Three forms of $\delta$ for a DFSA

$\delta: Q \times \Sigma \rightarrow Q$ defined schematically by $\delta(q, c) = r$

1. State $\delta_0$ (State $q$, char $c$)
2. State $\delta_1$ (State $q$, char $c$)
3. Set $\langle \text{Triple} \langle \text{State}, \text{char State} \rangle \rangle \rangle \delta$

The FA is deterministic (a DFA) if form 3 defines a function, i.e., if $(\forall q \in Q)(\forall c \in \Σ)(\exists! r \in Q):(q, c, r) \in \delta$.

Otherwise, the FA is non-deterministic (an NFA).

Informal Def: An NFA $N$ has non-determinism at state $q$ on char $c$ if there are $r_1, r_2$ such that

$(q, c, r_1) \in \delta \land (q, c, r_2) \in \delta$

One more wrinkle: We can let NFAs have arcs on $\epsilon$, i.e.,

$Q \rightarrow \epsilon$