NFA to DFA by subset construction

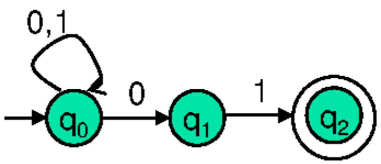
- Let $N = \{Q_N, \sum, \delta_N, q_0, F_N\}$
- <u>Goal:</u> Build $D=\{Q_D, \sum, \delta_D, \{q_0\}, F_D\}$ s.t. $L(D)=L(N)$
- <u>Construction:</u>
  1. Q_D= all subsets of Q_N (i.e., power set)
  2. F_D=set of subsets S of Q_N s.t. $S \cap F_N \neq \Phi$
  3. δ_D: for each subset S of Q_N and for each input symbol a in $\sum$:
     - $\delta_D(S,a) = \bigcup_{p \text{ in } s} \delta_N(p,a)$

Idea: To avoid enumerating all of power set, do "lazy creation of states"

NFA to DFA construction: Example

- $L = \{w \mid w \text{ ends in } 01\}$

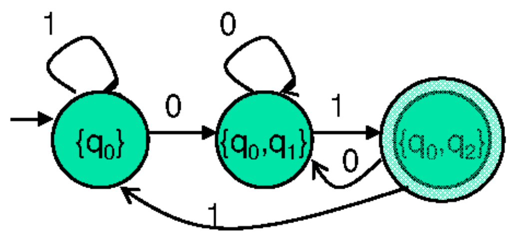
NFA:



δ_N	0	1
$\rightarrow q_0$	$\{q_0,q_1\}$	$\{q_0\}$
q_1	$\varnothing$	$\{q_2\}$
$*q_2$	$\varnothing$	$\varnothing$

DFA:

δ_D
~~$\varnothing$~~
$\rightarrow \{q_0\}$
~~$\{q_1\}$~~
~~$*\{q_2\}$~~
$\{q_0,q_1\}$
$*\{q_0,q_2\}$
~~$*\{q_1,q_2\}$~~
~~$*\{q_0,q_1,q_2\}$~~



δ_D	0	1
$\rightarrow \{q_0\}$	$\{q_0,q_1\}$	$\{q_0\}$
$\{q_0,q_1\}$	$\{q_0,q_1\}$	$\{q_0,q_2\}$
$*\{q_0,q_2\}$	$\{q_0,q_1\}$	$\{q_0\}$

0. Enumerate all possible subsets
1. Determine transitions
2. Retain only those states reachable from $\{q_0\}$