Theory of Computation

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Definition 1.1 (Alphabet)**.** An *alphabet* is a non-empty set. The members of an alphabet are *symbols*.

Definition 1.2 (String)**.** A *string* is a sequence of symbols from the alphabet. ϵ is the empty string. For a string w The length of the string sequence is denoted $|w|$

Definition 1.3 (Finite Automaton)**.** Formally, a *finite automaton* is a 5-tuple $(Q, \Sigma, \delta, q_0, F)$, where

- Q is the finite set called the *states*.
- Σ is a finite set called alphabet.
- $\delta : Q \times \Sigma \to Q$ is the transition function.
- $q_0 \in Q$ is the start state.
- $F \subseteq$ is a set of accept states.

/*State diagram*/

Definition 1.4. Let $M = (Q, \Sigma, \delta, q_0, F)$. If M takes the string $w = w_1 w_2 \ldots w_n$, then M *accepts* w if a sequence of states $r_0, r_1, \ldots r_n$ exists such that:

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

Definition 1.5. For a finite automaton M, we say M *recognizes language* A if $A = \{w \mid M \text{ accepts } w\}$.

Definition 1.6 (Regular Language)**.** A language is called a *regular language* if some finite automaton recognizes it.