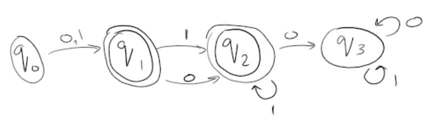
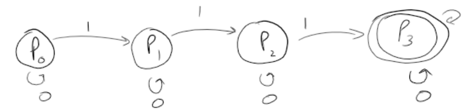
Homework 1

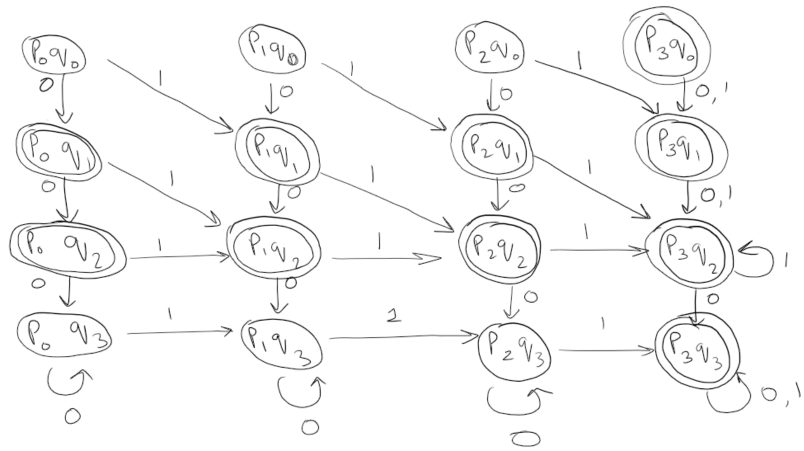
Wednesday, September 6, 2023 4:37 PM

Q.1)

(b)

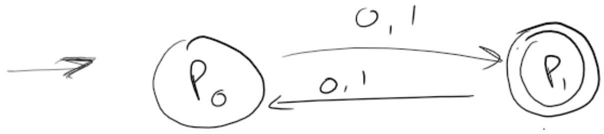


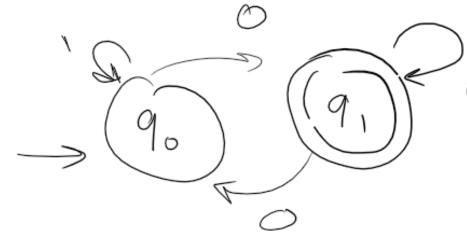


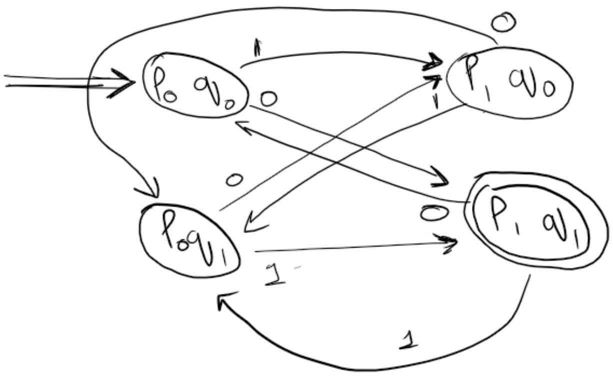


	0	1
q_0P_0	q_1P_0	q_1P_1
q_0P_1	q_1P_1	q_1P_2
q_0P_2	q_1P_2	q_1P_3
q_0P_3	q_1P_3	q_1P_3.
q_1P_0	q_2P_0	q_2P_1
q_1P_1	q_2P_1	q_2P_2
q_1P_2	q_2P_2	q_2P_3
q_1P_3	q_2P_3	q_2P_3
q_2P_0	q_3P_0	q_2P_1
q_2P_1	q_3P_1	q_2P_2
q_2P_2	q_3P_2	q_2P_3
q_2P_3	q_3P_3	q_2P_3
q_3P_0	q_3P_0	q_3P_1
q_3P_1	q_3P_1	q_3P_2
q_3P_2	q_3P_2	q_3P_3
q_3P_3	q_3P_3	q_3P_3

e

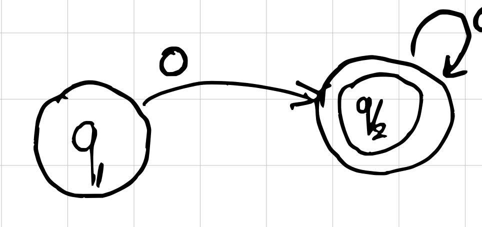




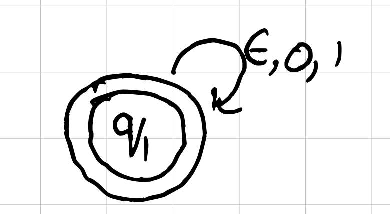


	0	1
p_0q_0	p_1q_1	p_1q_0
p_1q_0	p_0q_1	p_0q_1
p_0q_1	p_1q_0	p_0q_1
p_1q_1	p_0q_0	p_0q_1

2.c)



2.g)



7a) ⇒ number of languages recognised by a DFA is infinite :

- Consider the case where we have a DFA M with a language L such that L is a language of M i.e. L(M)
- Considering the usage of kleene star (*) on Language such that it is $L(M)^*$, it Indicates that there are infinitely many languages. Therefore since the star operation is closed under DFAs, the no. of Languages recognized by DFA is <u>infinite</u>.

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b) • Considering definition, we know that $Q \times \Sigma$ is no. of arrows exiting any specific state in a DFA. And because σ_{max} is finite ⊕ve Integer, we can say there are finite no. of alphabets as well. Additionally, Q_{max} being a finite ⊕ve Integer we can say that $Q \times \Sigma$ is not an infinite. Concluding that, we can say that the number of languages recognised by the DFA is finite.

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Let's say we have a NFA N which a regular Language L recognises such that L(M).

- From DFA said in question if we put an additional final state "q_F" and have each state that was previously final from the DFA ε-transition into the newly declared final State "q_F" and simultaneously switch all the initial final state to non-Final State.

So now, considering L(M such that $q_0 = q_0$, $q_1 =$ odd, $q_2 = q_F$ if an even String is passed, the machine accepts it at q_2 {a.k.a. q_F}, else rejected.
Hence we can conclude using above analogy that there exists a NFA that recognises

$L = (\text{even}(w) \mid w \in \Sigma)$

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Proving that Stut(w) is regular will do most of the work for us as Stut(L) is union of all the Stut(w) and the reason we will be able to conclude that is because DFAs are closed under union. Suppose we have a DFA M such that L(M). All we need to do is make the states Loop back to itself wherever identical Inputs are read and progressively move on only if a distinct character is read. The given sequence (String) will keep going until final character is read and if any other character is read, M shall transition into a dead state. Since stut(w) is regular in M we can conclude that the collection (union) of all Stut(w) is regular as well. Hence if L is a regular Language then So is stut(L).

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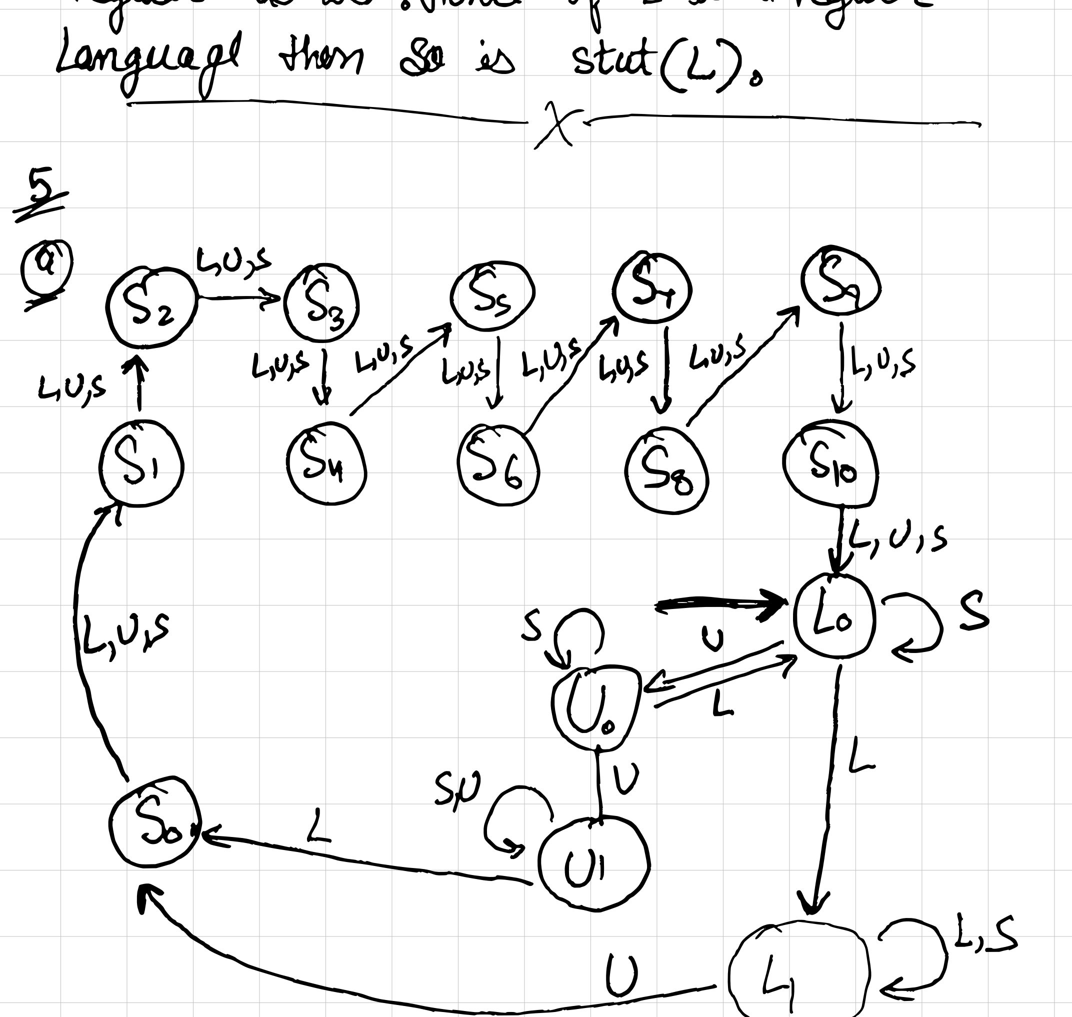
ⓐ



ⓑ

For any string that sends the machine in Lock state will - keep the machine in the Lock state; will unlock it then Lock it back again; or it could in either Locked or unlocked state and reset which will send the machine back in the Locked State; "USL" unlocks the machine and lock it after and lastly "UUSL - - -" will reset machine that unlocked state to ~~now~~ now Locked State. ("UUSL---" indicates that regardless of instructions, the machine will pertain ~~to~~ to be in the state of reset for 10 input characters.
