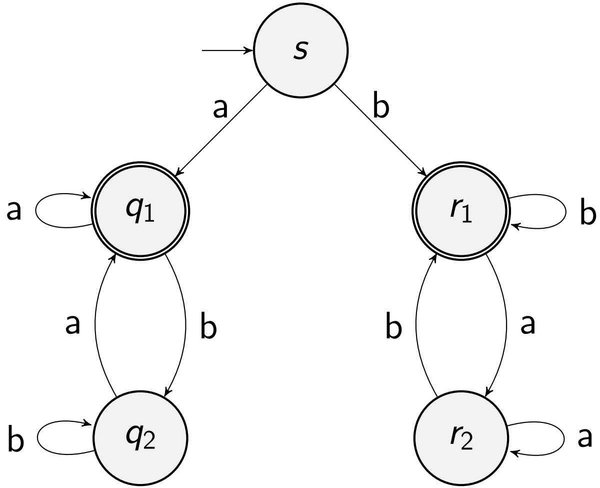
Example 1.11 I

- Fig 1.12

Example 1.11 II



Example 1.11 III

- $L(M) = ?$

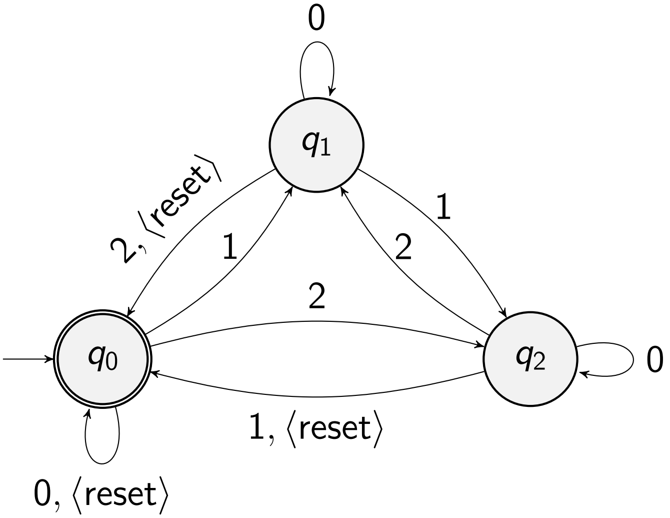
$$a \ldots a, b \ldots b$$

where "$\ldots$" can be any string of a and b

Example 1.13 I

- Figure 1.14

Example 1.13 II



Example 1.13 III

- $\Sigma = \{\langle \mathit{reset} \rangle, 0, 1, 2\}$

$$\begin{aligned} L(M) &= \ldots\ldots \langle \mathit{reset} \rangle \ldots \langle \mathit{reset} \rangle \ldots \\ &= \{\text{sum of the last segment} \mod 3 = 0\} \end{aligned}$$

- Example:

$$10\langle \mathit{reset} \rangle 22 \langle \mathit{reset} \rangle 012$$

Example 1.13 IV

- Running this string

$$q_0 \xrightarrow{1} q_1 \xrightarrow{0} q_1 \xrightarrow{\langle reset \rangle} q_0 \xrightarrow{2} q_2 \xrightarrow{2} q_1$$
$$\xrightarrow{\langle reset \rangle} q_0 \xrightarrow{0} q_0 \xrightarrow{1} q_1 \xrightarrow{2} q_0$$

Accepted.

Formal Definition of Computation I

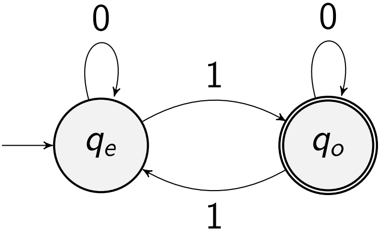
- M accepts $w = w_1 \cdots w_n$ if $\exists$ states $r_0 \cdots r_n$ such that
  1. $r_0 = q_0$
  2. $\delta(r_i, w_{i+1}) = r_{i+1}, i = 0, \ldots, n-1$
  3. $r_n \in F$
- Definition: a language is regular if recognized by some automata

Designing Automata I

- Given a language, how do we construct a machine to recognize it?
- Basically we need to get a state diagram (where the number of states is finite)
- An automaton recognizing $\{0, 1\}$ strings with odd $\#$ of 1's

  Fig 1.20

Designing Automata II



- Examples

01

$$q_e \xrightarrow{0} q_e \xrightarrow{1} q_o$$

010101

$$q_e \xrightarrow{0} q_e \xrightarrow{1} q_o \xrightarrow{0} q_o \xrightarrow{1} q_e \xrightarrow{0} q_e \xrightarrow{1} q_o$$

Designing Automata III

- Two ways to think about the design
  - After the first 1, we go to q_o. Subsequently, every $1, \ldots, 1$ pair is cancelled out by

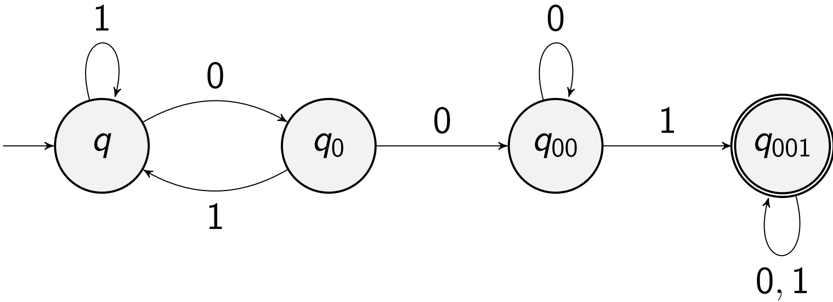
$$q_o \xrightarrow{1} q_e \rightarrow \cdots \rightarrow q_e \xrightarrow{1} q_o$$

  - q_e, q_o respectively remember whether the number of 1's so far is even or odd
- Example 1.21

  strings contain 001

  Fig 1.22

Designing Automata IV



- q_0, q_{00} indicate that before the current input character, we have 0 and 00, respectively