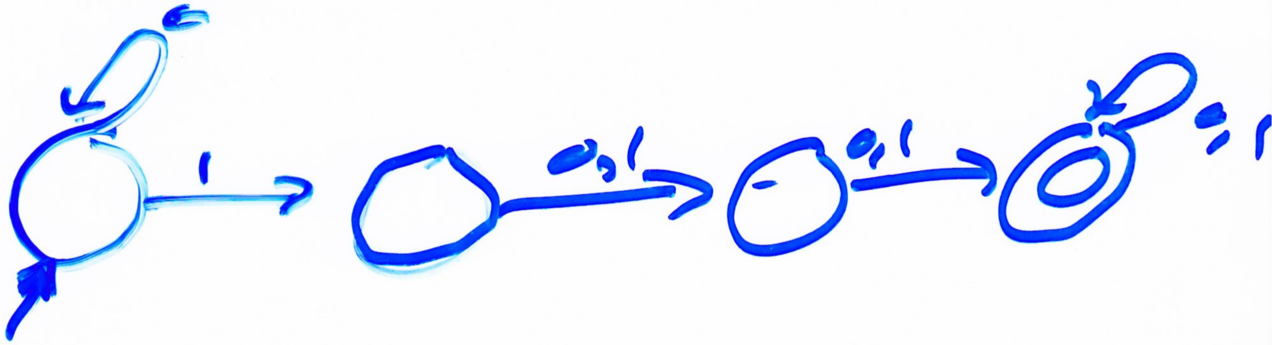
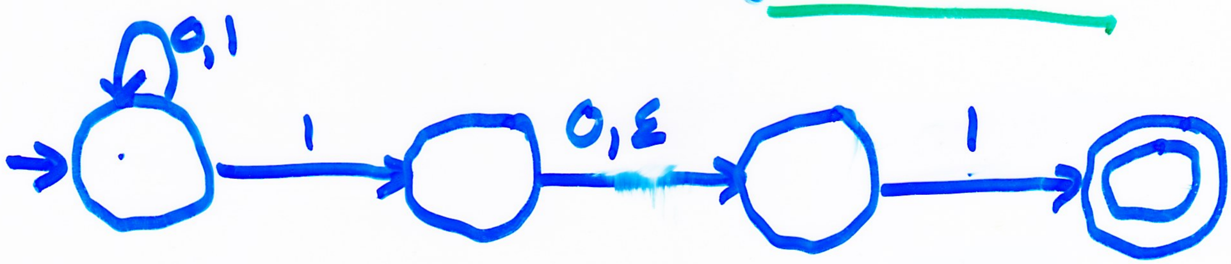


① DFA as a recognizer.

② " " " " " generator

000110001

③ A different kind of generator!



101 11

01101 ...

④ Q. What would it mean/how could we define an equivalent recognizer

A. Nondeterminism

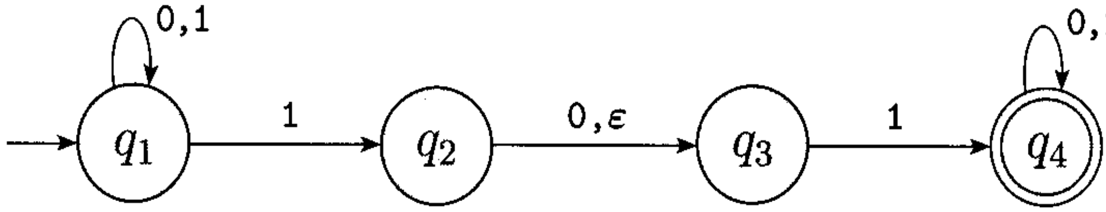


FIGURE 1.27

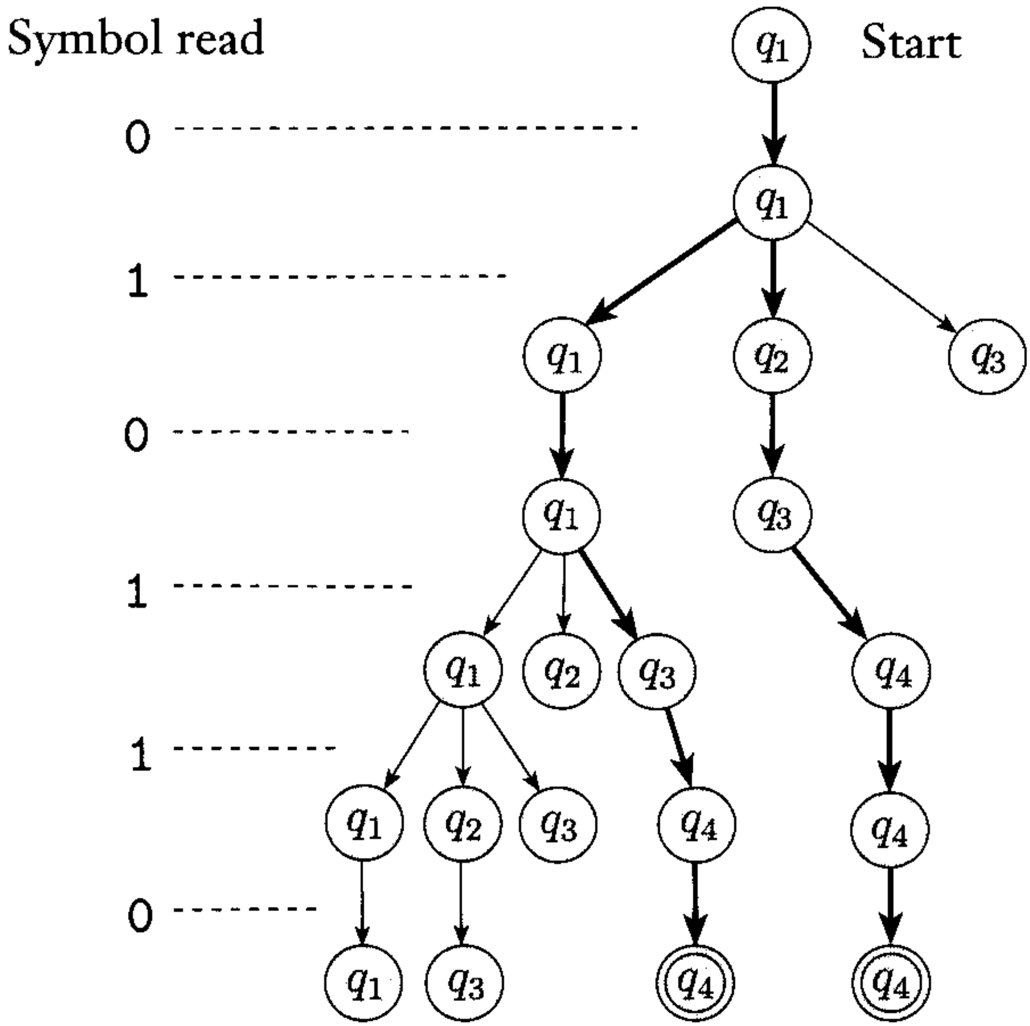


FIGURE 1.29

A nondeterministic finite state machine

$$M = (Q, \Sigma, \delta, q_0, F)$$

where

- Q is a finite set (states)
- $q_0 \in Q$ start state
- Σ is a finite set (alphabet)
- $F \subseteq Q$ Final states / Accepting states

~~$\delta : Q \times \Sigma \to Q$ transition function~~

function

$$\delta : Q \times (\Sigma \cup \{\varepsilon\}) \to 2^Q \quad \text{transition function}$$

E.g. for fig 627 M

$$\delta(q_1, 0) = \{q_1\}$$

$$\delta(q_1, 1) = \{q_1, q_2\}$$

$$\delta(q_2, 1) = \emptyset$$

6.3

~~2.4~~

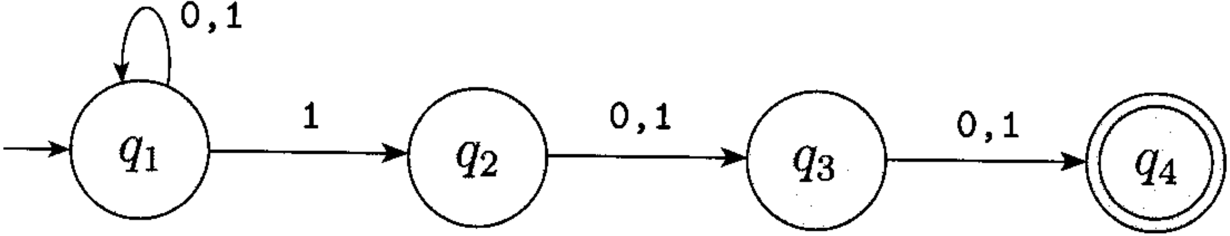
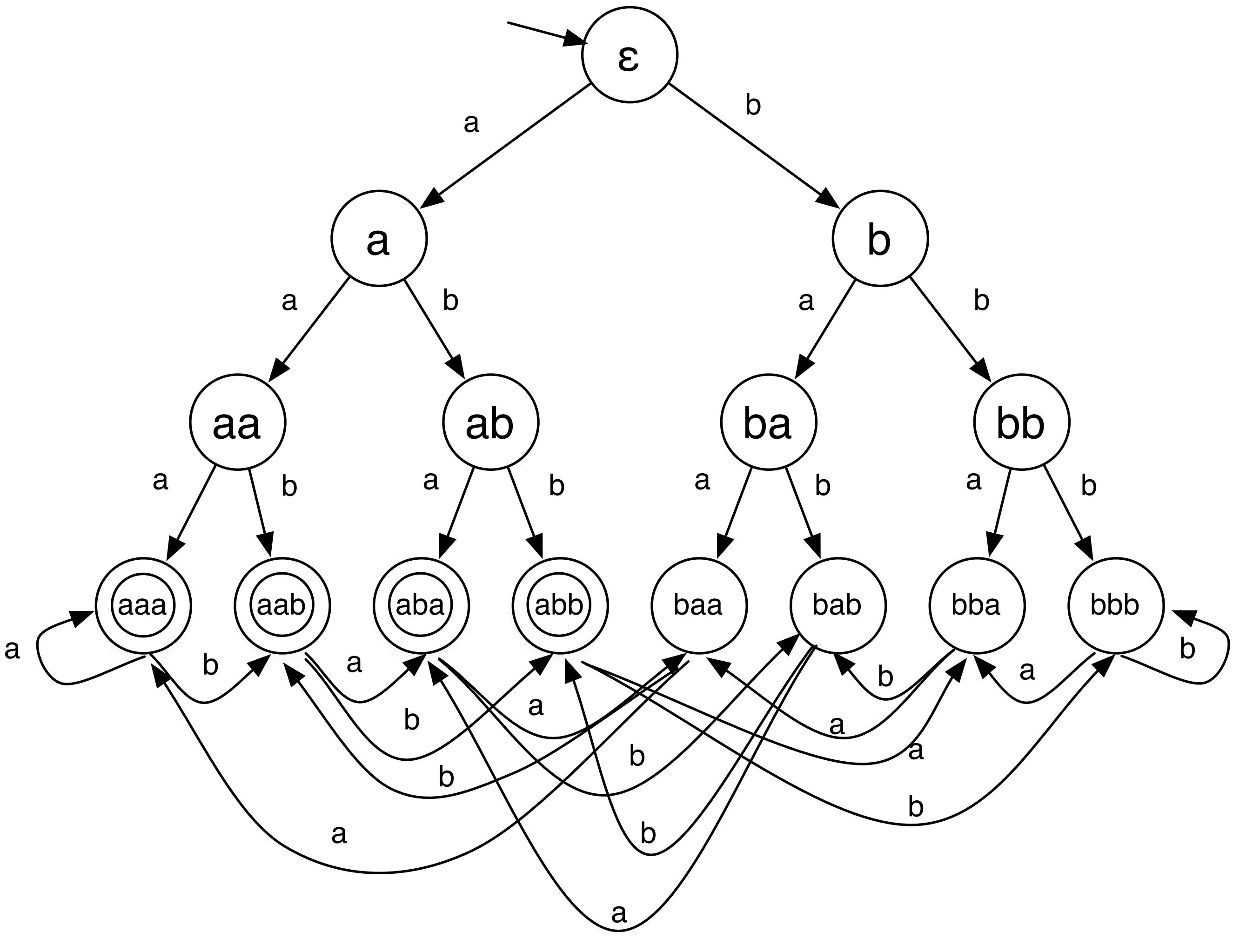


FIGURE 1.31

L = { w in {a,b}* | 3rd letter from the right end of w is "a" }



DEFN ("~~is in~~ might be in state q")

M might end~~s~~ ~~in~~ in state q after reading $w \in \Sigma^*$ if

(1) $w = w_1 w_2 \cdots w_n$

where $w_i \in \Sigma \cup \{\varepsilon\}$

(2) $\exists$ state $r_0, r_1, r_2 \cdots r_n \in Q$

s.t. (a) $r_0 = q_0$

(b) $\forall\ 1 \le i \le n$

$r_i \in \delta(r_{i-1}, w_i)\ \cancel{= r_i}$

(c) $r_n = q$

~~Fact: q is unique~~

~~because δ is a function, basically~~

Defn

M accepts $w \in \Sigma^*$ $\Leftrightarrow$ ~~the~~ some state, q, reached by M after reading w is an accepting state, i.e., $q \in F$.

Defn

The language recognized by M, $L(M) = \{ w \in \Sigma^* \mid M \text{ accepts } w \}$.

Note

Every M recognizes exactly one language. Implicitly, it "recognizes" both strings it must accept and those it must reject.

??

Very important: note that "might be in a non-final state" does not imply "reject".