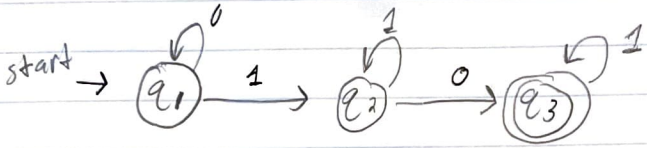
Kush Patel

Midterm

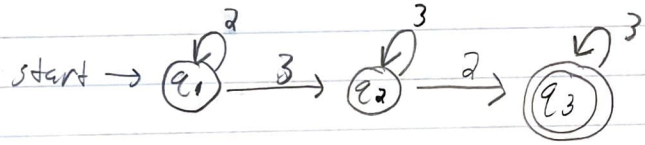
1.) Draw state diagram

$L_1 = \{w \in \{0,1\}^* \mid w$ contains 11 as a substring $\}$



2.) Draw the state diagram

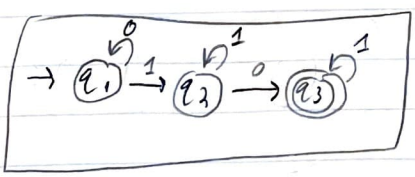
$L_2 = \{w \in \{2,3\}^* \mid w$ ends with substring $23\}$



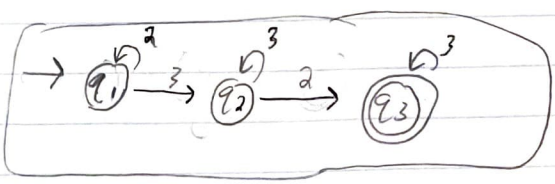
3.) Draw the state diagram.

$L_3 = L_1 \cup L_2$ $\{0,1,2,3\}$

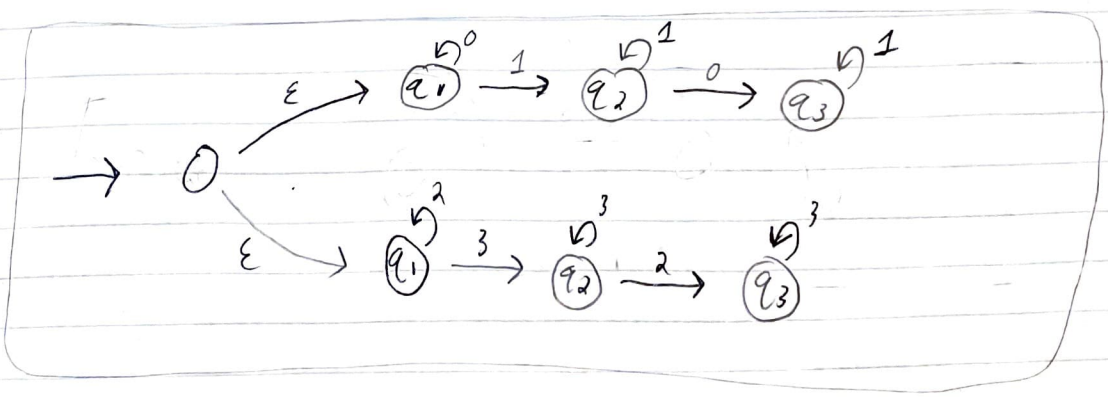
L_1



L_2



L_3



4.) Give a regular expression for L_3

$L_1 = \{(01)((10)1)\}$

$L_2 = \{(23)((32)3)\}$

$L_3 = \{(01)((10)1) \cup (23)((32)3)\}$

5.) Design a CFG for L_3

$V = \{S, A, B, C, D\}$

$\Sigma = \{0, 1, 2, 3\}$

$R =$

$S = A$

$S \rightarrow AS \mid BS \mid CS \mid DS \mid$

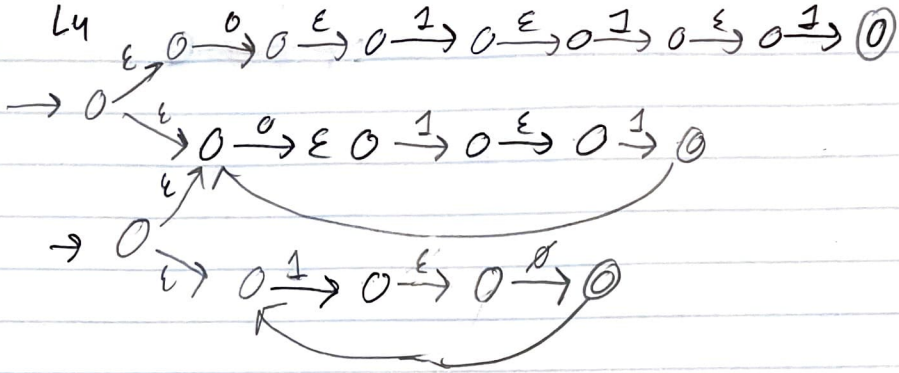
$A \rightarrow 01S$

$B \rightarrow 101S$

$C \rightarrow 23S$

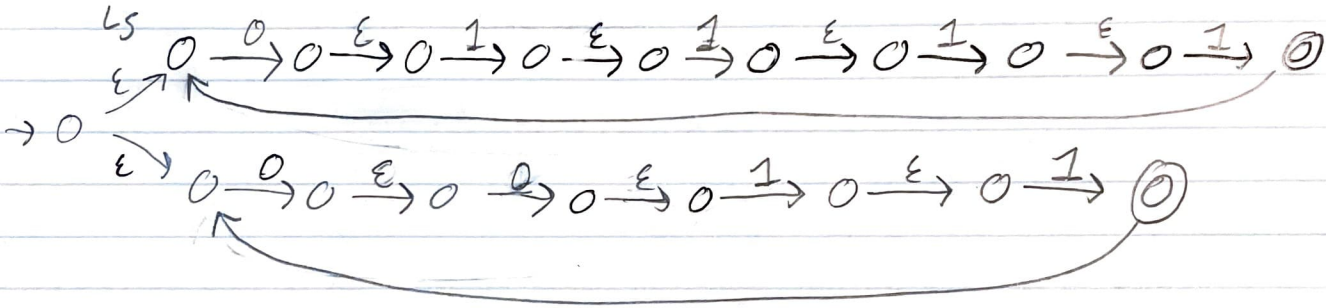
$D \rightarrow 323S$

6a.) L_4



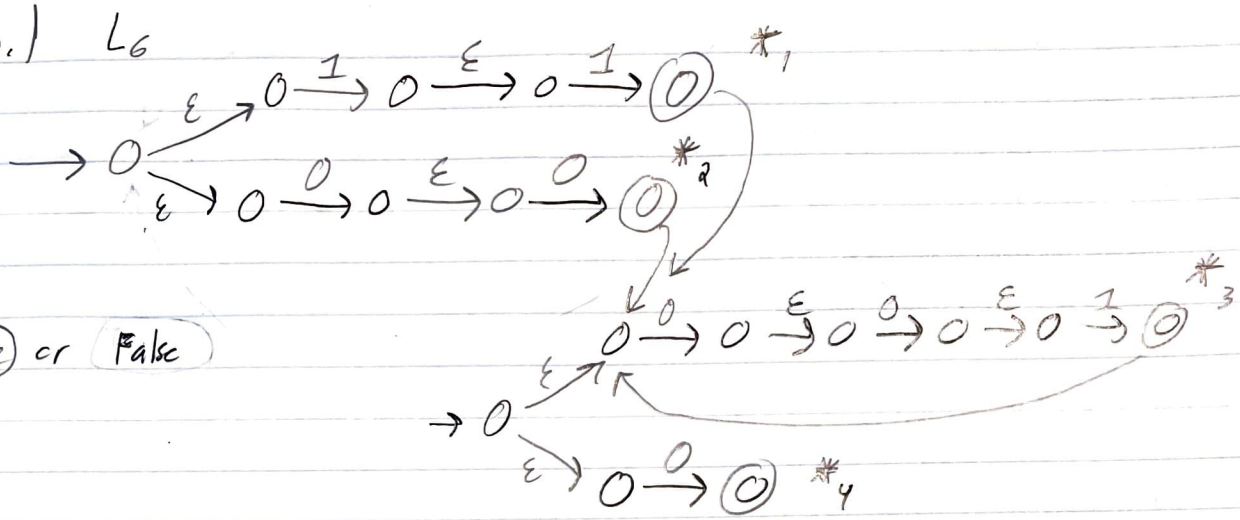
True or False

L_5



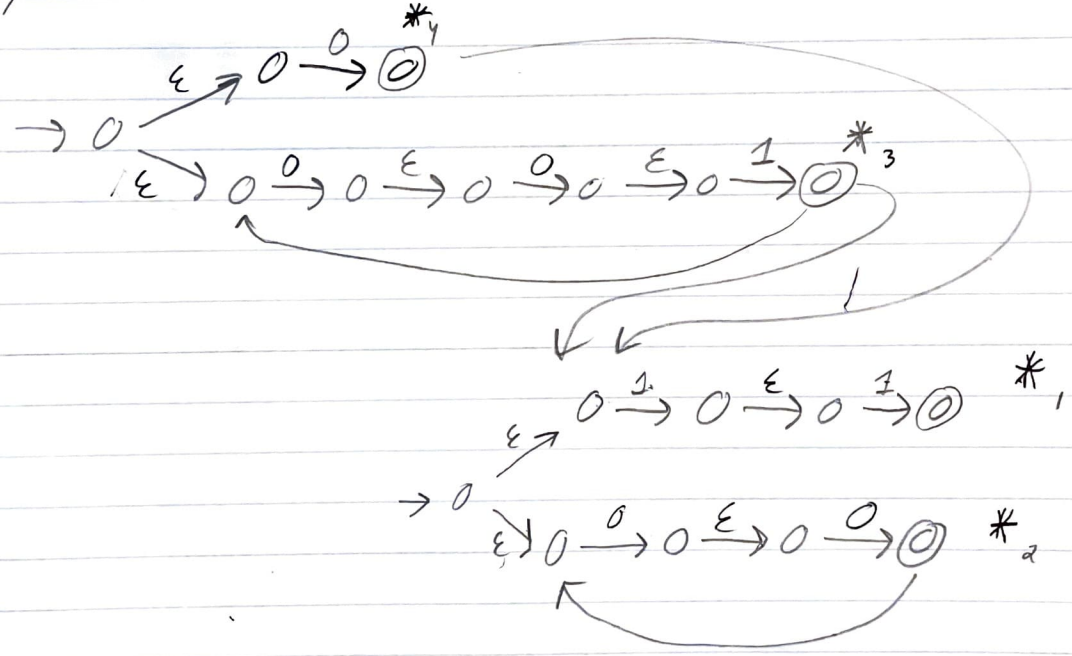
By converting the reg. expression to an NFA, L_4 & L_5 do not match. They don't match at various places and their ordering of the states also doesn't match. L_4 has more 0's and 2 unions. L_5 has fewer 0's and only 1 union.

6b.) L_6



True or False

L_7



By converting the reg. expression to an NFA, they do Match
The two NFA's are fairly similar and have matching strings.
I have labeled which strings match: top of L_6: 11 matches with bottom of L_7: 11. Other substrings also match in the NFA's as labeled with a *

7.) $L_g = \{0^m(101)^n \mid m,n \in Z \text{ and } m,n \geq 1 \text{ and } m \geq n\}$

Is L_g regular? Regular or (Not Regular) Using Pumping Lemma

$s = 0101$

$x = 0 \quad y = 10 \quad z = 11$

$xyz \in A$

$y = 1 > 0$

$xy = 3 \leq p$

$x = 0 \quad y = 100 \quad z = 11$

$s' = 010011$

$s' \notin L$

This proves this is not regular

8.) Is L_g Context-free? (Context-free) or Not Context-Free

Yes, it is Context-free, because the left hand side contains at least 1 non-terminal symbol, m & n.