COT6210 8/22/24

DFA

Any language, L, that can be accepted by some DFA is a <u>regular</u> language.

A language is a subset of strings over Σ^*.

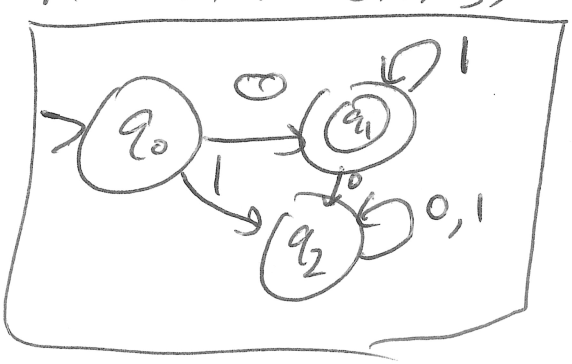
ϵ = empty string

Word "accepted" used in two ways.

① String s is accepted by the DFA D.

② If a DFA D accepts language L, then that means the <u>exact</u> set of strings described in L are accepted by D, <u>AND</u> no other strings are accepted by D.

D



D accepts the string 0

Wrong to say D accepts the language $\{0\}$.

D accepts $\{0, 01, 011, 0111, \ldots\}$

$\{w \mid w$ is of form $01^*\}$

01^*

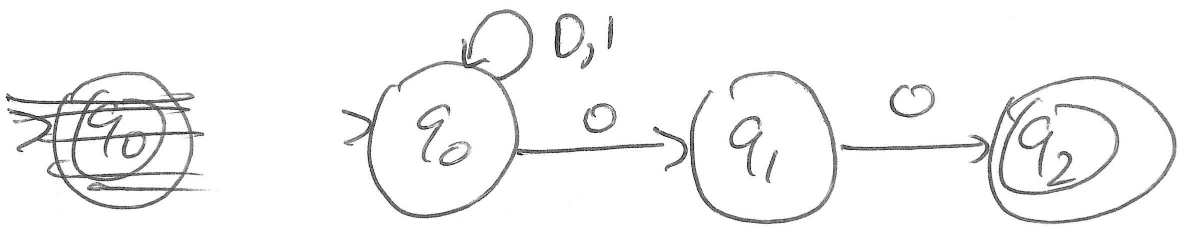
This NFA accepts the language of strings where the 3^{rd} char. from end is 1.

(1) Design a couple NFAs

(2) Are there languages for which we can design an NFA to accept them but not a DFA? (Is there a non-regular language that an NFA can accept?)

(3) Closure under $\cup$, $\circ$, $*$

$\Sigma = \{0,1\}$ all strings that end in 00.



note: we could draw an equiv DFA but it would look a little diff.

Formal Defn of accepting a string w in NFA N.

$w = y_1 y_2 \cdots y_m$

There exists a sequence of states $r_0, r_1, \ldots r_m$ with 3 conditions

1. $r_0 = q_0$
2. $r_{i+1} \in \overbrace{\delta(r_i, y_{i+1})}^{\text{~~state~~ SET}}$ for $i = 0, \ldots m-1$

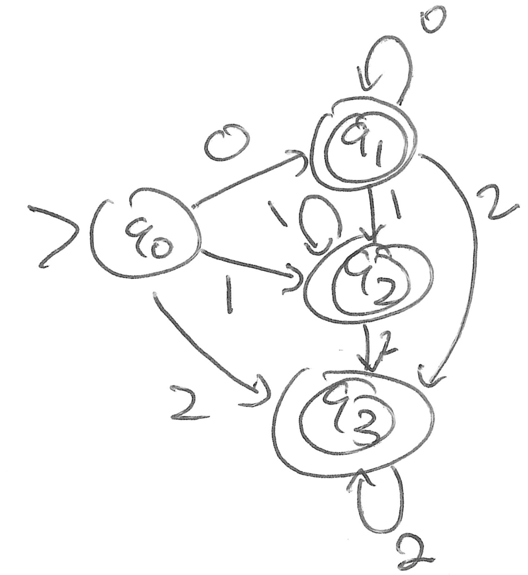
and 3. $r_m \in F$.

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

000111112

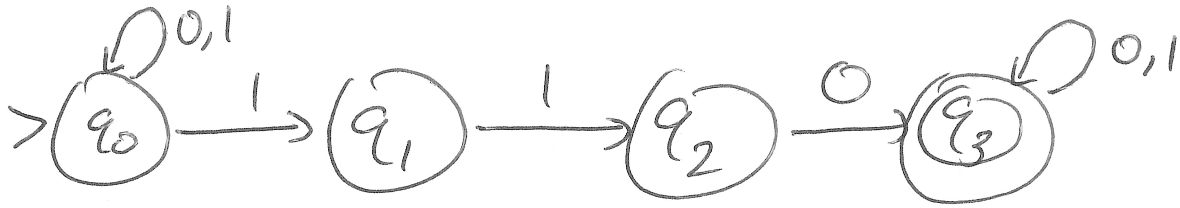
non-decreasing #

no ϵ



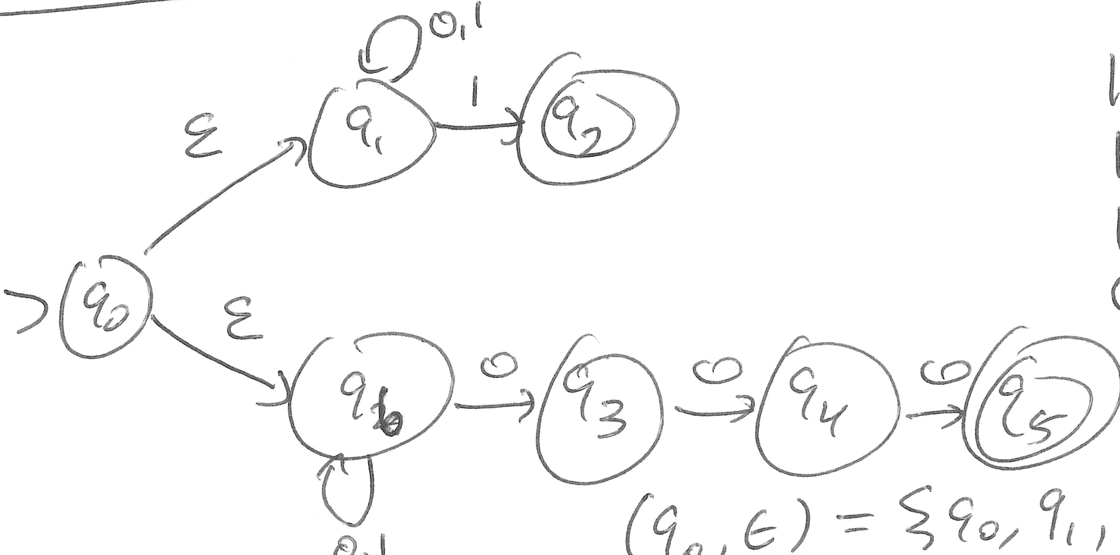
Contains the substring 110

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



$\underbrace{010101}_{q_0}\boxed{110}11$

q_3



1101 $\in L$

1100 $\notin L$

100 $\notin L$

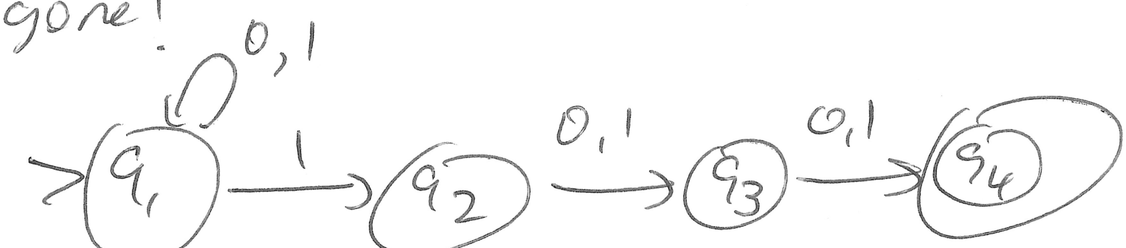
000001 $\in L$

$(q_0, \epsilon) = \{q_0, q_1, q_6\}$

$(q_0, 0) \rightarrow \{q_1, q_6, q_3\}$ but q_0 is out of the realm of poss.

To prove NFAs are no more powerful that DFAs, we need an algorithm to convert NFAs to equivalent DFAs.

Imagine that whenever you have a "choice" you spontaneously replicate and send a body double in each of the possible directions you could have gone!



$(q_1, 0) \to q_1$

$(q_1, 1) \to q_1 q_2$

$(q_{12}, 0) \to q_{13}$