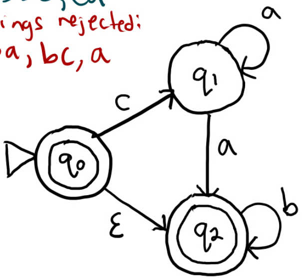
Examples of strings accepted:
cab, ε, b, bbb, ca

Examples of strings rejected:
cb, ba, bc, a



To construct DFA M from NFA N:

$\{q_0, q_1, q_2\}$ $\{q_0, q_2\}$

Let $N = (\boxed{Q}, \Sigma, \delta, q_0, \boxed{F})$. Define

set of states from NFA

$$M = (\boxed{P(Q)}, \Sigma, \delta', q', \{\boxed{X \subseteq Q} \mid X \cap F \neq \emptyset\})$$

all possible combinations of states from NFA

where $q' = \{q \in Q \mid \boxed{q = q_0}$ or is accessible from q_0 by spontaneous moves in N $\}$

state in DFA (labeled by a set of states from NFA)

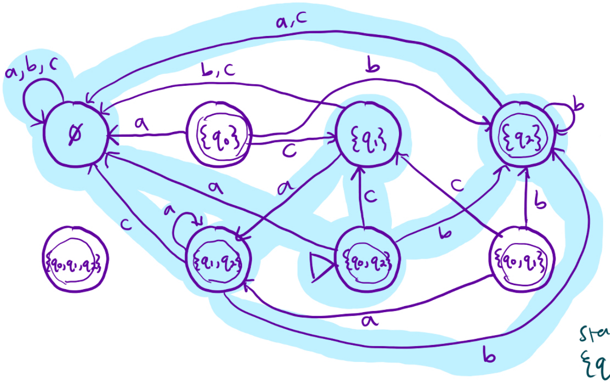
symbol to read

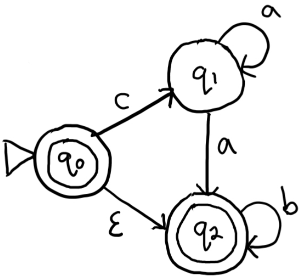
$$\delta'((\boxed{X}, \boxed{x})) = \underbrace{\{q \in Q \mid q \in \delta((r, \boxed{x})) \text{ for some } r \in \boxed{X} \text{ or is accessible from such an } r \text{ by spontaneous moves in N}\}}_{\text{label for the state to transition to}}$$

label for a single state in the new DFA

$$\delta'((\boxed{\{q_0, q_2\}}, c)) = \delta((q_0, c)) \cup \delta((q_2, c)) = \{q_1\} \cup \emptyset = \boxed{\{q_1\}}$$

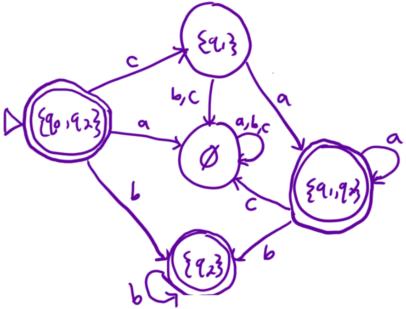
different inputs → $\delta'((\{q_0\}, c))$





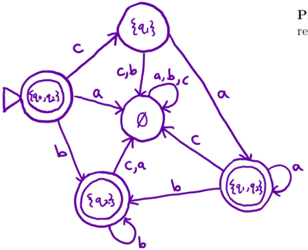
start state
$\{q_0, q_2\}$

Remove unreachable states:



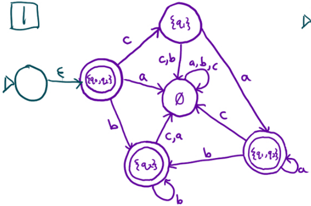
Proof idea: Trace all possible paths from start state to accept state. Express labels of these paths as regular expressions, and union them all.

1. Add new start state with ε arrow to old start state.
2. Add new accept state with ε arrow from old accept states. Make old accept states non-accept.
3. Remove one (of the old) states at a time: modify regular expressions on arrows that went through removed state to restore language recognized by machine.

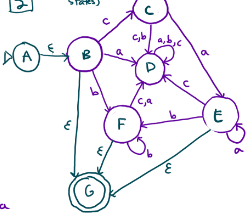


Examples of removing states:

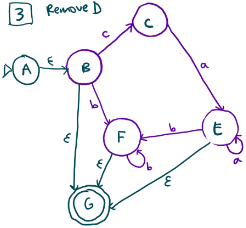
1



2 (also renamed states)

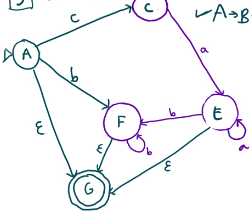


3 Remove D



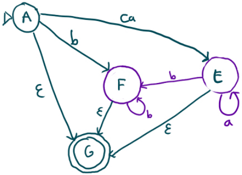
3 Remove B

✓A→B→F
✓A→B→C
✓A→B→G



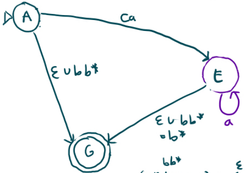
3 Remove C

✓A→C→E



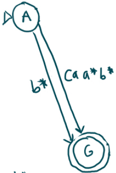
3 Remove F

✓A→F→G
✓E→F→G



$$\overset{bb^*}{\{b^n \mid n \geq 1\}} \cup \overset{\varepsilon}{\{\varepsilon\}} = \overset{b^*}{\{b^n \mid n \geq 0\}}$$

3 Remove E ✓A→E→G



$$\boxed{caa^*b^* \cup b^*}$$