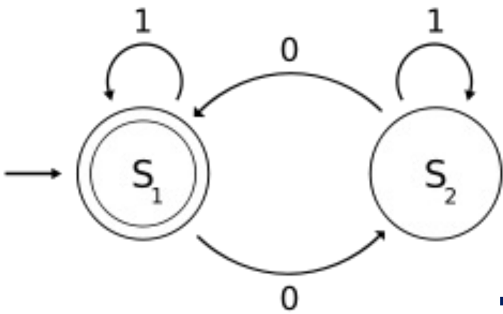


We say that **M recognizes the language** ***L(M)***.

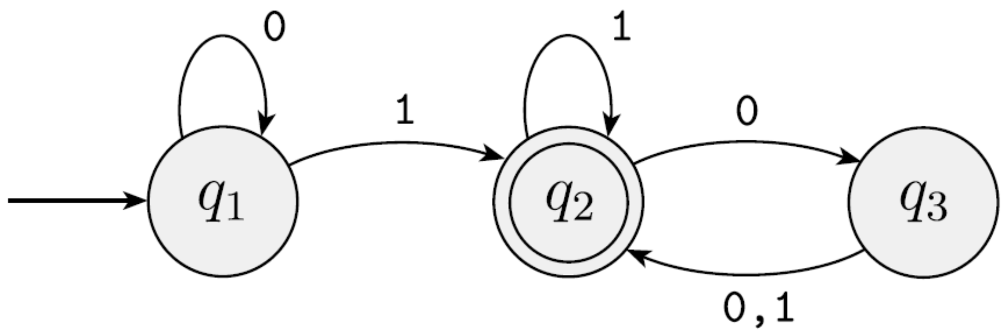


What language?



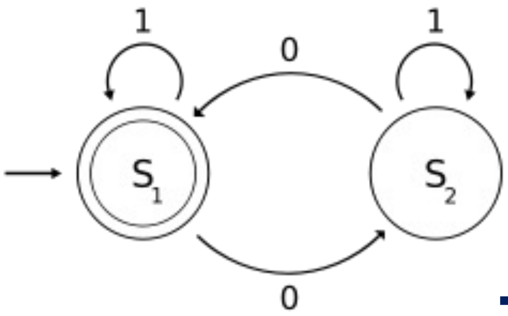


Automata Computation



Let $M = (Q, \Sigma, \delta, q_0, F)$ be a finite automaton and let $w = w_1 w_2 \cdots w_n$ be a string where each w_i is a member of the alphabet Σ. Then M **accepts** w if a sequence of states $r_0, r_1, \ldots, r_n$ in Q exists with three conditions:

1. $r_0 = q_0$,
2. $\delta(r_i, w_{i+1}) = r_{i+1}$, for $i = 0, \ldots, n-1$, and
3. $r_n \in F$.

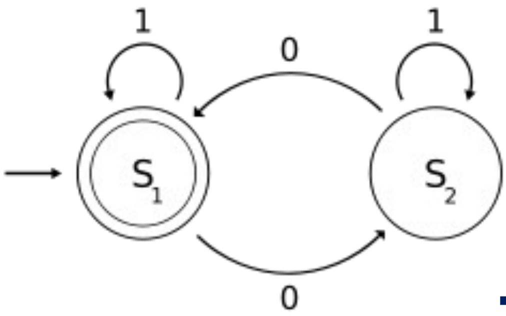


Regular Languages

A language is called a **regular language** if some finite automaton recognizes it.

$L(M_1)$ = {*w* | *w* contains at least one 1 and an even number of 0s follow the last 1 }

$L(M_4)$ = {*w* | *w* is a string over {*a*, *b*} that starts and ends with the same symbol }



Designing Your Own

Is {*w* | *w* is a string of 0s and 1s containing an even number of 0s } a regular language?

How about {*w* | *w* is a string of *a*s and *b*s containing the substring *aba* }?