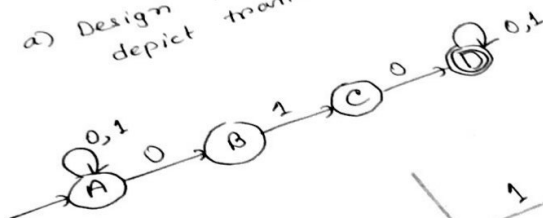


Question 2: a) Design NFA that has 010 substrings and depict transition table. $\Sigma = \{0,1\}$



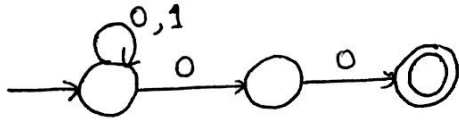
	0	1
ϕ	ϕ	ϕ
$\rightarrow A$	$\{A, B\}$	$\{A\}$
B	ϕ	$\{C\}$
C	$\{D\}$	ϕ
* D	$\{D\}$	$\{D\}$

b) Convert NFA to DFA using e. Show the resulting transition

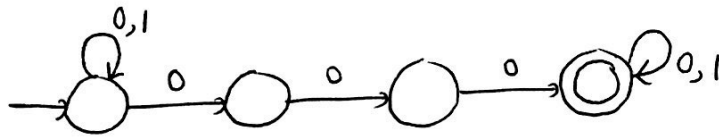
Worksheet - 2

Q.1: Design NFA / E-NFA over the alphabet $\{0,1\}$.

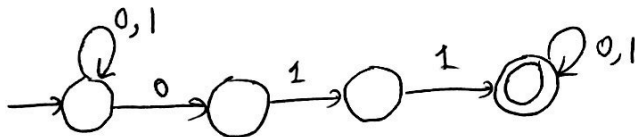
a) The set of all strings ending in 00.



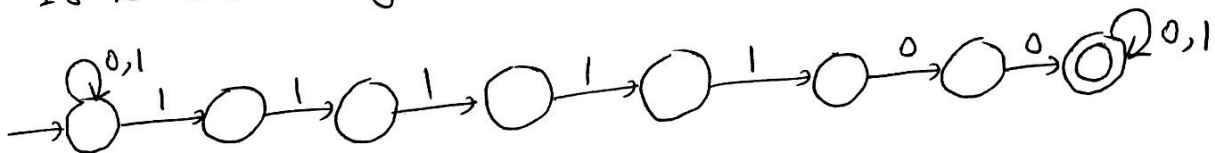
b) The set of all strings with three consecutive 0's.



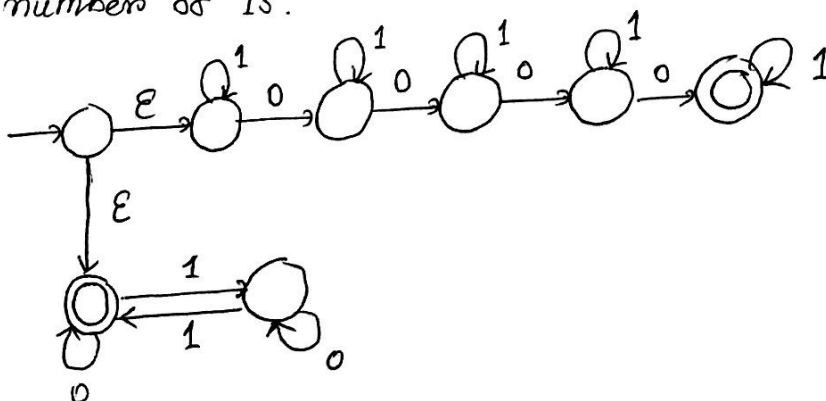
c) The set of strings with 011 as a substring.



d) Set of all strings such that each block of 5 consecutive 1's is followed by at least two 0's

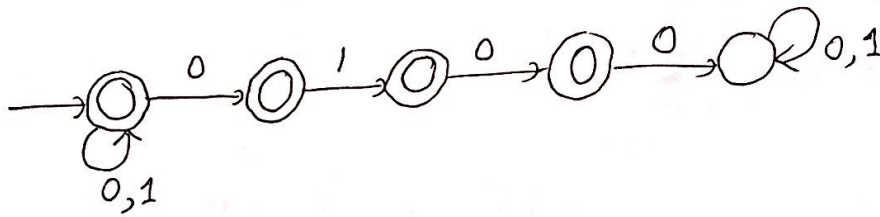


e) All strings containing exactly four 0's on an even number of 1s.

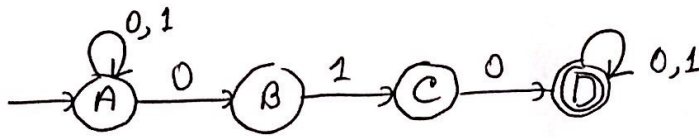


f) $L = \{ w \mid w \text{ has even numbers of 0's and contains exactly two 1's} \}$

g) All strings that do not contain substring 0100.



Question 2: a) Design NFA that has 010 substrings and depict transition table. $\Sigma = \{0,1\}$



	0	1
\emptyset	\emptyset	\emptyset
$\rightarrow A$	$\{A, B\}$	$\{A\}$
B	\emptyset	$\{C\}$
C	$\{D\}$	\emptyset
$* D$	$\{D\}$	$\{D\}$

b) Convert NFA to DFA using subset construction.
Show the resulting transition diagram.

Step 1:

$$n = 4$$

$$\text{subset} = 2^n = 2^4 = 16$$

Therefore, there are 16 possible combinations of the subset.

• (Starts from null set)

Step 2:

		0	1
a	\emptyset	\emptyset	\emptyset
b	$\rightarrow A$	A, B	A
c	B	\emptyset	c
d	C	D	\emptyset
e	* D	D	D
f	AB	AB	AC
g	$\leftarrow AC$	ABD	A
h	$\leftarrow * AD$	ABD	AD
i	BC	D	c
j	* BD	D	CD
k	* CD	D	D
l	ABC	ABD	AC
m	* BCD	D	CD
n	* ACD	ABD	AD
o	* ABD	ABD	ACD
p	* ABCD	ABD	ACD

Step 3:

Renaming

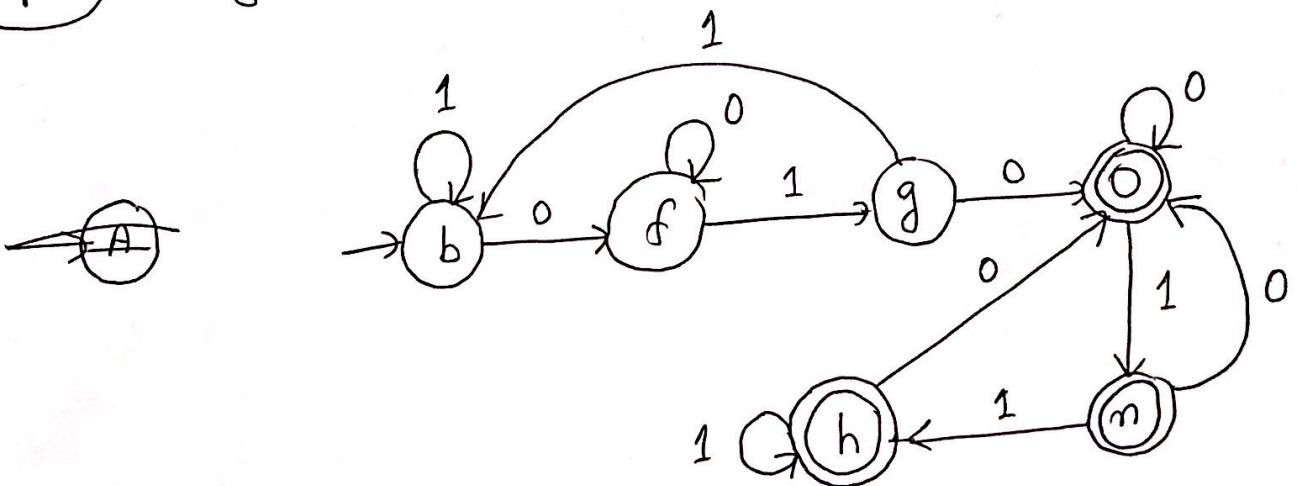
	0	1
a	a	a
→ b	f	b
c	a	d
d	e	a
* e	e	e
f	f	g
g	o	b
* h h	o	h
i	e	d
* j	e	k
* k	e	e
l	o	g
* m	e	k
* n	o	h
* o	o	n
* p	o	n

Step 4):

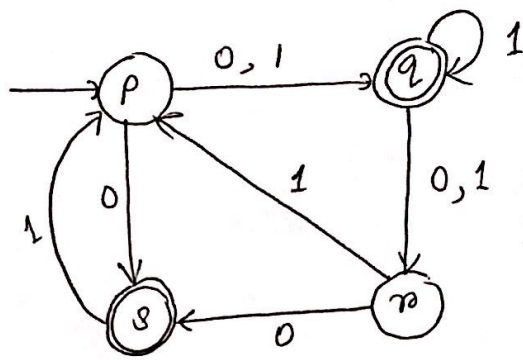
DFA T. table

		0	1
→	b	f	b
	f	f	g
	g	o	b
*	o	o	n
*	n	o	h
*	h	o	h

Step 5) T. Diagram



Ans 3:



$$n = 4$$

$$\text{subset} = 2^4 = 16$$

Step 1

Step 2

	0	1
A - \emptyset	\emptyset	\emptyset
B - $\rightarrow p$	qs	q
C - $* q$	r	qr
D - r	s	p
E - $* s$	\emptyset	p
F - $* pq$	qsr	qsr
G - pr	qs	qp
H - $* ps$	qs	qp
I - $* qr$	rs	qpr
J - $* qs$	rs	pqr
K - $* rs$	s	p
L - $* pqr$	qsr	pqr
M - $* qrs$	rs	qpr
N - $* prs$	qsr	pqr
O - $* pqr s$	qs	qp
P - $* pqr s$	qsr	pqr

Step 3:

Renaming

	0	1
A	A	A
→ B	J	C
*C	D	I
D	E	B
*E	A	B
*F	M	I
G	J	F
*H	J	F
*I	K	L
*J	D	L
*K	E	B
*L	M	L
*M	K	L
*N	M	L
*O	J	F
*P	M	L

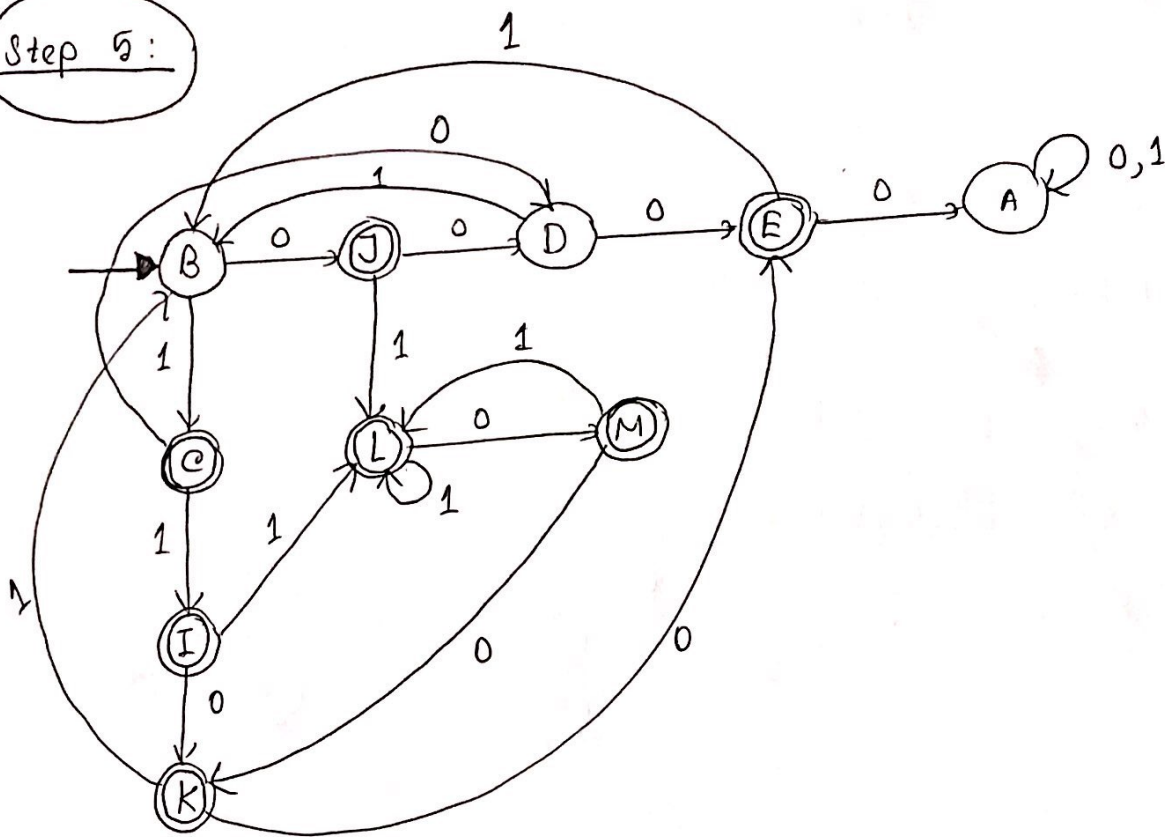
Step 4:

DFA T. table

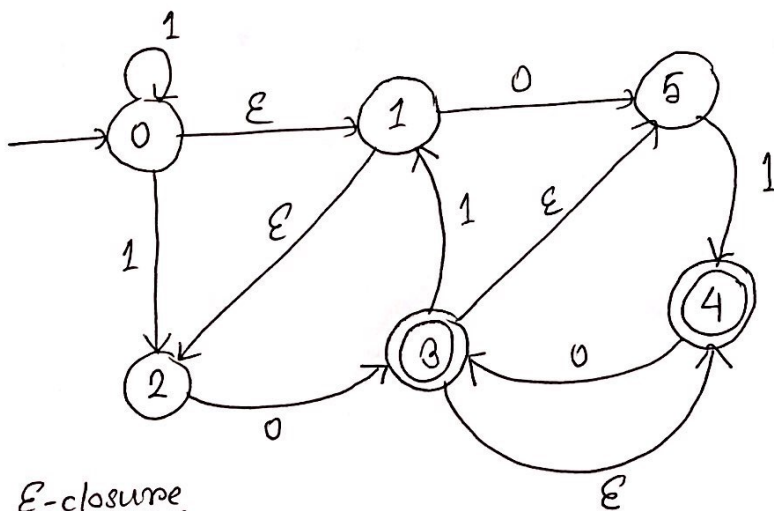
	0	1
→ B	J	C
*J	D	L
*C	D	I
D	E	B
*I	K	L
*L	M	L
*E	A	B
*K	E	B
*M	K	L

	0	1
A	A	A

Step 5:



Question 4:
Convert the following E-NFA to DFA over the alphabet $\{0,1\}$



E-closure

$$E(0) = \{0, 1, 2\}$$

$$E(1) = \{1, 2\}$$

$$E(2) = \{2\}$$

$$E(3) = \{3, 4, 5\}$$

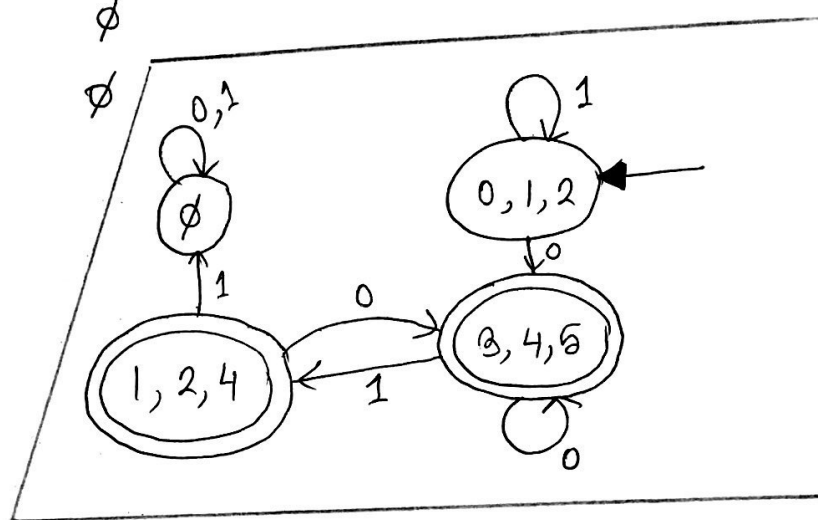
$$E(4) = \{4\}$$

$$E(5) = \{5\}$$

S.T.T. for E-NFA

	0	1
$\rightarrow \{0\}$	\emptyset	$\{0, 1, 2\}$
$\{1\}$	$\{5\}$	\emptyset
$\{2\}$	$\{3\}$	\emptyset
$*\{3\}$	\emptyset	$\{1\}$
$*\{4\}$	$\{3\}$	\emptyset
$\{5\}$	\emptyset	$\{4\}$

$E()$	0	1
$\rightarrow \{0, 1, 2\}$	$\{3, 4, 5\}$ ✓	$\{0, 1, 2\}$ ✓
* $\{3, 4, 5\}$	$\{3, 4, 5\}$ ✓	$\{1, 2, 4\}$ ✓
* $\{1, 2, 4\}$	$\{3, 4, 5\}$ ✓	\emptyset
\emptyset	\emptyset	\emptyset



$$\begin{aligned}
 & \{3, 4, 5\} \rightarrow E(\{3\}) = \{3, 4, 5\} \\
 & \{1, 4\} \rightarrow E(\{1, 4\}) = \{1, 2, 4\}
 \end{aligned}$$

$$\begin{aligned}
 & \{1, 2, 4\} \rightarrow E(\{3, 5\}) = \{3, 4, 5\} \\
 & \quad \quad \quad \rightarrow E(\emptyset) = \emptyset
 \end{aligned}$$

$$\begin{aligned}
 & \rightarrow E(\{0\}) = \{0, 1, 2\} \\
 & \quad \quad \quad \rightarrow E_0(\{3, 5\}) = \{3, 4, 5\} \\
 & \quad \quad \quad \rightarrow E_1(\{0, 2\}) = \{0, 1, 2\}
 \end{aligned}$$