Alternative Proof

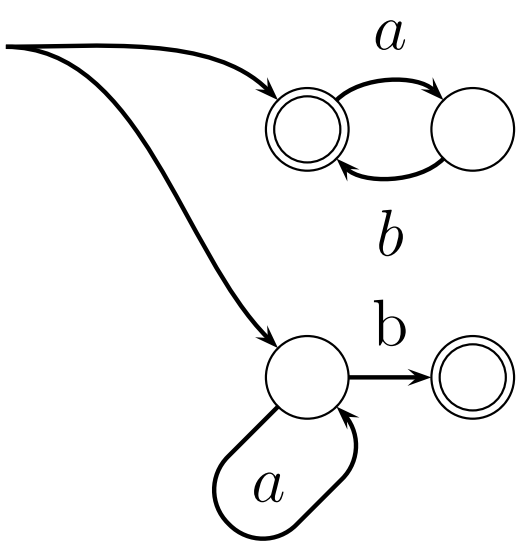
NFAs are closed under

- intersection $\mathcal{L} \cap \mathcal{L}'$
- union $\mathcal{L} \cup \mathcal{L}'$
- complement
  e.g., via power-set construction to get a DFA
- projection of the alphabet
  $\{\pi(a_1) \ldots \pi(a_n) \mid a_1 \ldots a_n \in \mathcal{L}\}$

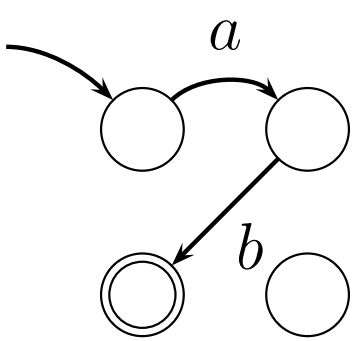
of their languages.

Moreover, this closure is effective.

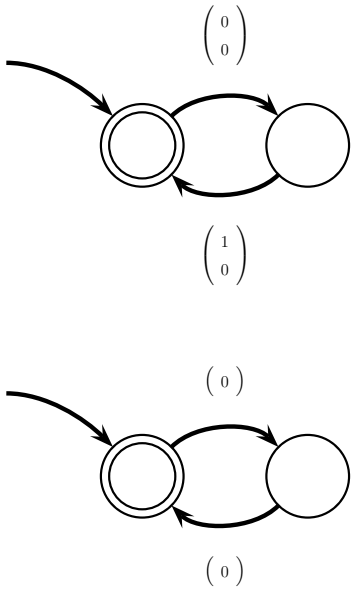
NFA Closure Properties



$Q = Q_0 \cup Q_1$

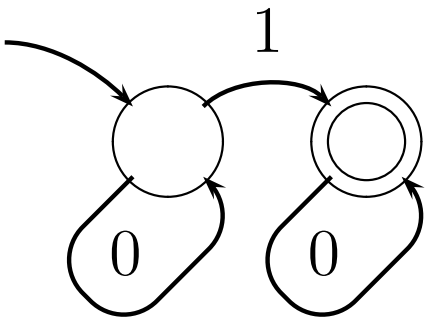


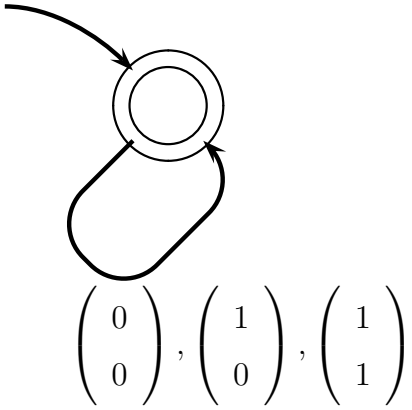
$Q = Q_0 \times Q_1$

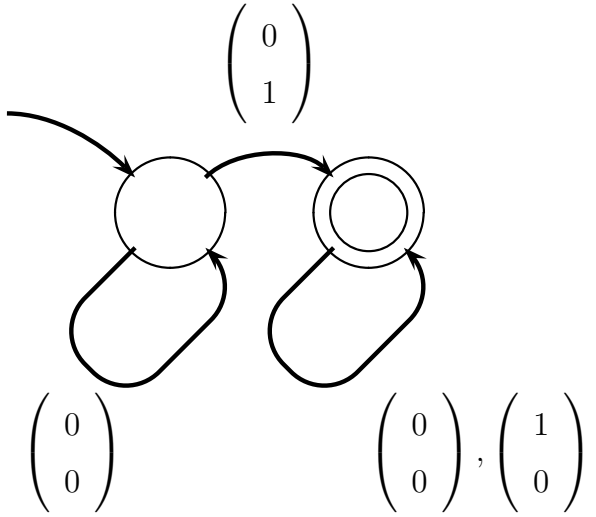


$Q = Q_0$

Primitives







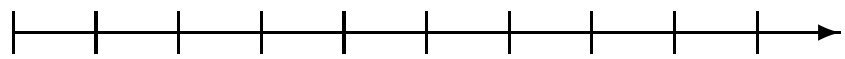
"X is a singleton"

$X \subset Y$

"$x < y$"

Presburger Arithmetic

$X = 13 \quad 1 \; 0 \; 1 \; 1 \; 0 \; 0 \; 0 \; 0 \; 0 \; 0$

$X = 30 \quad 0 \; 1 \; 1 \; 1 \; 1 \; 0 \; 0 \; 0 \; 0 \; 0$

$Z = 43 \quad 1 \; 1 \; 0 \; 1 \; 0 \; 1 \; 0 \; 0 \; 0 \; 0$