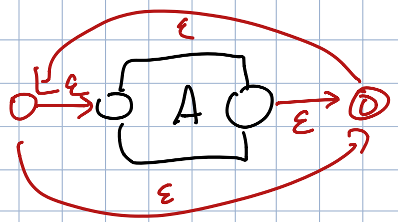
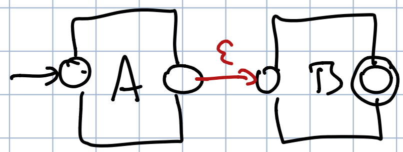
HW3 out

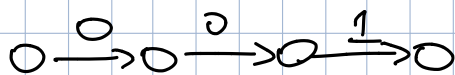
HW2 due today

A*

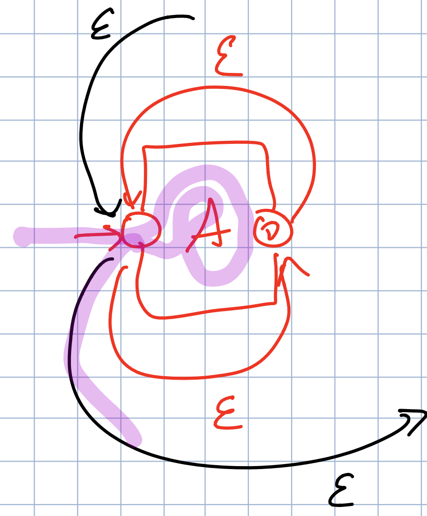


A·B





$(0^* 1 0^*)^*$



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Regular exp $\xrightarrow{\text{Thompson}}$ NFA with ε-transitions

↓

NFA w/o ε-transitions

↓ (inc) subset

DFA → min. DFA

?

NFA

↓ +ε

ε-NFA

↓

string NFA

↓

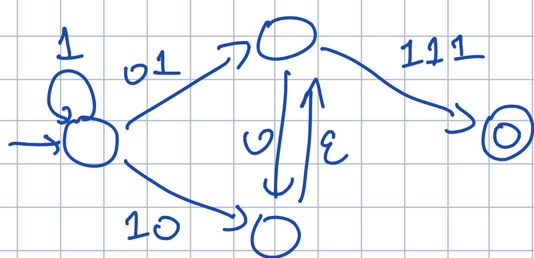
finite set NFA

↓

expression NFA (Han Wood '05)

↓

reg. exp.



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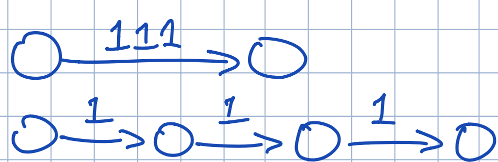

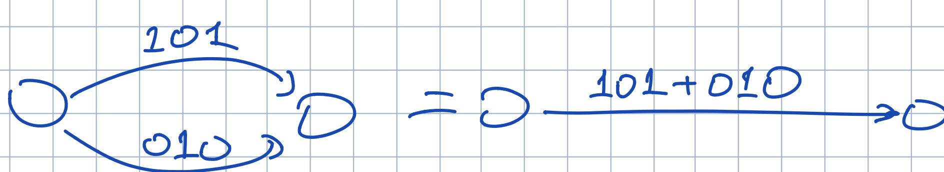

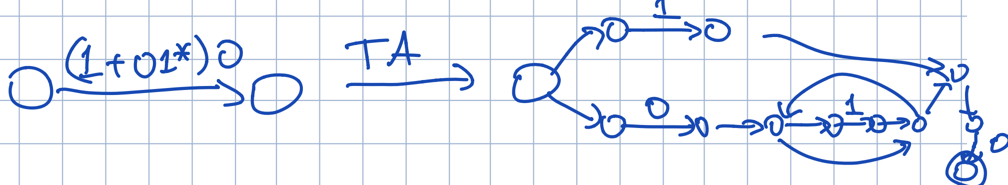

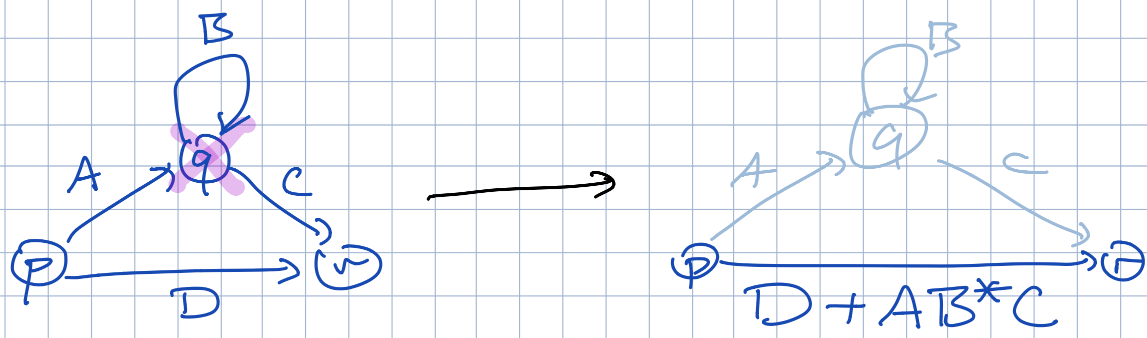


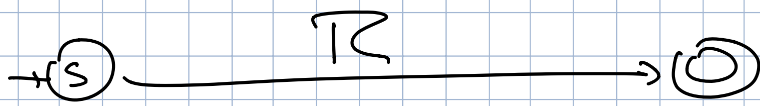


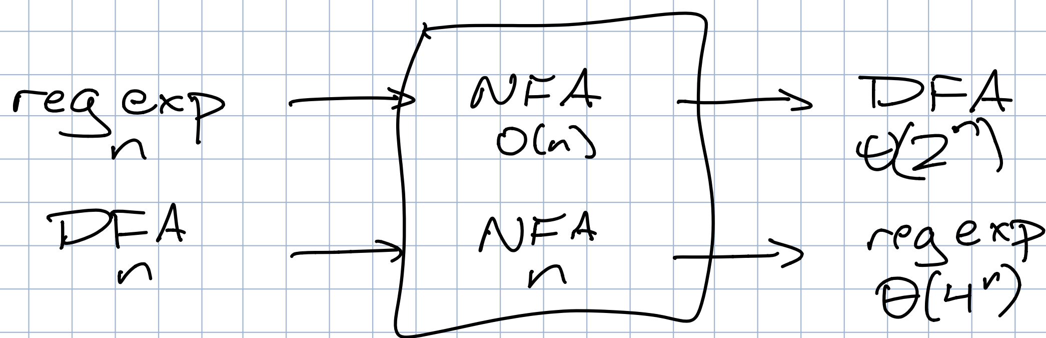


Given any reg. language $L$, prove that $F(L)$ is regular

- $F(L) = \Sigma^* \setminus L$

  Given any DFA $M = (Q, s, A, \delta)$ that accepts $L$

  Build a DFA $\bar{M} = (\bar{Q}, \bar{s}, \bar{A}, \bar{\delta})$ that accepts $\bar{L}$ as follows:

  $\bar{Q} = Q \qquad \bar{s} = s \qquad \bar{\delta} = \delta$

  $\bar{A} = Q \setminus A$

  (Swap accepting/rejecting states of $M$.)

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- $\text{reverse}(L) = \{ w^R \mid w \in L \}$
  - $\emptyset^R = \emptyset$
  - $w^R = w^R$
    $(w)^R \qquad (w^R)$
  - $(A+B)^R = A^R + B^R$
  - $(A^*)^R = (A^R)^*$
  - $(A \cdot B)^R = B^R \cdot A^R$

- Given DFA $M=(Q,s,A,\delta)$ accepting $L$.

Build NFA with $\varepsilon$-transitions $M^R=(Q^R,s^R,A^R,\delta^R)$

"Reverse all the arrows"

$Q^R = Q \cup \{s^R\}$

$s^R$ is new state

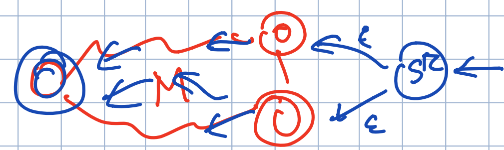
$A^R = \{s\}$

$\delta^R(s^R,\varepsilon) = A$

$\delta^R(s^R,a) = \emptyset$ for all $a$

$\delta^R(q,a) = \{p \mid \delta(p,a)=q\}$ for all $q\in Q$, $a\in\Sigma$

$\delta^R(q,\varepsilon) = \emptyset$ for all $q\in Q$

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$\{w \mid ww^R \in L\} \neq L\cdot L^R$

Accept ILLINI iff $L$ contains ILLINIINILLI

Given DFA $M=(Q,s,A,\delta)$ accepts $L$

Build $\varepsilon$-NFA $M'=(Q',s',A',\delta')$ as follows

Run both $M$ and $M^R$ in parallel, try to meet in the middle.

$Q' = Q\times(Q\cup\{s^R\})$

$s' = (s,s^R)$

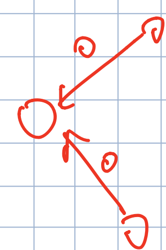
$A' = \{(q,q) \mid q\in Q\}$

$\delta'((s,s^R),\varepsilon) = \{(s,q) \mid q\in A\}$

$\delta'((q,r),\varepsilon) = \emptyset$ for all other $(q,r)\in Q'$

$\delta'((q,r),a) = \{(\delta(q,a),p) \mid \delta(p,a)=r\}$

$\delta'((q,s^R),a) = \emptyset$ for all $q\in Q$




$\{(\delta(q,a),p) \mid p\in\delta^R(q,a)\}$