Formal Definition of a Finite Automata

5-Tuple
$(Q, \Sigma, \delta, q_0, F)$

$Q \Rightarrow$ finite set of states

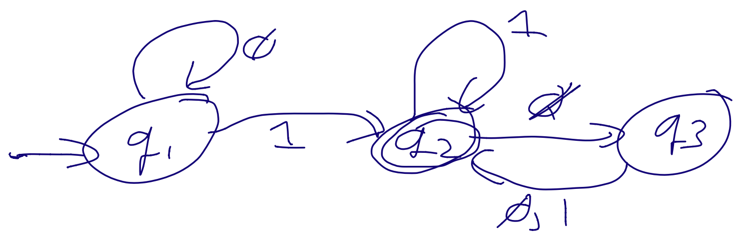
$\Sigma \Rightarrow$ finite set $\rightarrow$ Alphabet

$\delta : Q \times \Sigma \rightarrow Q \Rightarrow$ Transition function

$q_0 \in Q$ START STATE

$F \subseteq Q$ THE SET OF ACCEPT STATES

FIGURE 1.6



$Q = \{q_1, q_2, q_3\}$
$\Sigma = \{0, 1\}$

δ

	0	1
q_1	q_1	q_2
$\rightarrow q_2$	q_3	q_2
q_3	q_2	q_2

$q_0 = q_1$

$F = \{ q_2 \}$

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

LET $w = w_1 w_2 \ldots w_n$ IS A STRING $w \in \Sigma$

M ACCEPTS w IF A SEQUENCE OF STATES $r_0 r_1 \ldots r_n \in Q$ $\exists$ WITH 3 CONDITIONS:

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

M ACCEPTS language A IS

$$A = \{w \mid M \text{ ACCEPTS } w\}$$

A LANGUAGE IS A <u>regular language</u> IF SOME FINITE AUTOMATA RECOGNIZES IT

REGULAR OPERATIONS

1). UNION: $A \cup B = \{x \mid x \in A \text{ OR } x \in B\}$

2). CONCATENATION: $A \circ B = \{xy \mid x \in A \text{ AND } y \in B\}$

3). STAR: $A^* = \{x_1 x_2 \ldots x_k \mid k \geq \emptyset \text{ AND EACH } x_i \in A\}$

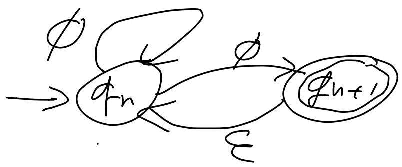
NON-DETERMINISM

DFA - One or zero transitions from any state

- All transition are from the alphabet

NFA - Non-deterministic FA

- $\emptyset$ or more exit from a state on a sym.
- All transitions are from either the alphabet or the symbol ϵ



Tree of Possibilities