Jay Patel

HW #2

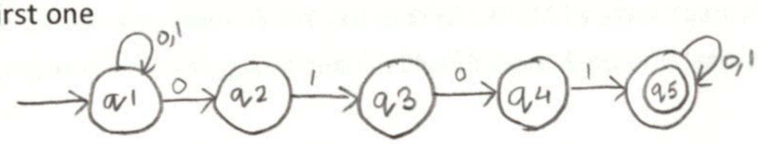
CS 331

Student ID: 469572103

Email: jbpatel@iastate.edu

1. First one

b]



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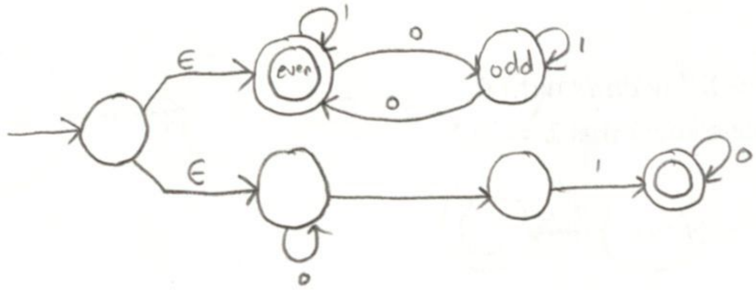

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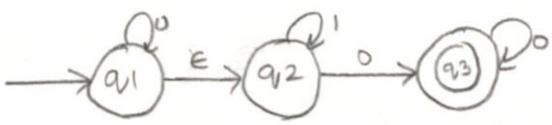

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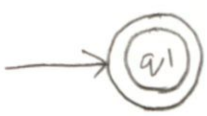

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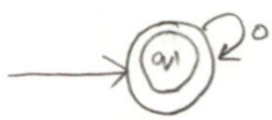
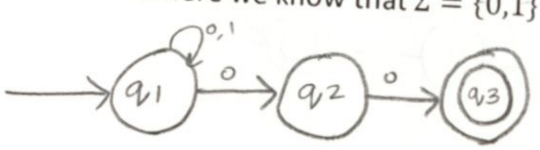


2. 1.4

a. Suppose language B over alphabet Σ *has a DFA*
   M = (Q, Σ, δ, q_1, F)
   So, for complimentary language
   $\overline{M} = (Q, \Sigma, \delta, q_1, Q - F)$
   by this we can tell that M and $\overline{M}$ have the same transition function δ. So, I can tell that both M and $\overline{M}$ are deterministic. We will be getting some state i.e. r $\in Q$ if we run M on any input string. There will be only one possible state that M can end into input W, as we figured that M is deterministic. Let's take another example, w $\in B$. This will then accept W for M, which is the ending state r $\in F$. Where r is the accept state of M. But in case of Q-F, $\overline{M}$ won't be able to accept W for the accept states. In conclusion, $\overline{M}$ will accept string W, so $\overline{M}$ recognizes language B.

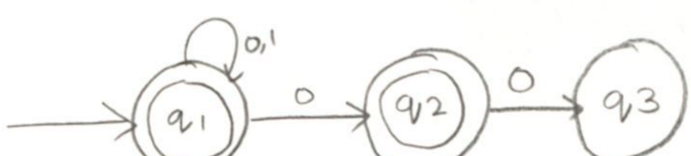
b.

   i. C = {W $\in \Sigma^*$| *w ends with* 00}
      Where we know that $\Sigma = \{0,1\}$



by swapping

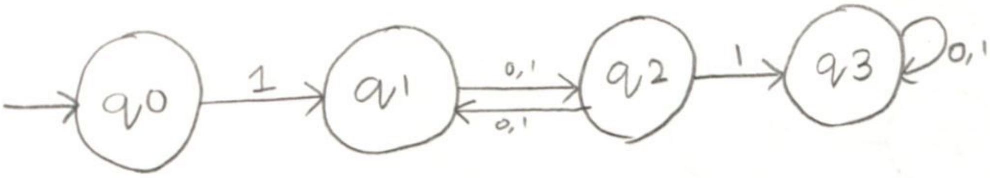
accept & non accept
we get,



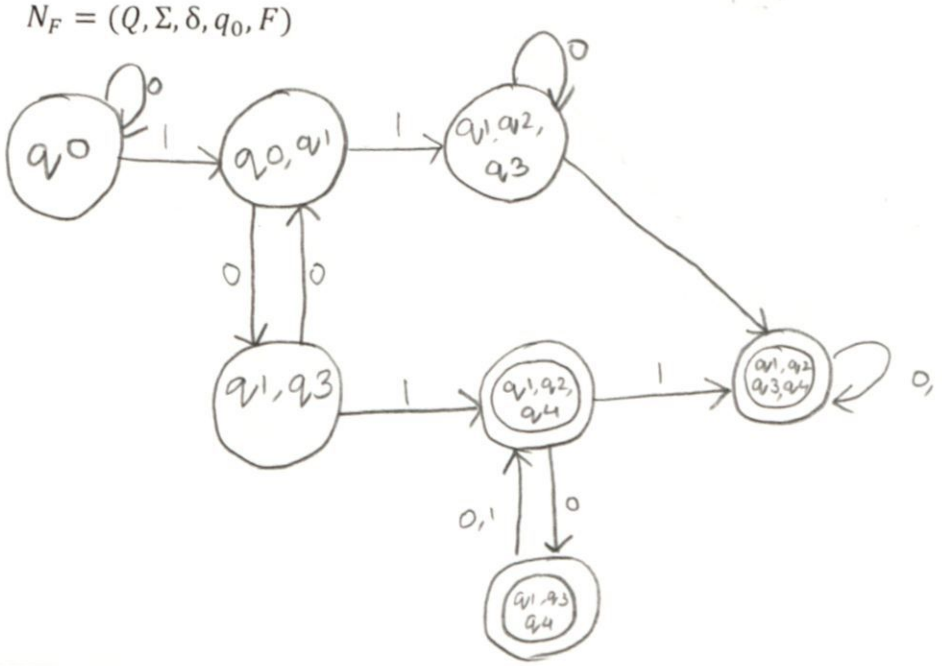
ii. For NFAs they are closed under complements, if c is a language recognized by NFAs
C = L(M)
So,
L(D)=L(M)=C
As we learned in class, every DFA is a NFA so there is a NFA.
Hence, $\bar{C} = L\overline{(D)}$

3. **1.13**

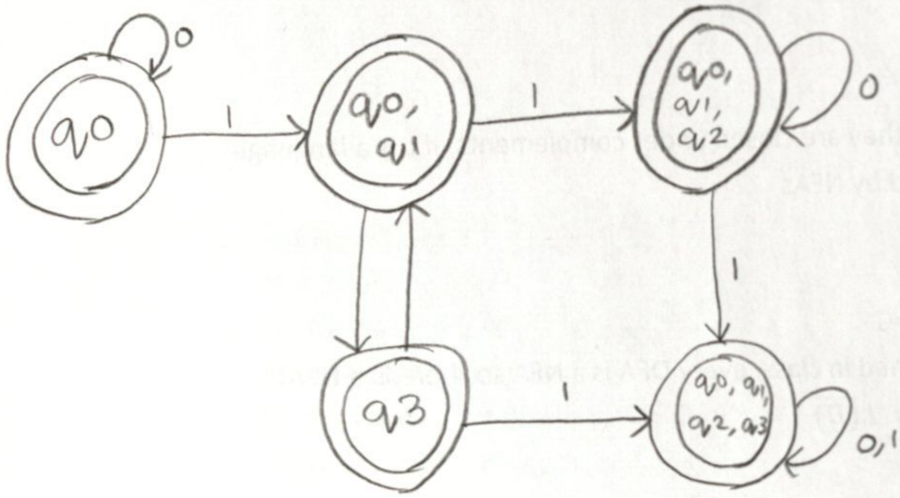
F = {W|W doesn't contain a pair of 1's that are separated by an odd number}
$\bar{F}$ = {W|W contains a pair of 1's that are separated by an odd number of symbol}
So,



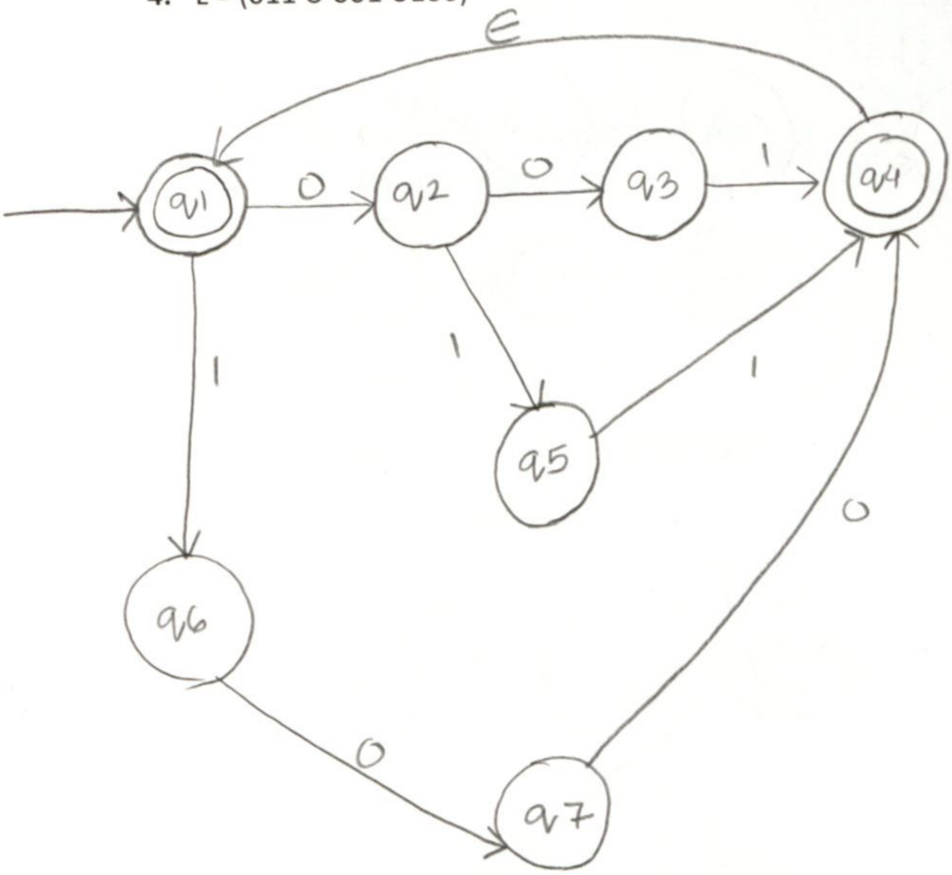
DFA,
$M_F = (Q', \Sigma, \delta', q0', F)$
$N_F = (Q, \Sigma, \delta, q_0, F)$



DFA mf has minimum state

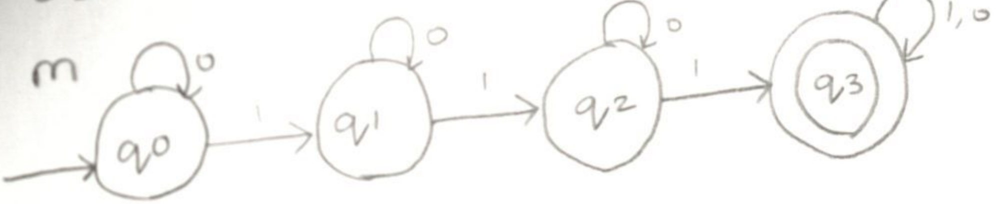


4. L = (011 U 001 U100) *



Q5]

M



Proof:

Base case: $\in, 0, 1$

Induction step: $|w| = n \geq 2$

Assume w ends with 0

w = x0

Where, x is the prefix that can ends in any state and ends in the same state

If we say that the state is in q_1 and waiting to process the ending 0

So,

$$\delta(q_1, 0) = q_1$$

Similarly,

For w = x1

If we suppose that M is some state q_1 such that it has processed all the characters in x

$$\delta(q_i, 1) = q_{i+1}$$

We do the same for q_3 , it will go to the first state, since there is no q_4.

Then, we can prove that the machine accepts the language, where it has at least 3 1's.