Thm For every NFA $N = (Q, \Sigma, \delta, q_0, F)$ has equivalent DFA M

$$L(N) = L(M)$$

Proof: $M = (2^Q, \Sigma, \tilde{\delta}, \{q_0\}, \tilde{F})$

$$\tilde{\delta}(A, a) = \bigcup_{q \in A} \delta(q, a)$$

$$\tilde{F} = \{A \in 2^Q : A \cap F \neq \emptyset\}$$

Correctness claim: M's state after $x \in \Sigma^*$ is $\tilde{\delta}(\{q_0\}, x) = \boxed{A}$

$$\Updownarrow$$

N's possible states after x is $\boxed{A}$

Base case: $x = \varepsilon$: $\tilde{\delta}(\{q_0\}, \varepsilon) = \underbrace{\{q_0\}}$

A = N's possible states after

Inductive step: Assume claim holds for x, want to prove it for $x.a$

Σ

$$\tilde{\delta}(\{q_0\}, x.a) = \tilde{\delta}(\underbrace{\tilde{\delta}(\{q_0\}, x)}, a)$$

$= A =$ N's possible states after x

$$\overset{\text{(def)}}{=} \underbrace{\bigcup_{q \in A} \delta(q, a)}_{\text{N's possible after } x.a}$$