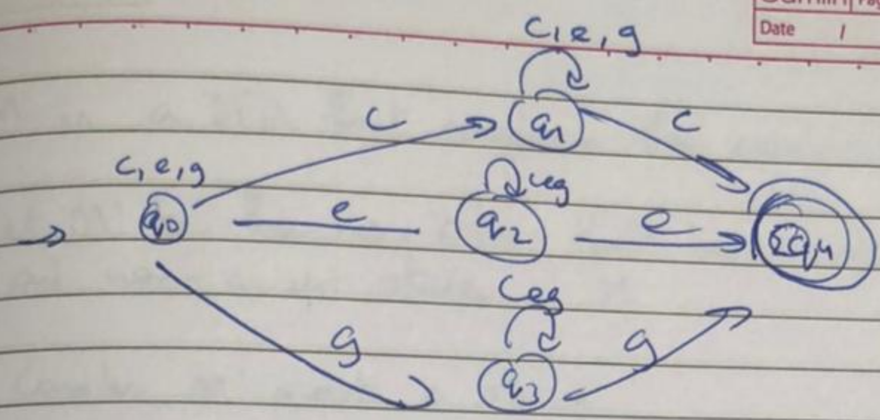
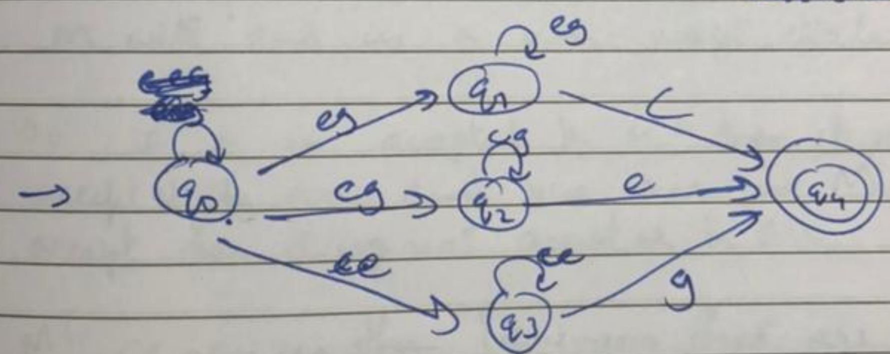
1)

a) 

Consider string starting from ~~e~~ and end with e

Test = e c g c g e . → q_0 goes to q_2 recursively

b) 

no last symbol before.

2 M is a DFA that recognizes the regular language B

Let M' be the new DFA that has swapped accept and non-accept states in M

Consider M' accepts a string

Run M's on x so it can enter the accept state

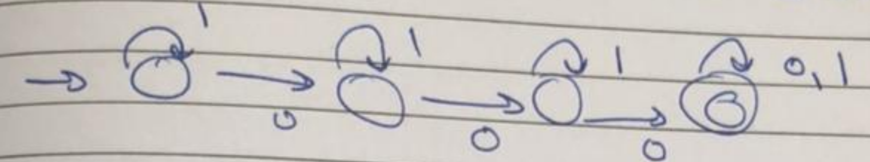
The machines M, M' have swapped accept, non-accept states so if we run M on x then M will end in a non-accept state.

So if x is accepted by M' then it is not accepted by M and vice versa. so M' will accept the strings not accepted by M.

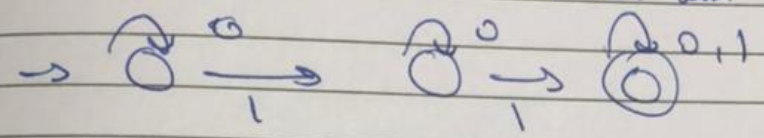
M' recognizes the languages that are complement of B.

As M recognizes a regular language B, there is M' which recognizes complement of B which is also regular.

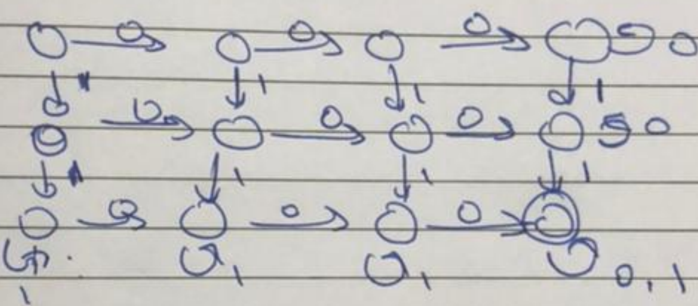
6) $M_1 \to L_1$ ({w | w → at least 3 0's }.



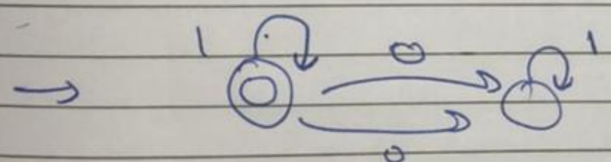
$M_2 \to L_2$ ({w | at least 2 1's })



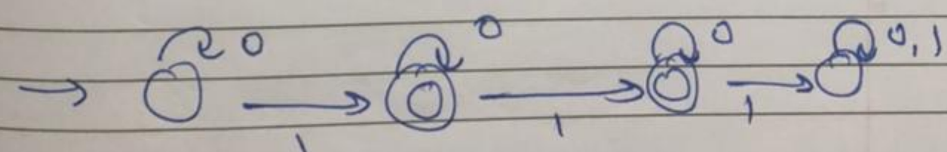
M



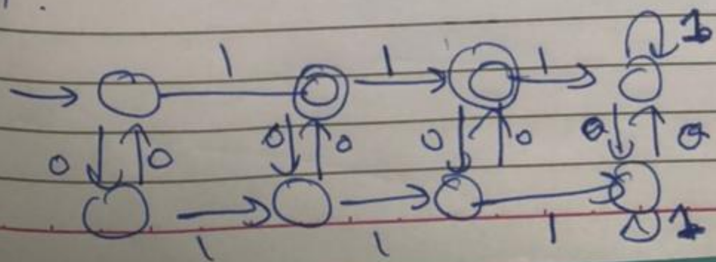
b) $M_1 \to$



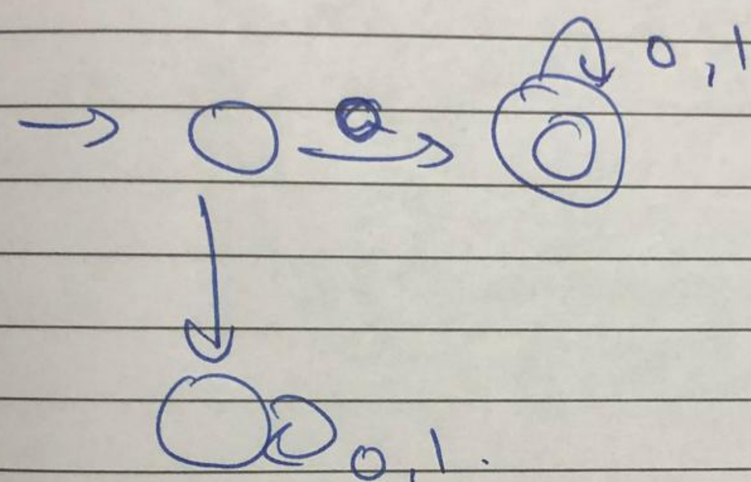
$M_2 \to L_2$



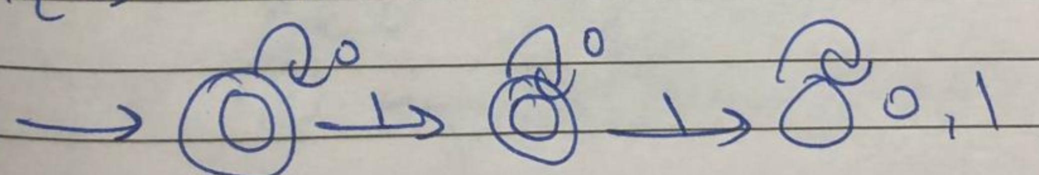
M.



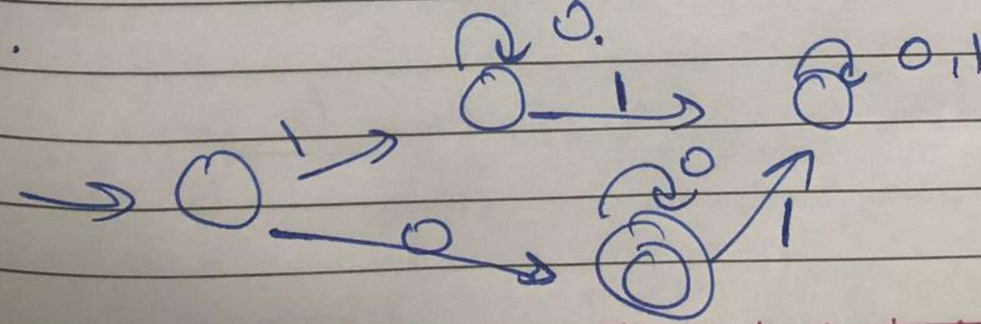
c) $M_1 \to L_1$



$M_2 \to L_2$.



M.



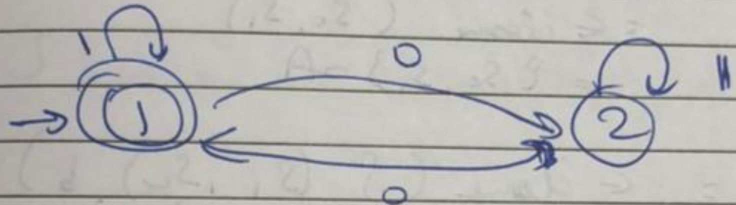
4)

a) Let M_1, M_2 be the NFAs recognizal.

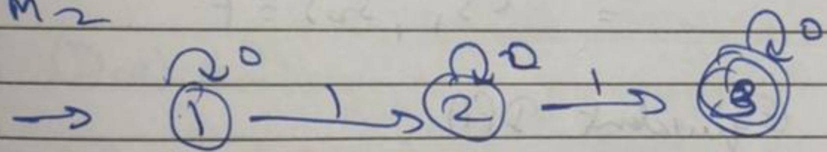
$L_1 = \{w \mid w$ contains even number of 0s$\}$

$L_2 = \{w \mid w$ contains exactly two 1s$\}$

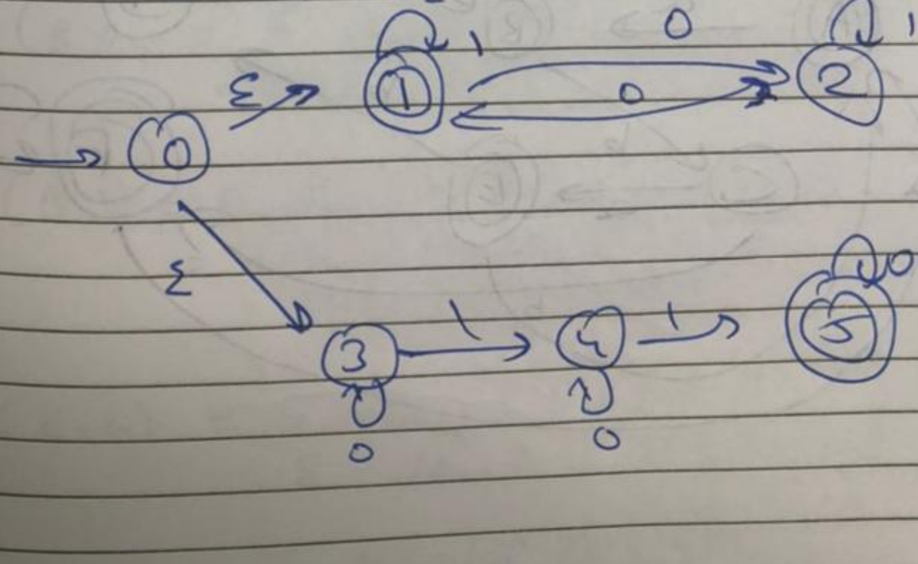
M_1



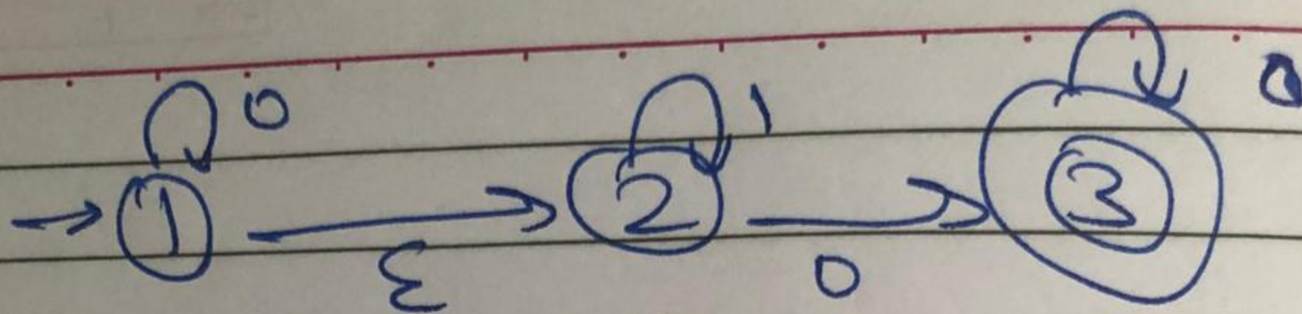
M_2



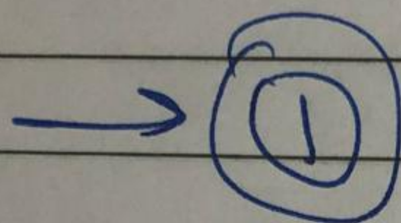
$L = L_1 \cup L_2$



b)



c)



Date / /

ϵ NFA to DFA.

ϵ closure (S_0) = $\{S_0, S_1\}$ = A

$\delta(A, a)$ = ϵ closure $(\delta(S_0, S_1), a)$

= ϵ closure (S_2, S_0)

= $\{S_0, S_1, S_2\}$ = B

$\delta(A, b)$ = ϵ closure $(\delta(S_0, S_1), b)$

= ϵ closure (ϕ) = D (Dummy state)

$\delta(D, a) = D$

$\delta(D, b) = D$

$\delta(B, a)$ = ϵ closure $(\delta(S_0, S_1, S_2), a)$
= ϵ closure (S_0, S_1, S_2) = B

$\delta(B, b)$ = ϵ closure $(\delta(S_0, S_1 S_2), b)$
= ϵ closure (S_2)
= $\{S_2\}$ = C

$\delta(C, a)$ = ϵ-closure $(\delta(S_2), a)$
= ϵ-closure $(S_1\}$ = $\{S_1\}$ = E

$\delta(C, b)$ = ϵ closure $(\delta(S_2), b)$
= ϵ-closure (S_1, S_2)
= $\{S_1, S_2\}$ = F

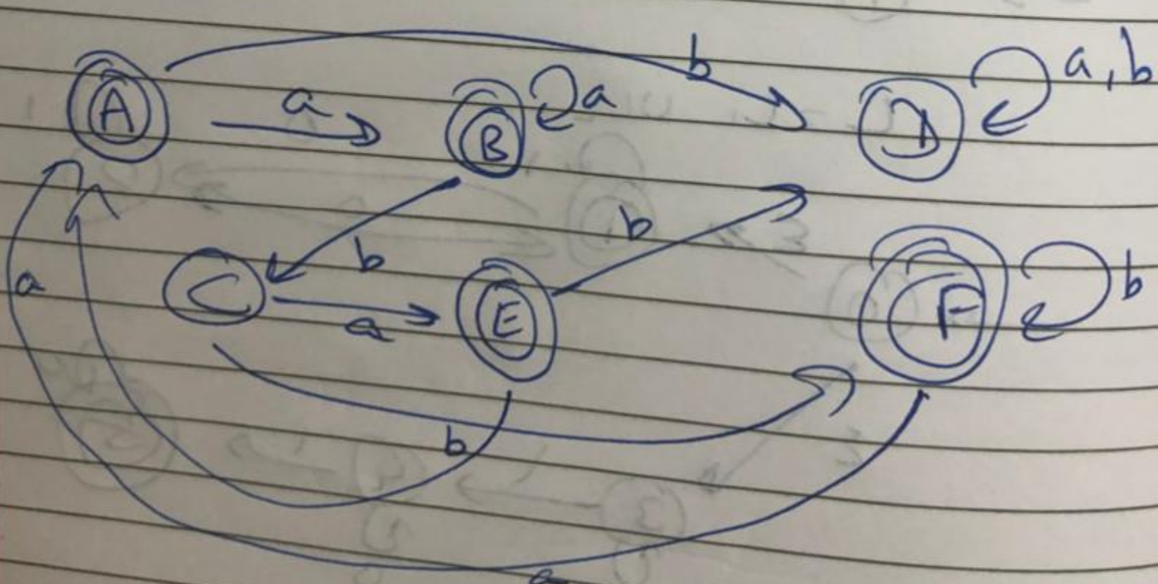
$\delta(E, a) = \epsilon\text{-closure}(\delta(S_1), a)$
$= \epsilon\text{ closure}(S_0)$
$= \{S_0, S_1\} = A$

$\delta(E, b) = \epsilon\text{ closure}(\delta(S_1), b)$
$= \epsilon\text{-closure}(\phi)$
$= D$

$\delta(F, a) = \epsilon\text{ closure}(\delta(S_1, S_2), a)$
$= \epsilon\text{ closure}(S_0, S_1)$
$= \{S_0, S_1\} = A$

$\delta(F, b) = \epsilon\text{ closure}(\delta(S_1, S_2), b)$
$= \epsilon\text{ closure}(S_1, S_2)$
$= \{S_1, S_2\} = F$

Equivalent DFA



6)

a) $\{w \mid w$ contains at least three 1s$\}$

$$= (0+1)^* 1 (0+1)^* 1 (0+1)^* 1 (0+1)^*$$

b) $\{w \mid w$ starts with 0 and has odd length, or starts with 1 and has even length$\}$

$$= 0((0+1)(0+1))^* + 1(0+1)((0+1)(0+1))^*$$

c) $\{w \mid$ the length of w is atmost 5$\}$

$$= (\varepsilon+0+1)(\varepsilon+0+1)(\varepsilon+0+1)(\varepsilon+0+1)(\varepsilon+0+1)$$

d) $\{w \mid w$ is any string except 11 and 111$\}$

$$(\varepsilon+1) + (0 + 01 + 110 + 1110 + 1111)(0+1)^*$$