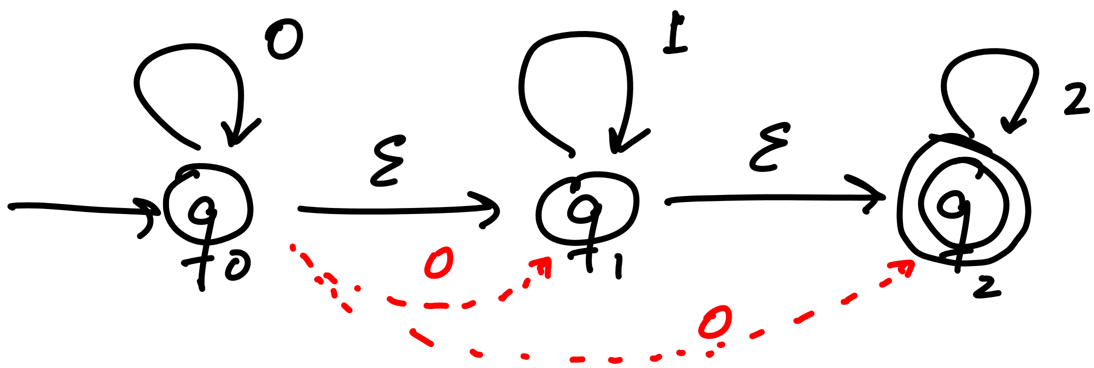
COL 352 Lecture 11 Jan 24

r.e. $\rightarrow$ NFA with ε transition

NFA with ε transitions $\rightarrow$ normal NFA



$\Sigma = \{0, 1, 2\}$

$0^* 1^* 2^*$

How do we construct a normal NFA

ε- closure of a state q is all the states p s.t. $q \overset{\varepsilon}{\rightsquigarrow} p$

$$\varepsilon\text{-clo}(q_0) = \{q_0, q_1, q_2\}$$

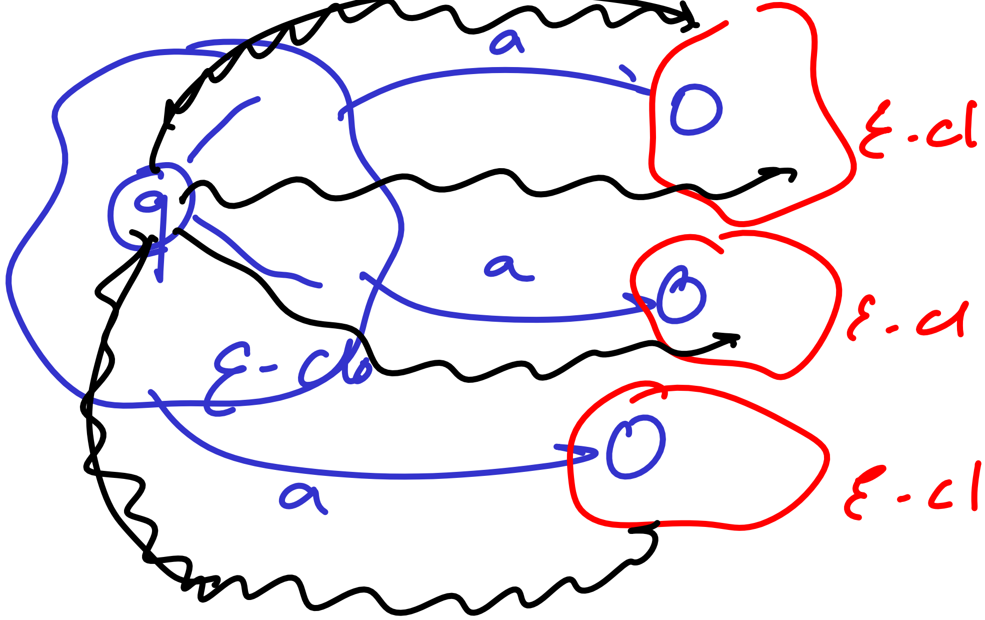
$\delta(q, \varepsilon) = q$

$$\varepsilon\text{-clo}(q_1) = \{q_1, q_2\}$$

$$\varepsilon\text{-clo}(q_2) = \{q_2\}$$

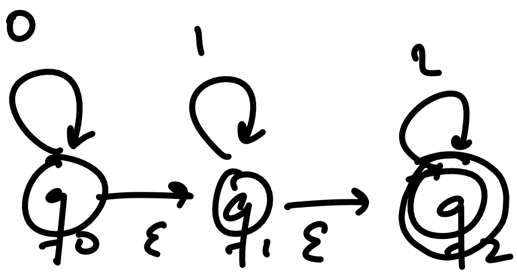
Say δ' is the transition function of NFA w/o ε-trans

$$\delta'(q, a) = \{p \mid p \in \delta(q, \varepsilon^i a \varepsilon^j)\}$$

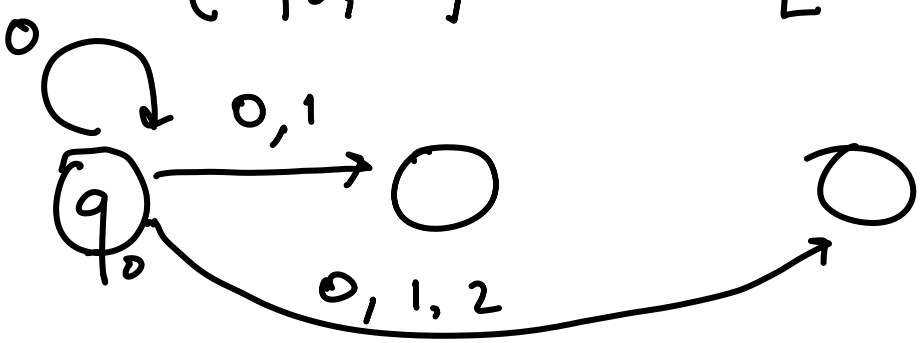


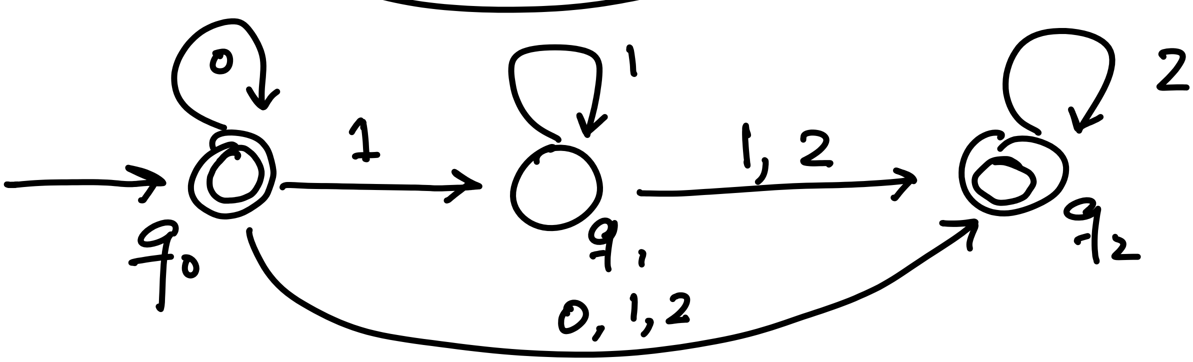
q^* : trap state

$$\delta'(q_0, 1) = \epsilon\text{-cl}\left[\{q_1, q^*\}\right] = \{q_1, q_2, q^*\}$$



$$\delta'(q_0, 2) = \epsilon\text{-cl}\left[\{q_2, q^*\}\right] = \{q_2, q^*\}$$



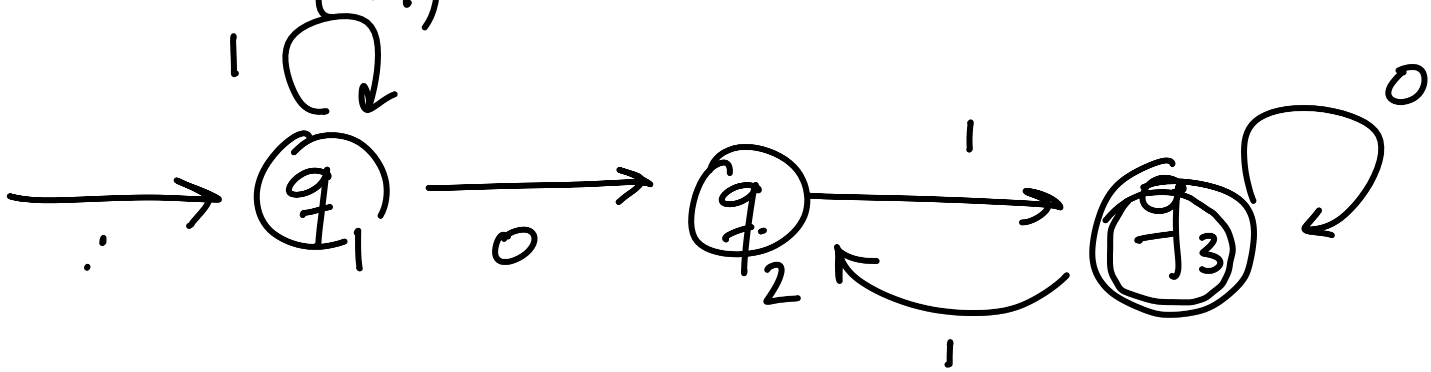


F' : the set of final states in the new machine

$$F \cup \{q_0\} \quad \text{if}$$

$\epsilon\ cl(q_0)$ contains F

Given a DFA M we want to find an equivalent r.e. for the $L(M)$



$$1^* 0 1 (0 + 11)^*$$

We will define r.e. for the set of string from q_i to q_j

We are interested in $\bigcup_{q_k \in F} (q_1, q_k)$

$R_{i,j}^{k}$: reg expression corresponding to strings that take us from state q_i to q_j

using $\boxed{\text{intermediate}}$ states in $\{q_1, q_2 .. q_k\}$
NOT including the initial / end state

Finally we are interested in

$$R_{i,j}^{n} \quad \forall\, i, j$$

Base case $k = 0$: no intermediate state can be used

Only direct transitions will be counted

$R^{0}_{i,j}$ can be computed directly from the state transition diagram

k =	0	1	2	3
R_{11}				
R_{12}				
R_{13}				
R_{22}				
R_{23}				
R_{21}				
R_{31}				
R_{32}				
R_{33}				

$$R^{k+1}_{i,j} = R^{k}_{i,j} \cup R^{(k)}_{i,k+1} \cdot R^{*(k)}_{k+1,k+1} \cdot R^{(k)}_{k+1,j}$$