DFA Definitions

A **Deterministic Finite Automaton**, DFA, is a structure M such that:

$M = (Q, \Sigma, \delta, s, F)$, where
Q is a finite set of "states".
Σ is a finite set of "symbols", an "alphabet".
$\delta : Q \times \Sigma \to Q$ is the "transition function".
For $p, q \in Q$ and $a \in \Sigma$, $\delta(p, a) = q$ means
state q is transitioned to when in state p scanning symbol a.
$s \in Q$ is the "start state".
$F \subseteq Q$ is the set of "final states".

The **extended transition function** for M is the function:

$$\hat{\delta} : Q \times \Sigma^* \to Q, \quad \text{where}$$
$$\hat{\delta}(q, \epsilon) = q, \quad \text{and}$$
$$\hat{\delta}(q, xa) = \delta(\hat{\delta}(q, x), a).$$

A string $x \in \Sigma^*$ is **accepted** by M if $\hat{\delta}(s, x) \in F$.

The language **accepted or recognized** by M is
$L(M) = \{x \in \Sigma^* \mid x \text{ is accepted by } M\}$.

A language is **regular** if there exists a DFA that recognizes it.