Theory of Computation, CSCI 438 spring 2022
Nondeterminism, pg. 47-54, Jan. 21

Nondeterministic finite automaton, NFA, $M = (Q,\Sigma,\delta,q_0,F)$

* Q - finite set of states
* Σ - finite set of symbols, input alphabet
* δ: Q x $\Sigma\varepsilon \rightarrow \mathcal{P}(Q)$, transition function ($\Sigma_\varepsilon$ is Σ augmented by ε which indicates that the machine can move forward without an input symbol)
* $q_0 \in Q$, initial state
* $F \subseteq Q$, set of accept states

(Definition 1.37, page 53)

Note about δ:

- Range of δ is a set of states so that, given a state and a symbol, the machine can go to several states. We assume that it will always take the correct move.
- Move can be made without using the input. These are ε-transitions and they can be made before or after an input symbol is used.

Deterministic finite automaton - DFA	**Nondeterministic finite automaton - NFA**
$M = (Q,\Sigma,\delta,q_0,F)$	$M = (Q,\Sigma,\delta,q_0,F)$
* Q - finite set of states * Σ - finite set of symbols, input alphabet * δ: Q x $\Sigma \rightarrow$ Q, transition function * $q_0 \in Q$, initial state * $F \subseteq Q$, set of accept states	* Q - finite set of states * Σ - finite set of symbols, input alphabet * δ: Q x $\Sigma\varepsilon \rightarrow \mathcal{P}(Q)$, transition function ($\Sigma\varepsilon = \Sigma \cup \{\varepsilon\}$ where ε indicates that the machine can move forward without an input symbol) * $q_0 \in Q$, initial state * $F \subseteq Q$, set of accept states

A string is accepted by an NFA if there is some sequence of possible moves that will put the machine in a final state at the end of the string. (Intuitively, the right move is always chosen.)
(Page 54)

M accepts string $w \in \Sigma^*$ iff $\delta^*(q_0,w) \in F$	M accepts string $w \in \Sigma^*$ iff there exists some sequence such that $\delta^*(q_0,w) \in F$