Consider the following figure
Example 1.33 II
For this language, $\Sigma = \{0\}$. This is called unary alphabets.

What is the language?

$$\{0^k \mid k \text{ multiples of 2 or 3}\}$$
Example 1.35 I

- Fig 1.36

- Accept
  - $\epsilon$, $a$, $baba$, $baa$ can be accepted
  - But babba is rejected
Example 1.35 II

See the tree below

\[
\begin{array}{c}
q_1 & q_2 & q_3 \\
\downarrow & \downarrow & \downarrow \\
q_2 & q_2 & q_3 \\
\downarrow & \downarrow & \\
q_3 & q_3 & \\
\end{array}
\]

- This example is later used to illustrate the procedure for converting NFA to DFA
Definition: NFA I

- \((Q, \Sigma, \delta, q_0, F)\)
- \(\delta: Q \times \Sigma_{\epsilon} \to P(Q)\)

\(P(Q)\): all possible subsets of \(Q\)

- \(\Sigma_{\epsilon} = \Sigma \cup \{\epsilon\}\)

\(P(Q)\): power set of \(Q\)

“power”: all \(2^{|Q|}\) combinations

\[Q = \{1, 2, 3\}\]

\[P(Q) = \{\emptyset, \{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}, \{1, 2, 3\}\}\]
Example 1.38

- \( Q = \{ q_1, \ldots, q_4 \} \)
- \( \Sigma = \{ 0, 1 \} \)
- Start state: \( q_1 \)
- \( F = \{ q_4 \} \)
- \( \delta: \)
Example 1.38 II

Note that DFA does not allow $\emptyset$
$N$ accepts $w$ if

- First we have that $w$ can be written as
  
  $$w = y_1 \ldots y_m$$

  where $y_i \in \Sigma \epsilon$

- A sequence $r_0 \ldots r_m$ such that
  1. $r_0 = q_0$
  2. $r_{i+1} \in \delta(r_i, y_{i+1})$
  3. $r_m \in F$

- So $m$ may not be the original length (as $y_i$ may be $\epsilon$)