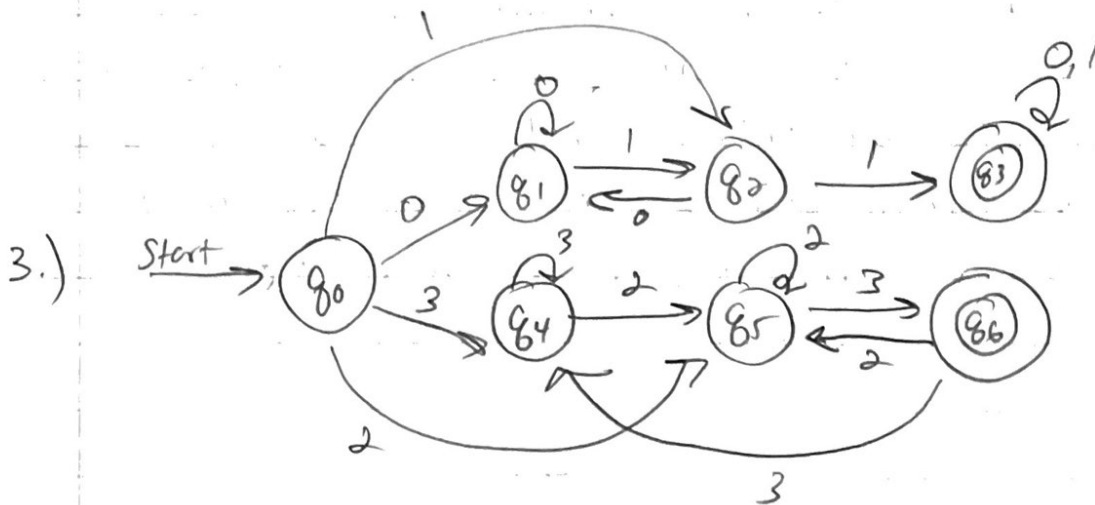
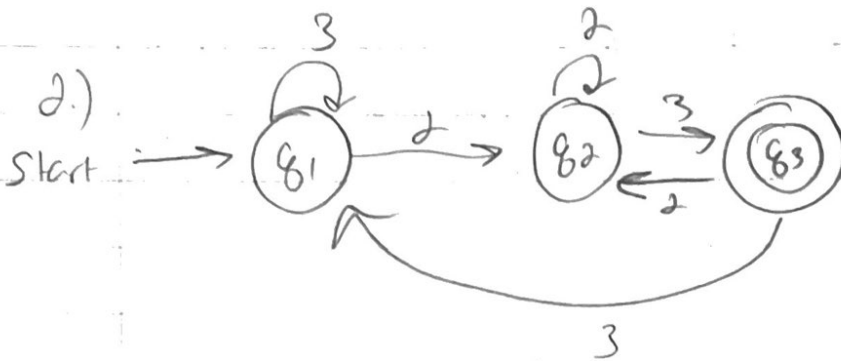
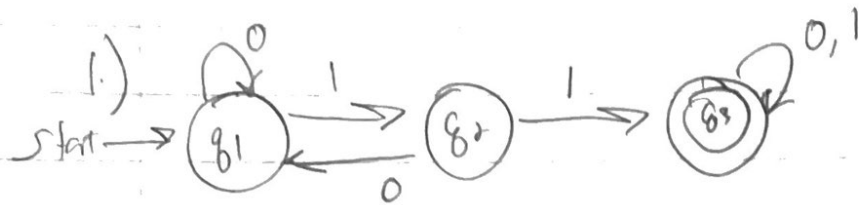


Thomas DeMasse - Midterm



4.) $L_1 = \Sigma^* 11 \Sigma^*$, $L_2 = \Sigma^* 03$

So, $L_3 = (\Sigma^* 11 \Sigma^*) \cup (\Sigma^* 03)$

$$5.) V = \{T, R_1, R_2, R_3, S_1, S_2, S_3\}$$

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

$$R = \{ T \rightarrow R_1 | S_1, R_1 \rightarrow 1R_2 | 0R_1, R_2 \rightarrow 1R_3 | 0R_1, \\ R_3 \rightarrow 0R_3 | 1R_3, R_3 \rightarrow \epsilon, S_1 \rightarrow 2S_2 | 3S_1, \\ S_2 \rightarrow 2S_2 | 3S_3, S_3 \rightarrow 2S_2 | 3S_1, S_3 \rightarrow \epsilon \}$$

$$S = \{T\}$$

a.) (a) The statement is FALSE:

The reason is because L_4 can have a string that begins with a 1 given the Union of $(0(111 \cup 01)1^*) \cup (10)^+$

L_5 can't generate a string that begins with a 1 given its conditions. This means the languages aren't equivalent

(b) The statement is FALSE:

Given the string "0", the language L_6 is able to generate a string given $(00)^0(0) \rightarrow 0$.

The language L_7 is not capable of generating the string 0. Although the first part of the language is capable of generating a 0, the 2nd part is only capable of generating 11 or 1 or 10. This means the languages cannot be equal

2.) L_8 is NOT REGULAR.

Assume L_8 is Regular and has pumping length p .

$\rightarrow S = 0^p 101^p$ \rightarrow ① for each $i > 0$ $xy^i z \in A$
 $S = xyz$ \rightarrow ② $|y| > 0$ and $|xy| \leq p$ ①

Examine String $xyyz$ is in L_8 , by doing this we add another copy y leading to having more

0s than 101s which is acceptable. Given the condition 1 of the pumping lemma, $xy^i z \in A$ must be true for all $i > 0$. If we set $i = 0$ in this

case such that $xy^0 z = xz$ which results in there being more 101s than 0s because of this it creates a contradiction because xz cannot contain more 101s than 0s. Therefore it can't be in language L_8 proving the contradiction. This means we can say the language is not regular.

8.) L_8 is Context-free:

CFG for the language:

$S \rightarrow 0A101$

$A \rightarrow 0A10A101 \mid \epsilon$

Given the CFG for the language L_8 it is Context-free.

In testing strings that the CFG is capable of recognizing based on that of the stipulations of the language itself, we find that the CFG consistently is able to recognize strings of the language.

It is able to accept strings of as many 0s followed by at least 1 group of 101.

0 doesn't match

000101 matches

000101101 matches

000101101101 matches.

So long as the string for the generated CFG matches the parameters for that of the language, the string matches the CFG!
It's context-free.