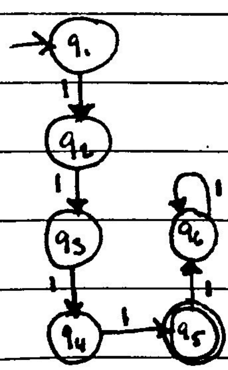
Julia Nelson Problem Set 2 September 18, 2020

"I pledge my honor that I have abided by the Stevens Honor system."

Problem 1

a. $L_4 = \{1111\}$

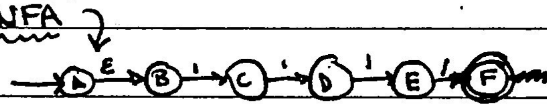
FSA



6-states

$Q = \{q_1, q_2, q_3, q_4, q_5, q_6\}$

6-state NFA



5-state NFA

5-state FSA not NFA is not possible in order to show the correct/necessary transitions.

b.

Problem 2

$$A = \{w \mid w \in A\}$$
$$A^R = \{w^R \mid w \in A\}$$

let $M = (Q, \Sigma, \delta, q_0, F)$ recognizes A

M' recognizes A^R → MUST Reverse all arrows M for M'.

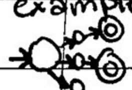
$M = (Q', \Sigma', \delta', q_0', F')$

Q' = all states of M including addition of new start state q_0'

$\Sigma' = \Sigma$

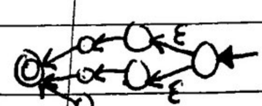
$q_0' = q_0'$ (new start state) has ε-transition to every original accept state of M

M example



$F' = \{$ the original start state of M accept $\}$
original accept states of M are no longer accept states

M' example



δ' = all M transitions reversed

ε-transitions added from new q_0' to old M accept states F

let $R \subseteq Q'$

$E(R) = \{q \mid q$ can be reach by 0 or more ε arrows$\}$

replace $\delta'(r, a)$ by

$\delta'(R, a) = \{q \in Q' \mid q \in E(\delta'(r, a))$ for some $r \in R\}$

now

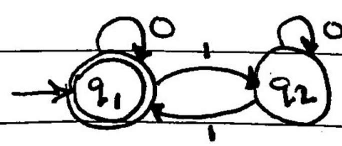
$q_0' = E(\{q_0'\})$

A is recognized by NFA M so it is regular

A^R is recognized by NFA M' so it is also regular

Problem 3

2-state FSA for B^R

M = 

$Q = \{q_1, q_2\}$

$q_0 = q_1$

$F = \{q_1\}$

$\cancel{\delta(q_1, a) = q_1}$

Reverse to find FSA for B

→ add new start
ε-transitions to old accept states
old start is now new accept