4/26/2010

Midterm is closed book. Allowed one 8.5" x 11" sheet of paper, 2-sided. Typeset allowed.

Covers HW 1-4

How are regular expressions related to DFA's / NFA's?

THM L is regular $\iff$ $L = L(R)$ where R is a reg. expr.

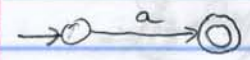
THM1 If R is a reg. expr, then $L(R)$ is regular
i.e. $\exists$ NFA N s.t. $L(R) = L(N)$

PF R is a reg. expr. Then,

1. R is $a \in \Sigma$
2. R is ε
3. $R = \emptyset$
4. $R = R_1 \cup R_2$
5. $R = R_1 R_2$
6. $R = R_1^*$

} We know how to construct these, just need NFA's for first 3 cases.

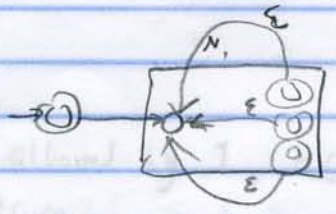
$a \in \Sigma$:



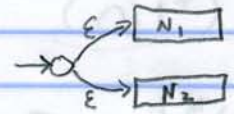
ε:

$\emptyset$:

R_1^*:



$R_1 \cup R_2$:



$L(R_1) = L(N_1)$

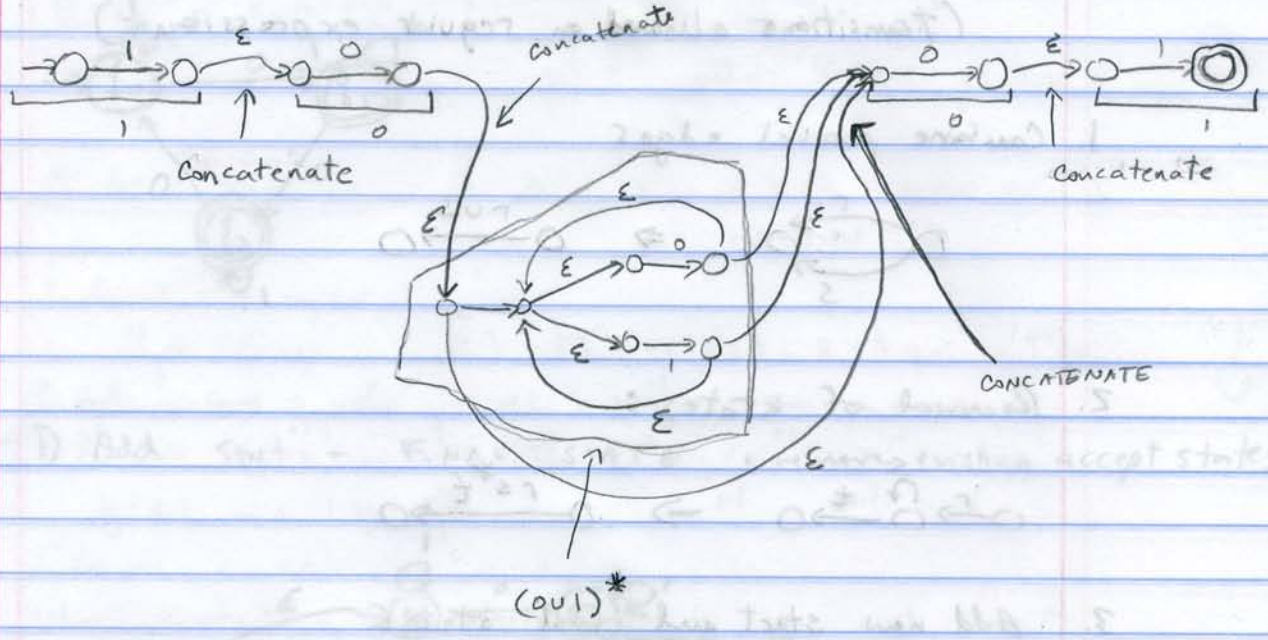
$L(R_2) = L(N_2)$

$R_1 \cdot R_2$:

EXAMPLE

$R = 10\Sigma^*01 = \{w \mid w \text{ starts with } 10 \text{ and ends with } 01\}$

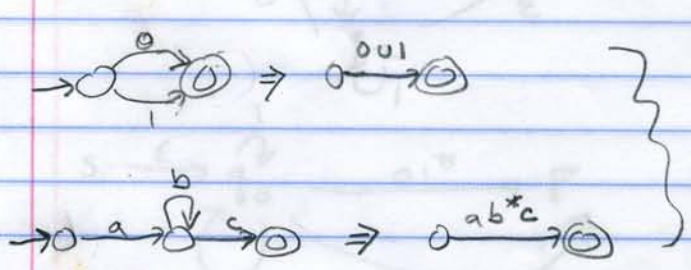
$= 10(0 \cup 1)^* 01$



[This machine can be reduced by eliminating some states.]

THM 2 ($\Rightarrow$) L is regular $\Rightarrow$ $L = L(R)$ for some reg. exp. R.

PF L regular $\Rightarrow$ $\exists$ DFA M s.t. $L = L(M)$



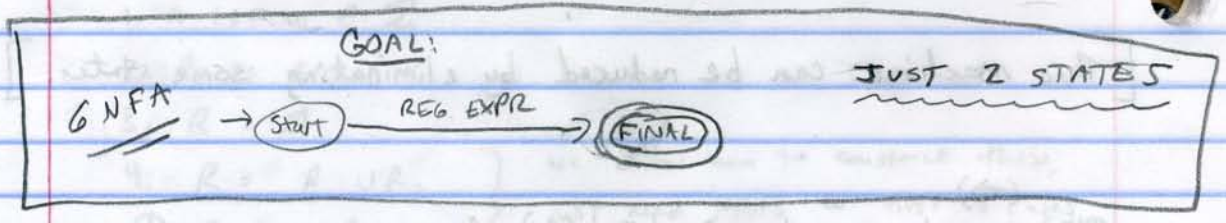
THESE ARE ALL YOU NEED TO CONSTRUCT A REG. EXPR FROM ANY DFA

CONVERT DFA TO A SEQUENCE OF "GENERALIZED NFAs"
(G NFAs)
(transitions allowed on regular expressions)

1. Combine parallel edges

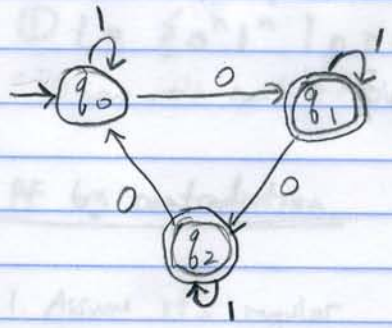
2. Removal of states:

3. Add new start and final states

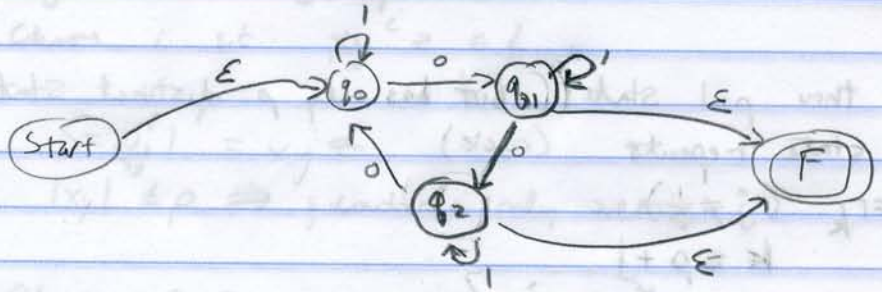


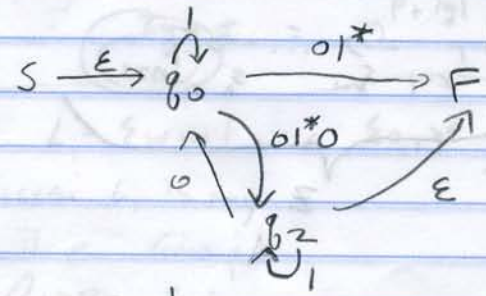
Example

$L(M) = \{w \mid \#\text{ of } 0\text{s in } w \text{ is } \underline{\text{not}} \text{ divisible by } 3\}$

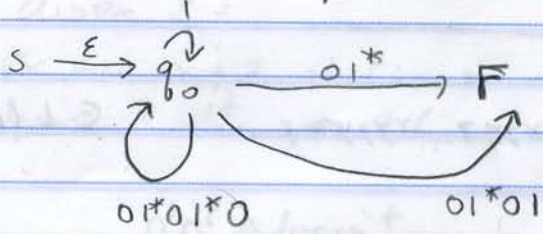


1) Add START + FINAL STATE, + remove existing accept states





get rid of q_1



get rid of q_2