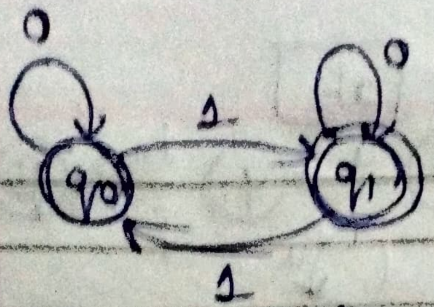
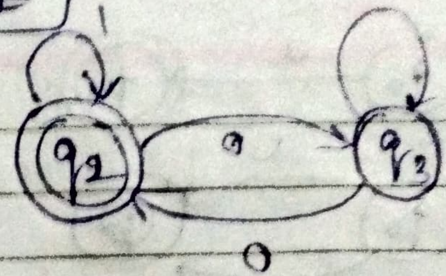
even 0
odd 1

Q1)





[accepting only odd number of 1's]

[accepting only even number of 0's]

$\{q_0, q_1\}$ $\{q_2, q_3\}$ → $\{q_0 q_2\}$ $\{q_0, q_3\}$

$\{q_1 q_2\}$ $\{q_1 q_3\}$

{odd number of 1's

even number of zero

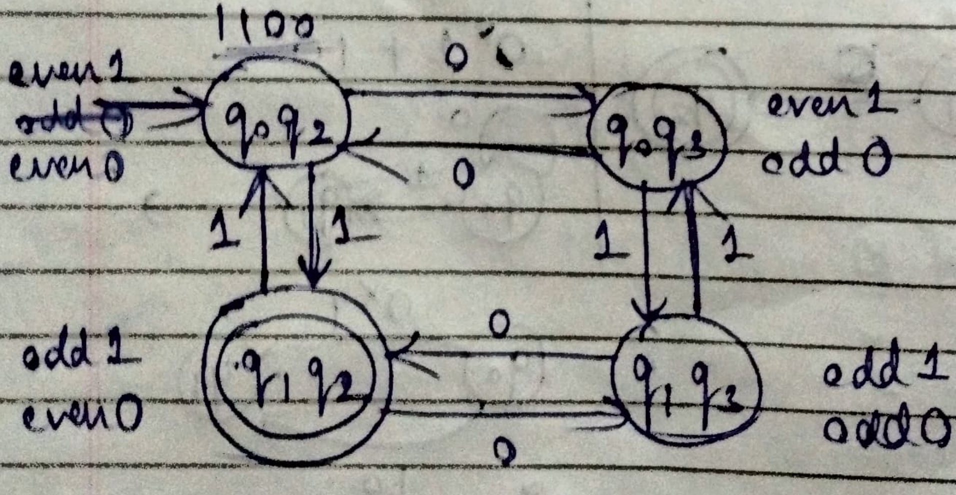
even

$\{q_0 q_2\}$ → even 1 odd even 0

$\{q_0, q_3\}$ → even 1 odd 0

$\{q_1 q_2\}$ → ~~odd number~~ odd 1 even 0

$\{q_1, q_3\}$ → odd 1 ~~even~~ odd 0

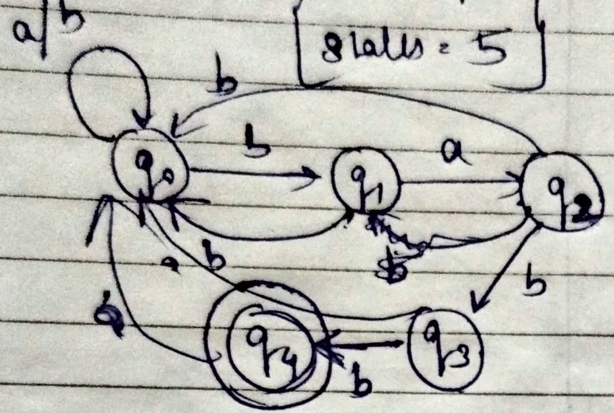


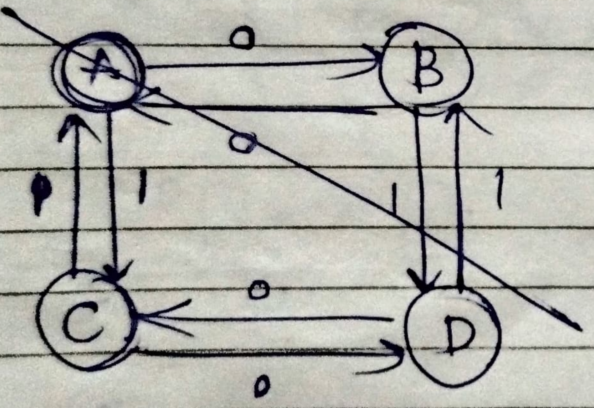
11000

Q2) $\Sigma = \{a, b\}$

$L = \{ababb, \underbrace{babb}, ababbaa, bbabb \ldots\ldots\}$

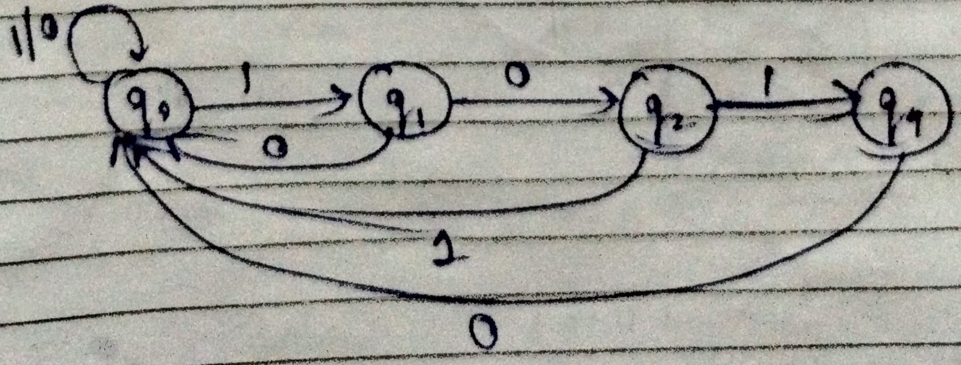
$n = 4$
states $= 5$





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

Q3) $L = \{\underline{101}, 0101, 01010,$

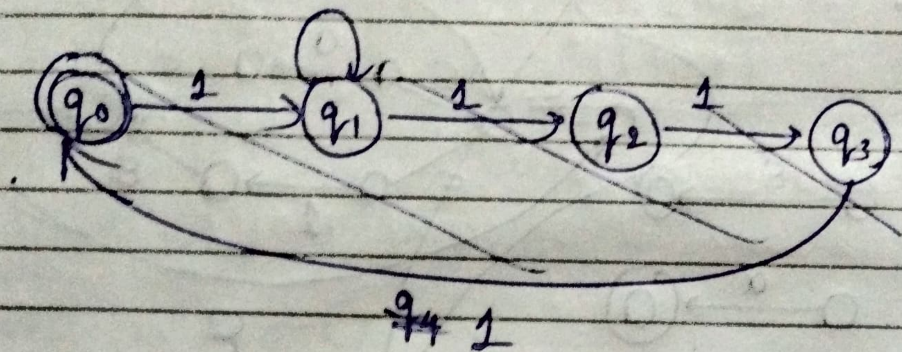


Q4) ~~R = (0+1)* 10~~

L = { w ∈ {0,1}* | the number of 1's in w is not an integer ~~not~~ multiple of ~~4~~ }

m

L = { ε, 1111, 1101111, 110, 10 }



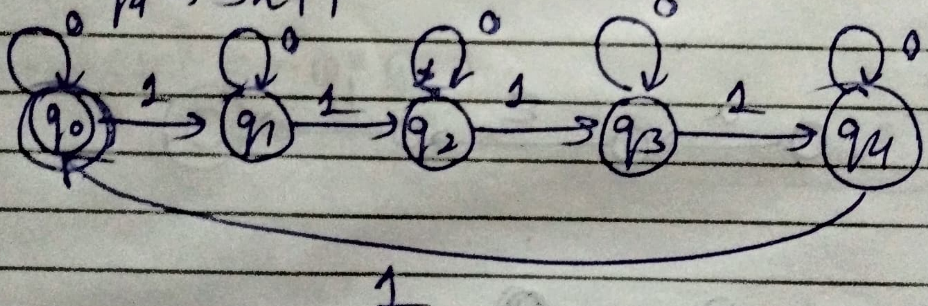
multiple of 5

q0

$q_0 \to 5n+1$, $q_1 \to 5n+1$, $q_2 \to 5n+2$, $q_3 \to 5n+1$

$q_4 \to 5n+1$

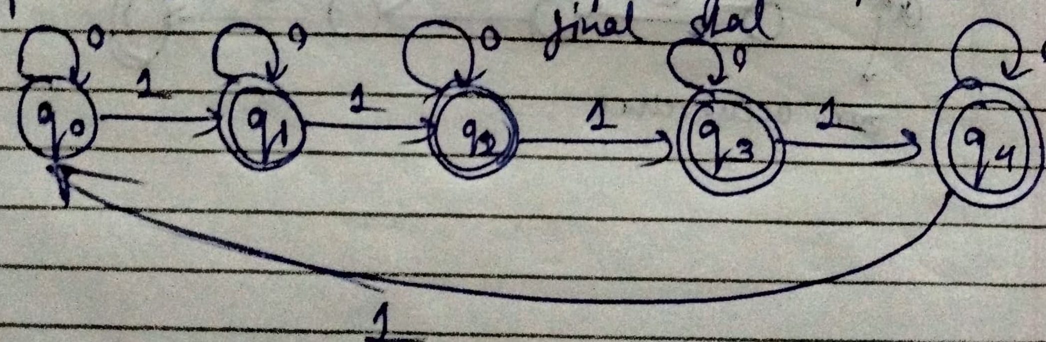
for multiple of 5



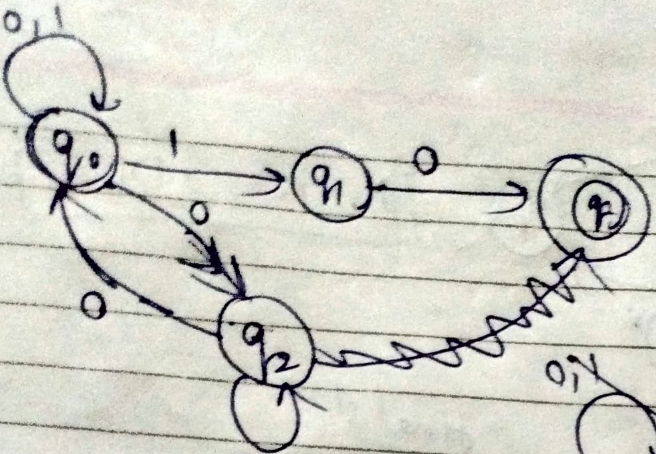
1011110

non multiple of 5

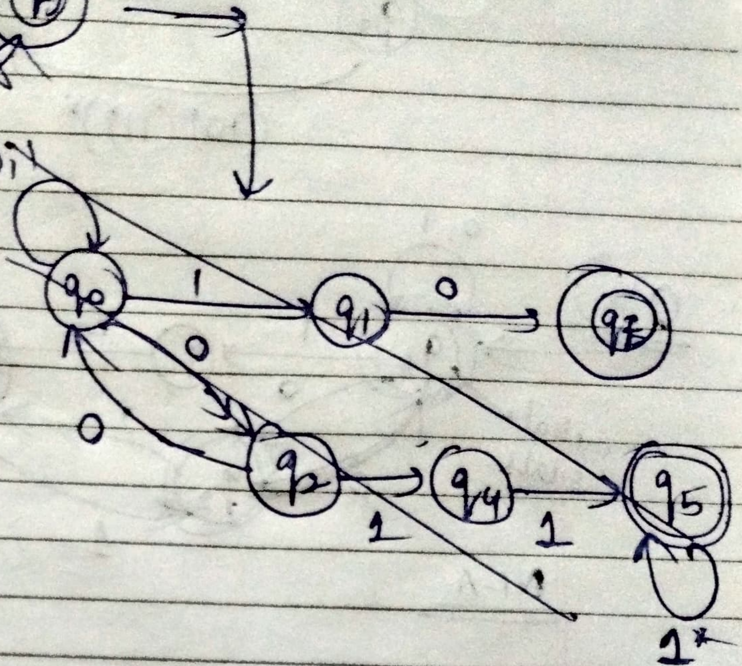
when it's not multiple of 5 it reaches final state

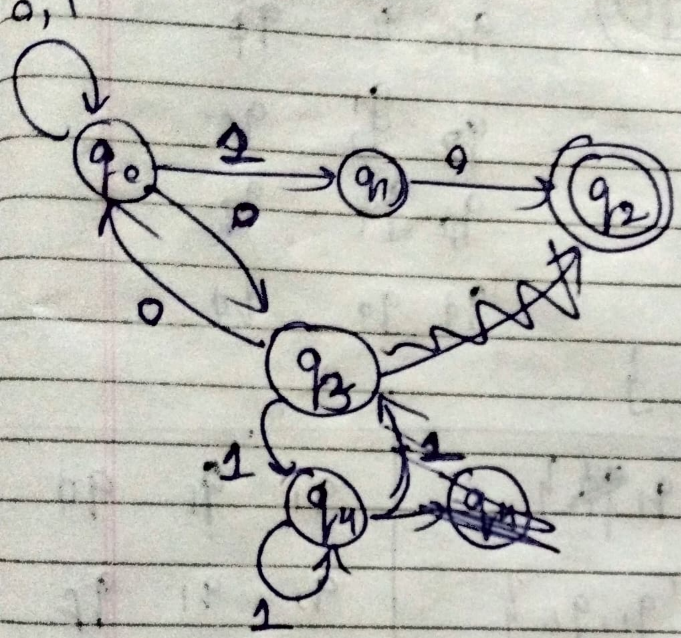


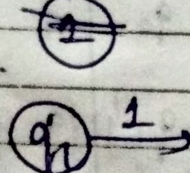
Q5)



$(11^*)^*$



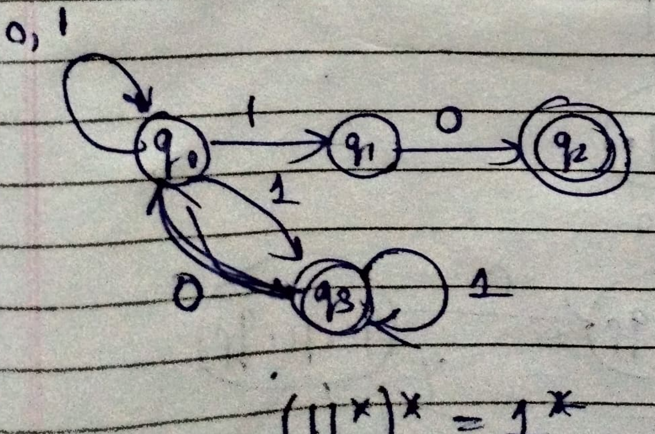




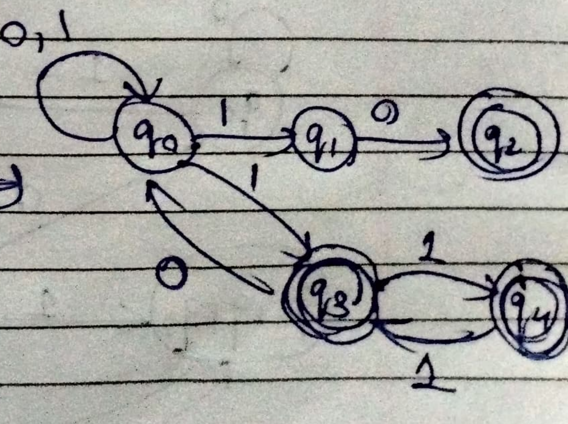
$\cancel{1^*}(11^*1)^*$

$\{1, 11, 11\}.\times\{1\}$

1



or $\Longrightarrow$



$(11^*)^* = 1^*$

$\{1, 11, 111, 1111\} \longrightarrow \{\varepsilon$

NFA

Q5)

	0	1
q_0	q_0	$\{q_0, q_1, q_3\}$
q_1	q_2	q_ϕ
q_3	q_0	q_3

DFA

	0	1
q_0	q_0	$\{q_0, q_1, q_3\}$
$\{q_0, q_1, q_3\}$	$\{q_0, q_2\}$	$\{q_0, q_1, q_3, q_\phi\}$
q_1	q_2	q_ϕ
q_3	q_0	q_3

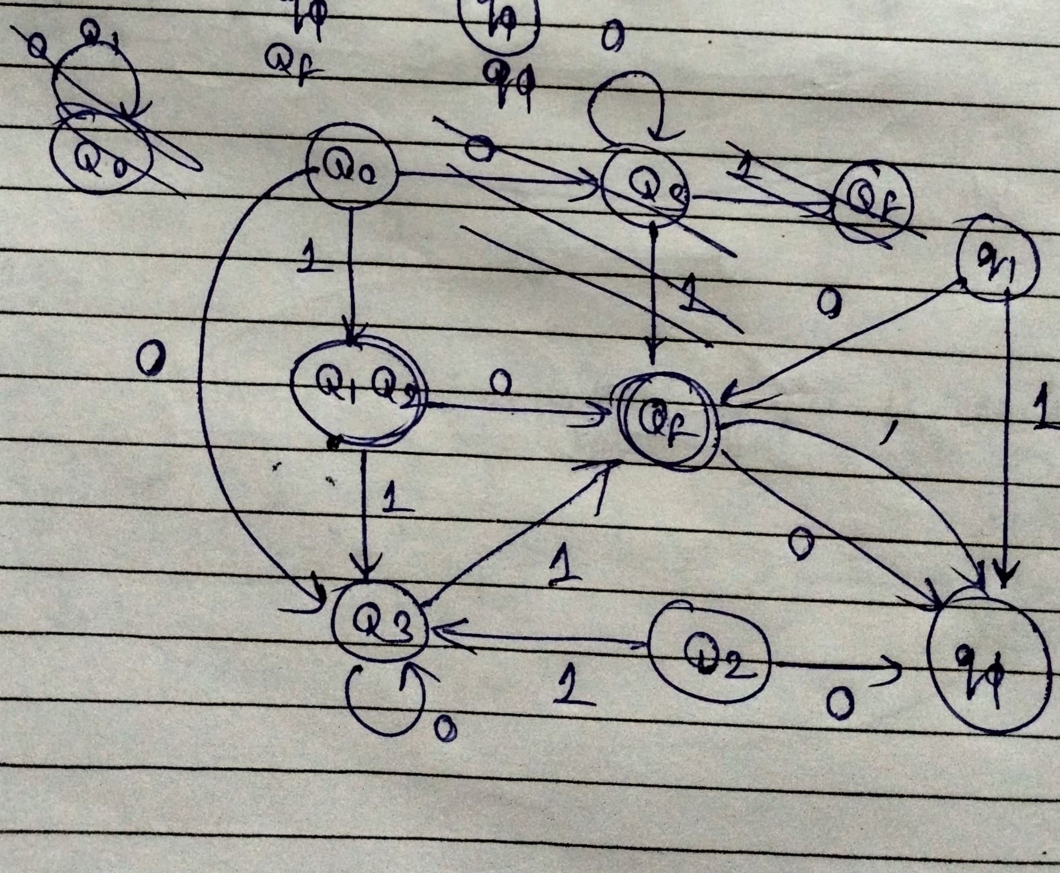
~~$\{q_0, q_1, q_3, q_\phi\}$~~

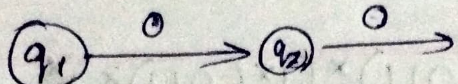
Q8)

States	0	1
→Q0	Q3	Q1, Q2
Q1	Qf	
Q2		Q3
Q3	Q3	Qf
Qf		

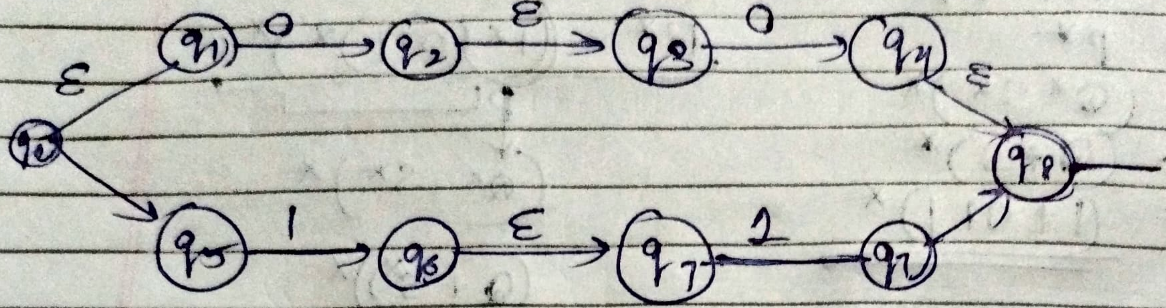
~~DFA~~ NFA → DFA

	0	1
→ Q0	Q3	Q1Q2
Q1Q2	Qf	Q3
Q2	—	Q3
Q3	Q3	Qf
Qf	~~qϕ~~ Qf	qϕ qϕ

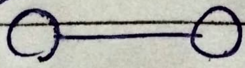




Q10)



very lengthy
gonna do it later



Q12) $P + PQ^* = a^*bQ^*$ where $P = b + a \cdot a^*b$

LHS $b + aa^*b + b + aa^*b\, Q^*Q$

$= b + aa^*b\,(\varepsilon + Q^*Q)$

$= \cancel{(R^*)(Q^*)}$

$\boxed{\varepsilon + Q^*Q = Q^*}$

$= (b + aa^*b)(Q^*)$

$= b(aa^* + \varepsilon)\, Q^*$

$= ba^*Q^*$

$= a^*bQ^*$

LHS = RHS

Hence Proved.

Q11) $R = \varepsilon + \underbrace{1^* (011)^*}_{P} \underbrace{(1^*(011)^*)^*}_{P^*}$

$R = \varepsilon + PP^*$

$R = P^*$

$R = (Q^* S^*)^*$

$= (Q + S)^*$

$= (1 + 011)^*$

$P^* = (\underbrace{1^* (011)^*}_{P})^*$

$\downarrow$

$(Q^* \cdot S^*)^*$

$(Q + S^*))^*$

hence describes

the same set of string $(1+011)^*$