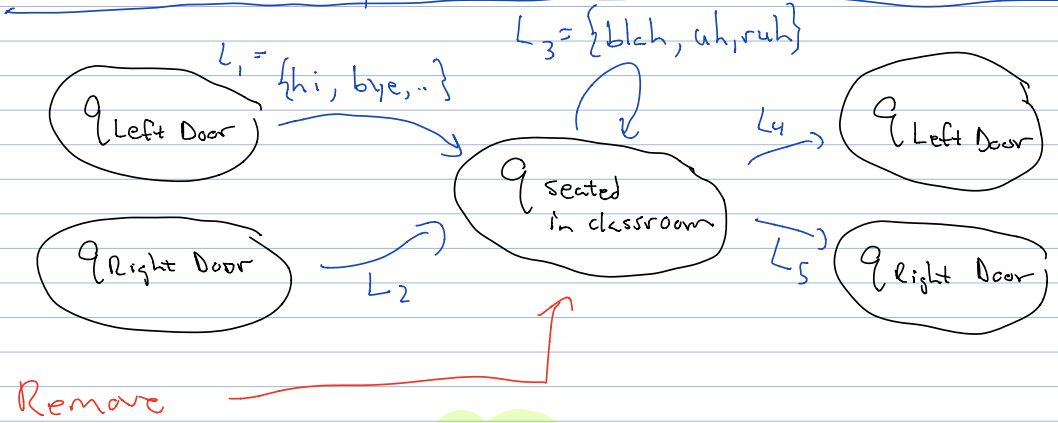
October 2: DFA/NFA → Regular Expression

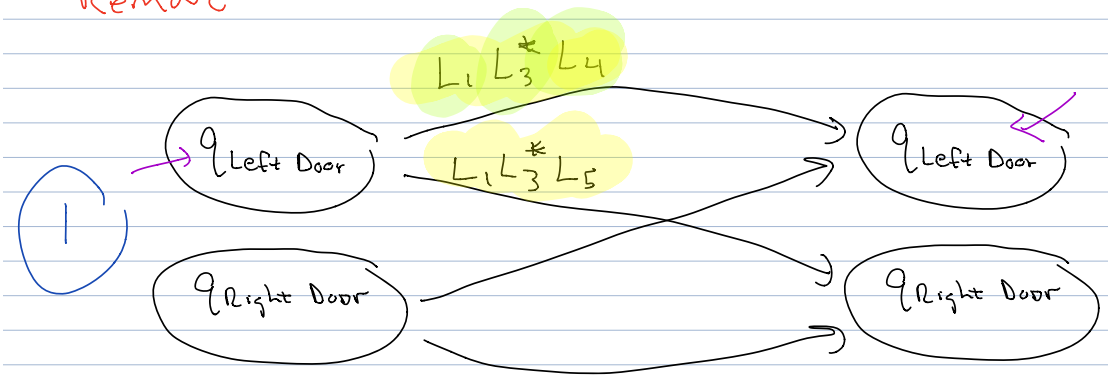
easy

motivation is that all these describe the same class of languages

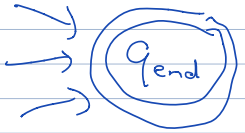
Idea:

what do you hear today





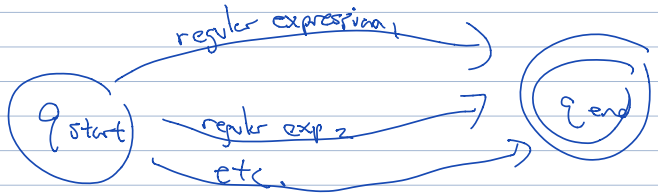
Start with DFA/NFA but introduce



only accepting state

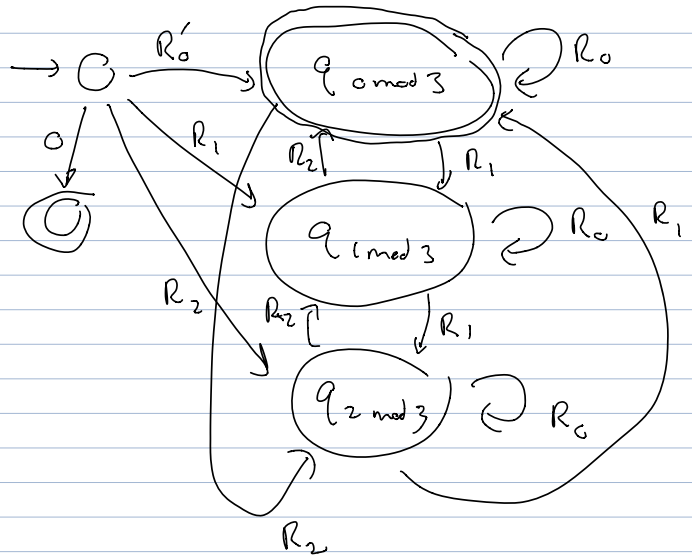
2 edges will have regular expressions

Eventually

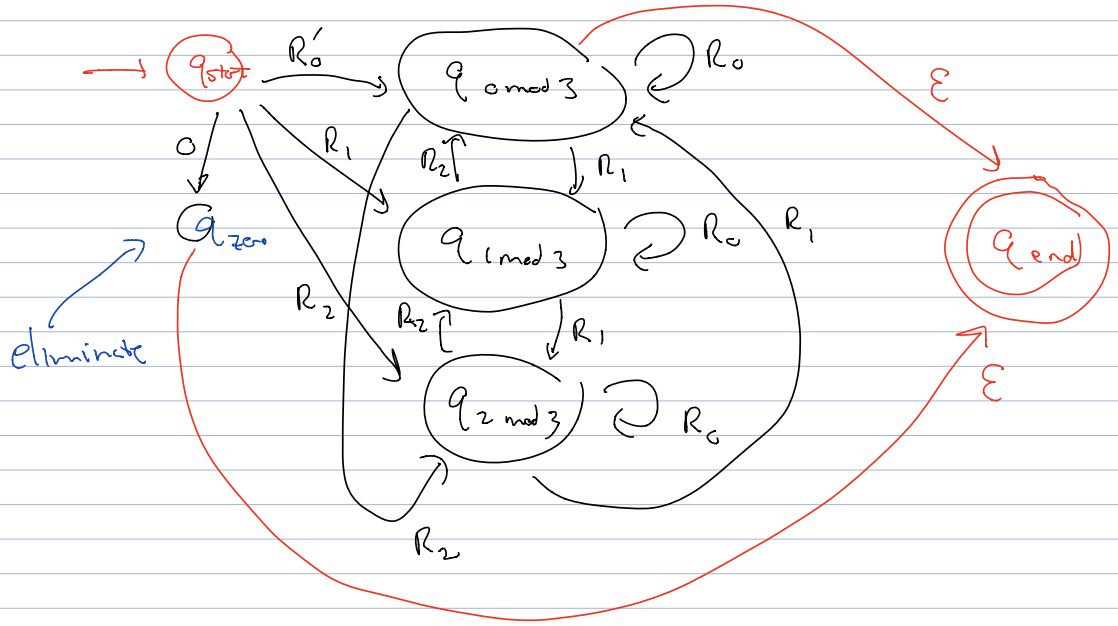


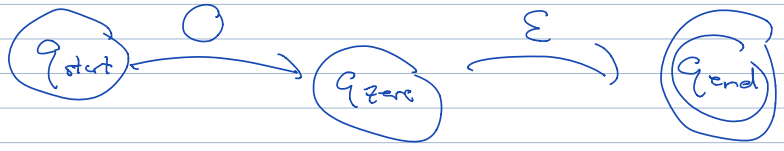
$L^* = L \cup L^{25} \cup L^{3002} \cup L^*$

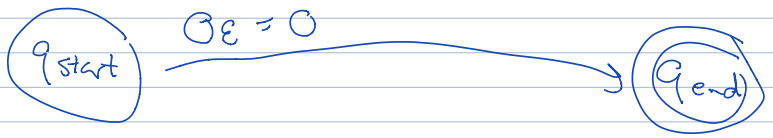
Example: DIV_BY_3 = { 0, 3, 6, 9, 12, 15, ... }

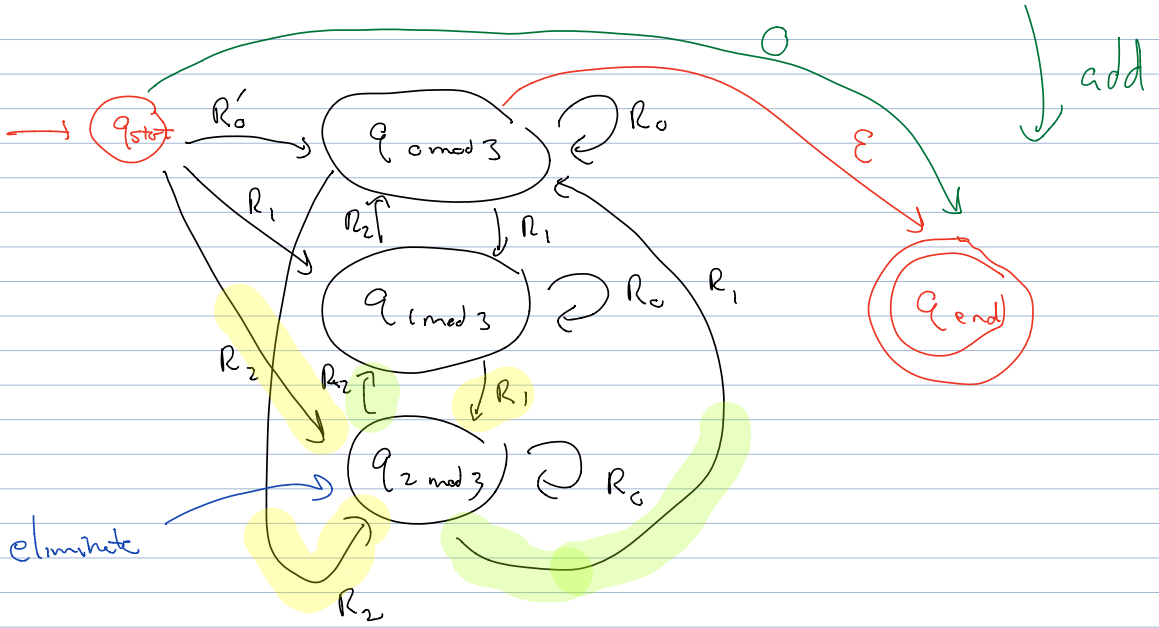


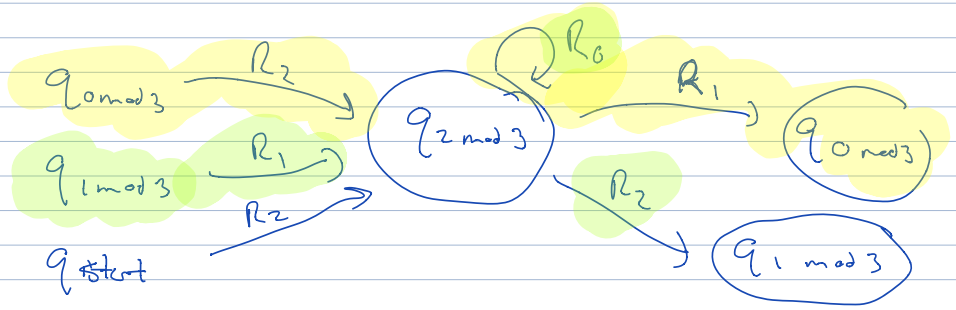
$R_0 = \{0,3,6,9\}$
$= 0 \cup 3 \cup 6 \cup 9$
$R_0' = 3 \cup 6 \cup 9$
$R_1 = 1 \cup 4 \cup 7$
$R_2 = 2 \cup 5 \cup 8$

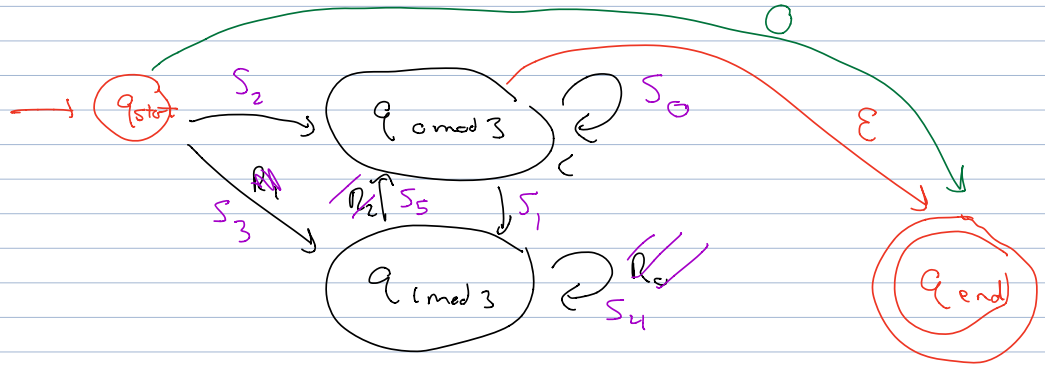












$S_2 = R_0' \cup R_2 R_0^* R_1$

$S_3 = R_1 \cup R_2 R_0^* R_2 = S_1$

old

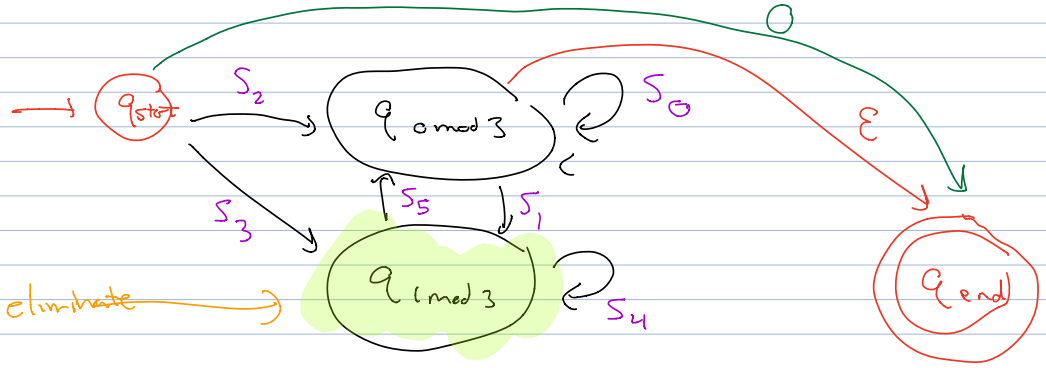
$S_4 = R_0 \cup R_1 R_0^* R_2$

new than $q_{2 \bmod 3}$

$S_5 = R_2 \cup R_1 R_0^* R_1$

$S_0 = R_0 \cup R_2 R_0^* R_1$

$S_1 = R_1 \cup R_2 R_0^* R_2$



$S_2 = R_0' \cup R_2 R_0^* R_1$

$S_3 = R_1 \cup R_2 R_0^* R_2 = S_1$

old

$S_4 = R_0 \cup R_1 R_0^* R_2$

new thru $q_{2 \bmod 3}$

$S_5 = R_2 \cup R_1 R_0^* R_1$

$S_0 = R_0 \cup R_2 R_0^* R_1$

$S_1 = R_1 \cup R_2 R_0^* R_2$

$R_0 = \{0,3,6,9\}$

$= 0 \cup 3 \cup 6 \cup 9$

$R_0' = 3 \cup 6 \cup 9$

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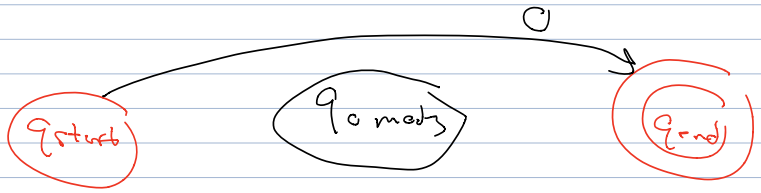
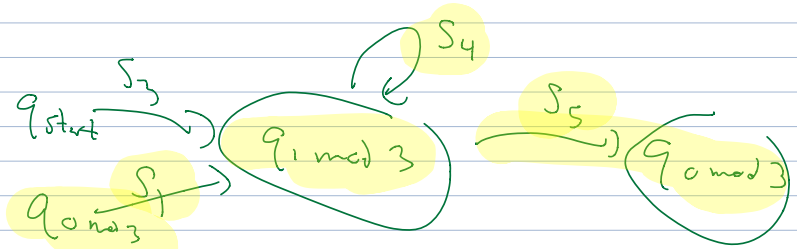
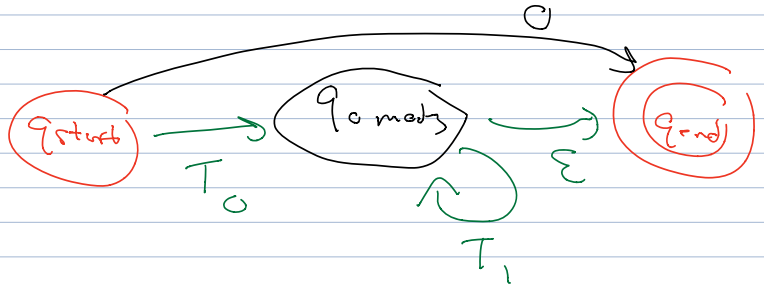
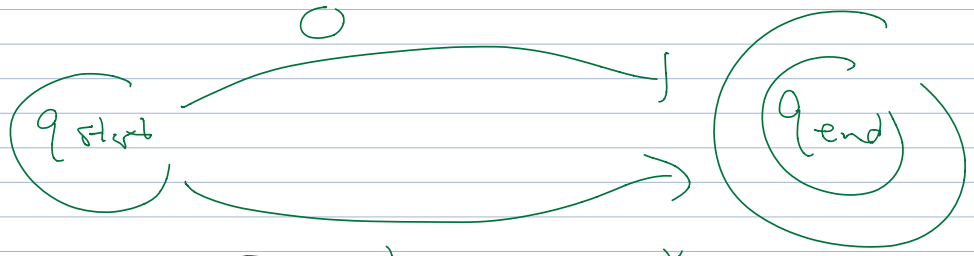






$T_0 = S_2 \cup S_3 S_4^* S_5$

$T_1 = S_0 \cup S_1 S_4^* S_5$



$T_0 T_1^* \xi = T_0 T_1$

$(s_2 \cup s_3 s_4^* s_5)(s_0 \cup \dots)$

etc.