TOC

T1

symbol → Letter & digits

Alphabet → Finite set of symbols

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

string → Finite sequence of symbols

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

$w = 0110, \quad w_2 = 1110 \ldots$

ϵ is empty string

T2

Language → collection of strings (Finite/Infinite)

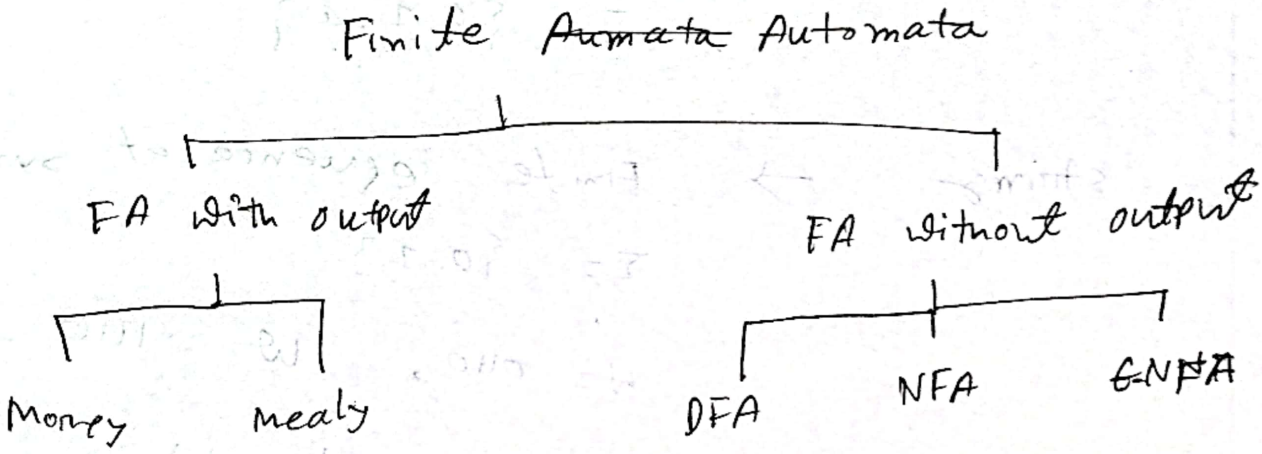
Ex $\Sigma = \{a, b\}$

L_1 = set of all strings over Σ of length 2

$= \{aa, ab, ba, bb\}$

ϵ^* means $\Sigma^* = \Sigma^0 \cup \Sigma^1 \cup \Sigma^2 \cup \dots$

T4 Into to ~~DFA~~ DFA



Ex

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

L_1 = set of all string start with an 'a'.

$(Q, \Sigma, \delta, q_0, F)$ → Focal P.

Q = set of all states

Σ = input alphabets

q_0 = start state

F = set of final states

δ = transition function

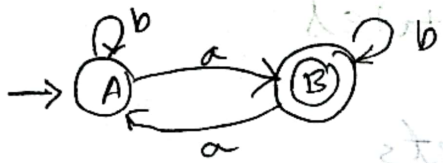
$\delta = Q \times \Sigma \rightarrow Q$

A state gets input and goes to which state determined by transition state.

| T5 Formal definition of DFA

DFA has 5 tuples, Q, Σ, q_0, F, δ

Ex



$Q = \{ A, B \}$

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

$q_0 = A$, $F = \{B\}$

δ : $Q \times \Sigma \rightarrow Q$

	a	b
A	B	A
B	A	B

T6, Exercise on DFA

Ex

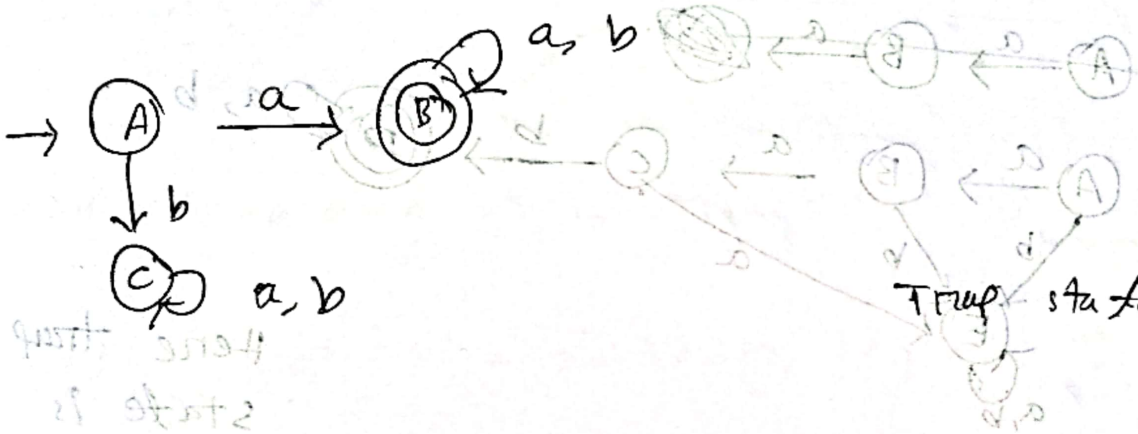
Construct a DFA which accepts set of all strings over the $\Sigma = \{a, b\}$ where each string start with 'a'

Or

$L(M) = \{w \mid w$ starts with an 'a' $\}$

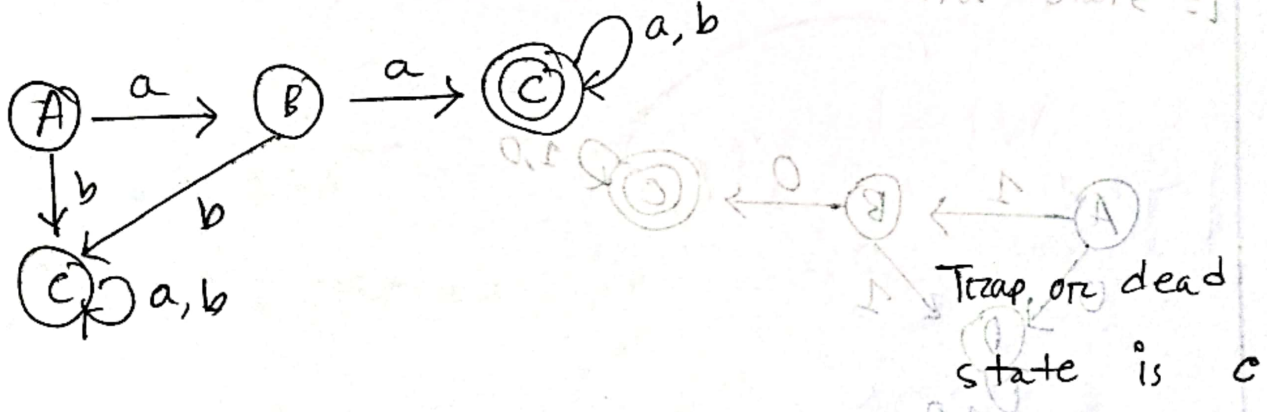
Sol

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



T7

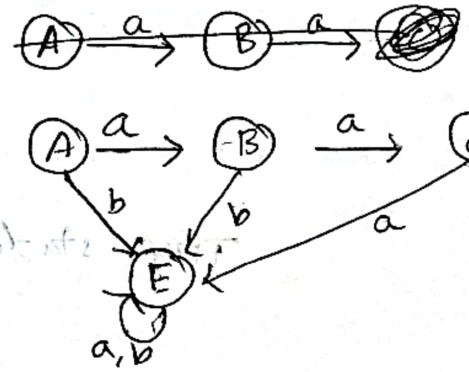
L = set of all strings that start with 'aa'



T8 DFA

Ex

L = set of all string over $\Sigma = \{a, b\}$ where each strings start with "aab"

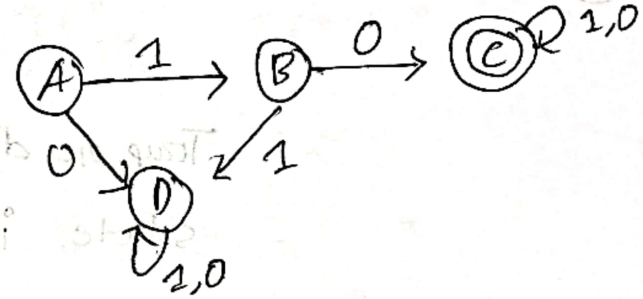


Here trap or dead state is E.

T9 DFA

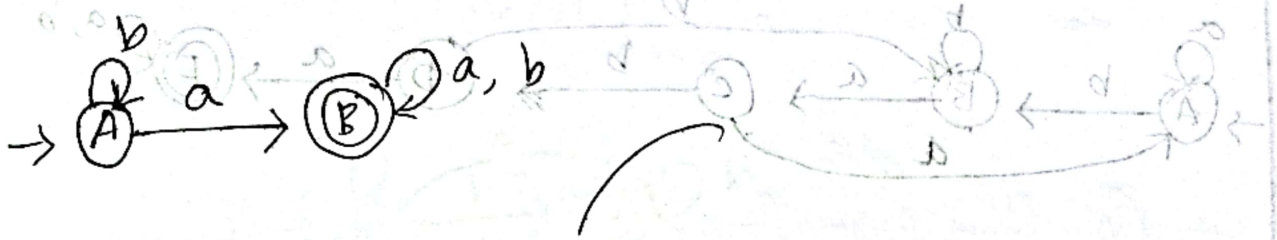
L = start will '10'

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



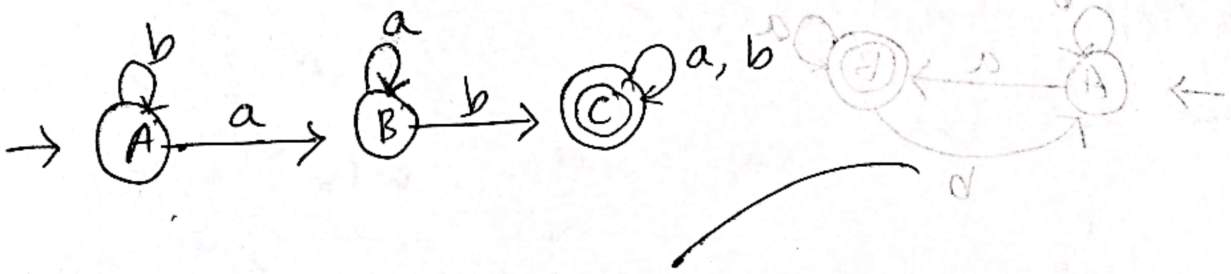
T10 DFA

L: set of all strings $\Sigma = \{a, b\}$ in where every string contains 'a'



T11 DFA

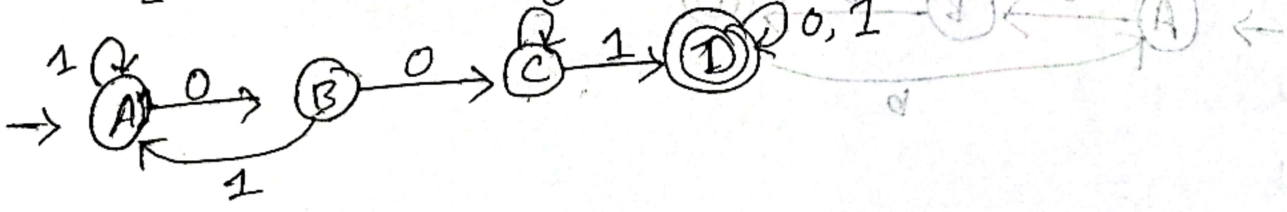
L = set of all strings over $\{a, b\}$ which contains "ab"



T12 DFA

$L(M) = \{ w \mid w$ contains the string 001 as a substring $\}$

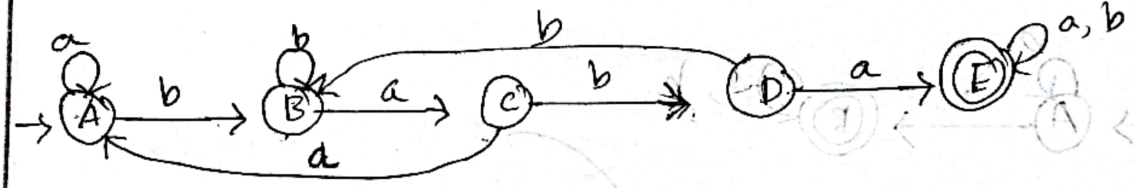
$\Sigma = \{0, 1\}$



T13 DFA

$L(M) = \{ w \mid w$ contains the substring baaba$\}$

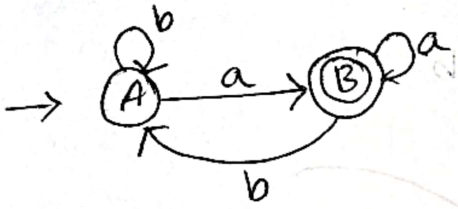
$\Sigma = \{a, b\}$



T14 DFA

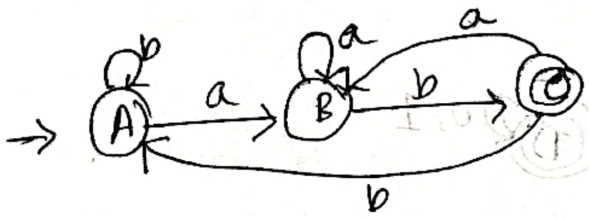
$\Sigma = \{a, b\}$

$L(M) = \{ w \mid w$ ends with a 'a' $\}$



T15 DFA

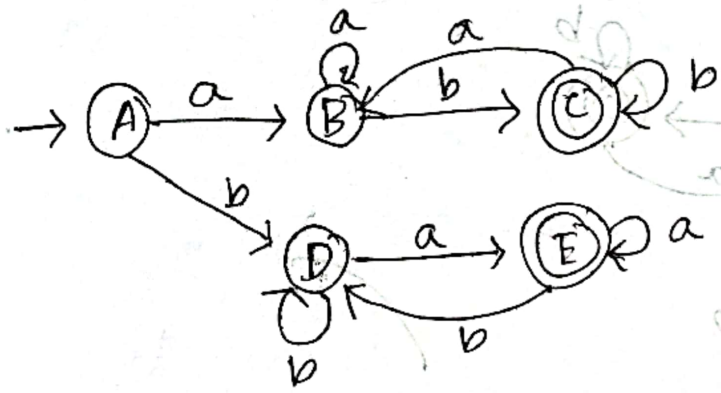
$\Sigma = \{a, b\}$, $L(M) = \{w \mid w$ end with 'ab' $\}$



| T 16 DFA

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

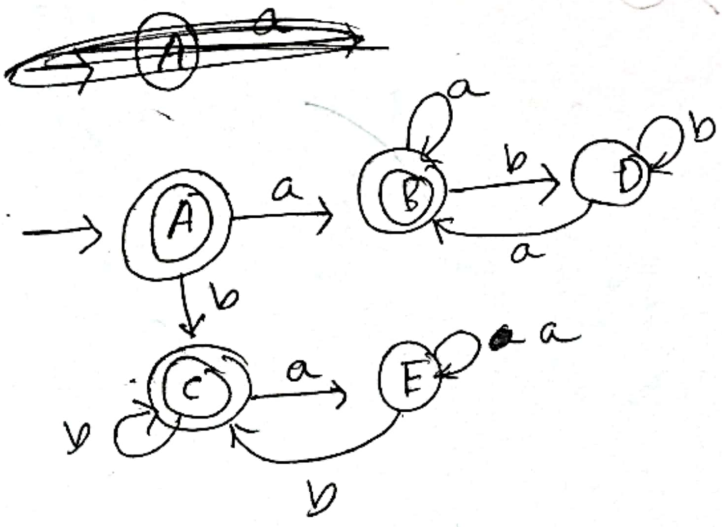
$L(M) = \{w \mid w$ start and end with different symbol $\}$



| T 17 DFA

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

$L(M) = \{w \mid w$ start and end with same symbol $\}$



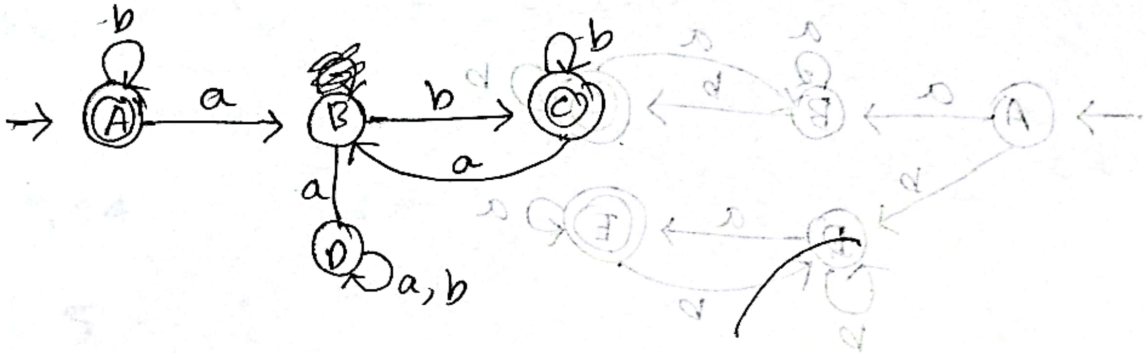
/!\

T16 and T17 are compliment of each other. see deeply

T 18 DFA

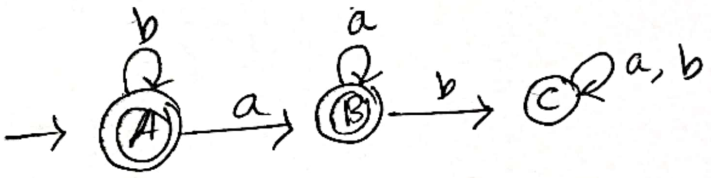
Construct a DFA, $\Sigma = \{a, b\}$

$L(M) = \{w \mid w$ every a in w followed by one 'b' $\}$



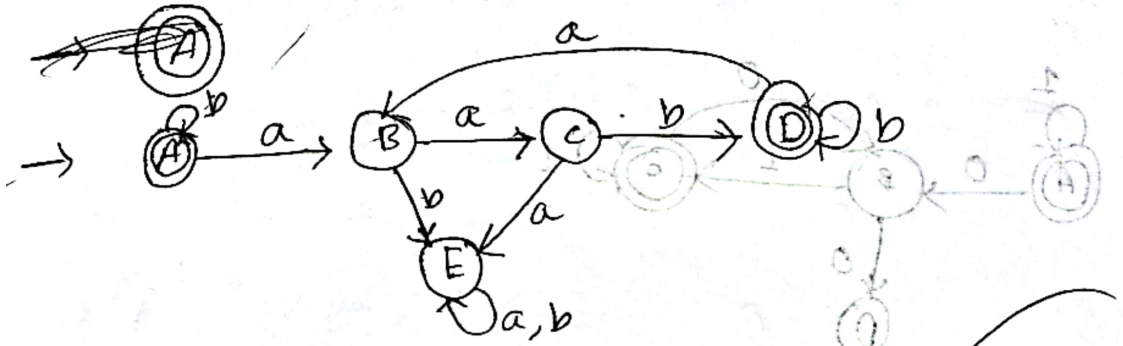
T 19 DFA

$L(M) = \{w \mid w$ every a in w is never followed by one 'b' $\}$



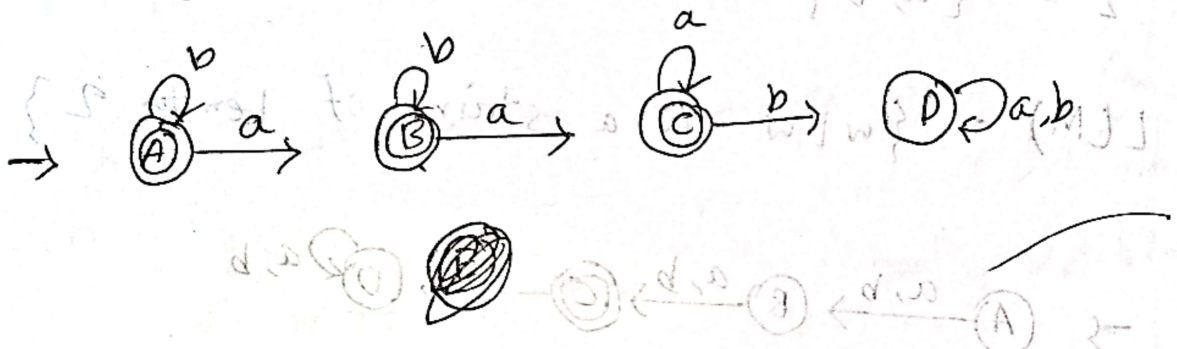
T20 DFA

$L(M) = \{w \mid w$ every 'a' in w is followed by 'ab'$\}$



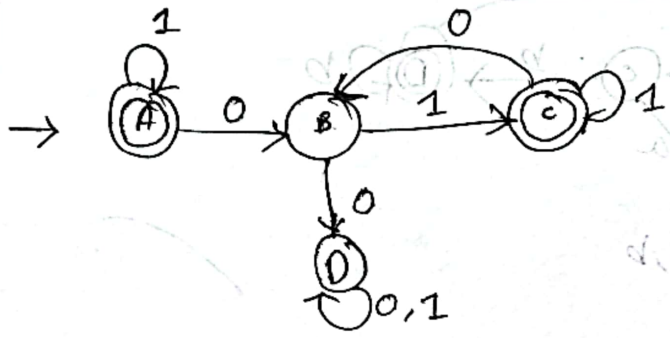
T21 DFA

$L(M) = \{ w \mid w$ every 'a' in w is never followed by 'ab'$\}$



T 22 DFA

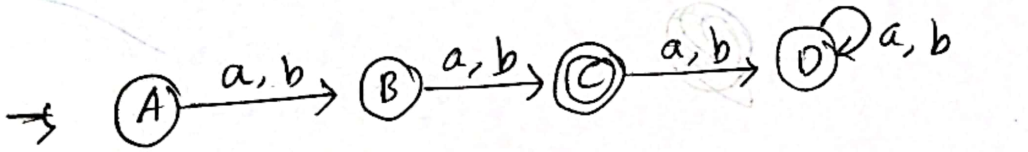
$L(m) = \{w \mid w$ every '0' in w is followed by at least one '1' $\}$



T23 DFA

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

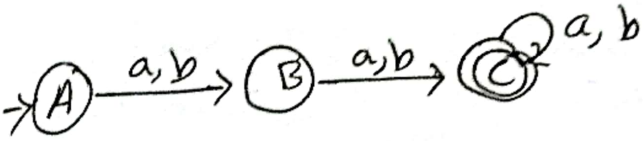
$L(M) = \{w \mid w$ is a string of length 2 $\}$



T24 DFA

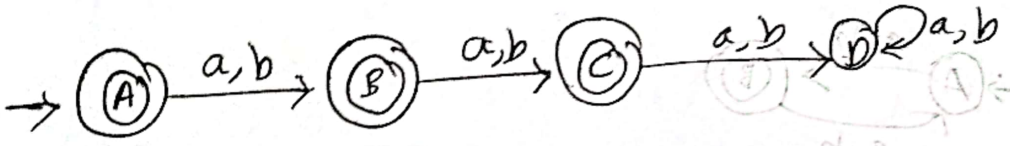
(M): string of length at least 2

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



T25 DFA

string of length at most 2. $\{a, b\}$



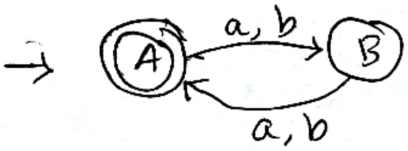
T26 Intro to minimal DFA (mDFA)

- Minimize as much as possible.

T 27 DFA

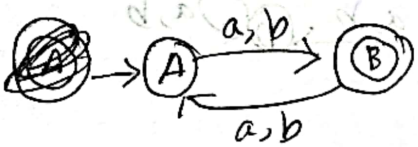
Length of string is divisible by 2

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



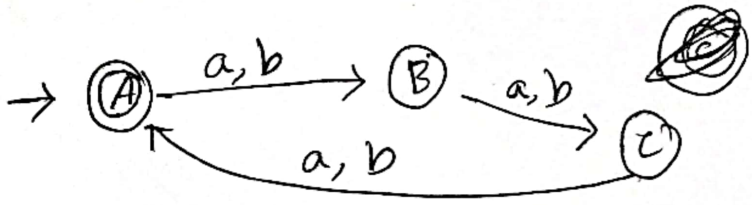
T 28 DFA

Length of string is not divisible by 2

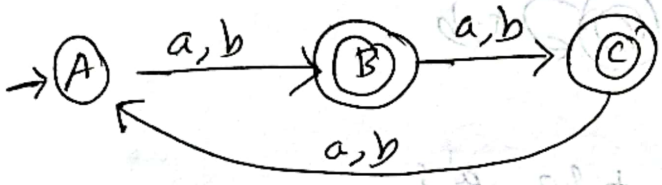


T29 DFA

Length of string divisible by 3

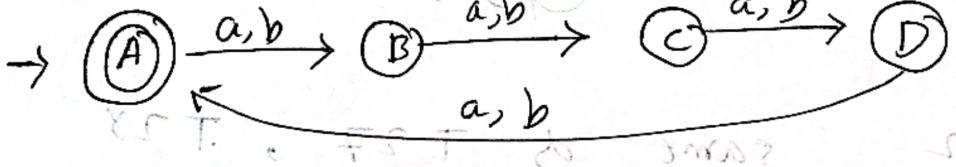


Not divisible by 3 of string length

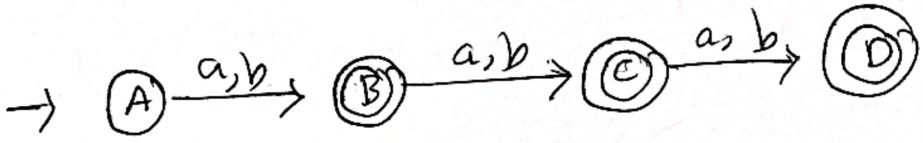


T 30 DFA

string length divisible by 4

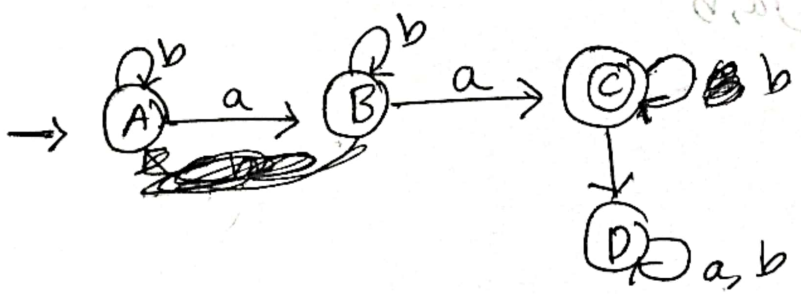


string length not divisible by 4



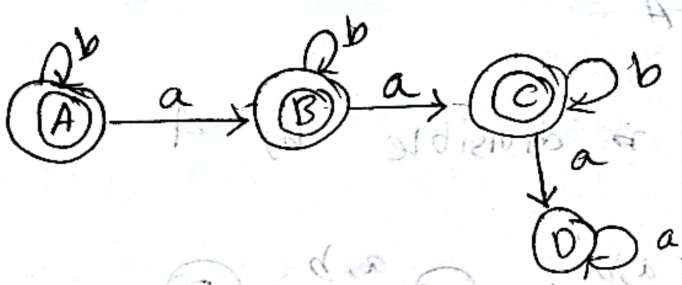
T3 1 DFA

L(M) = {w | w has exactly two a's}



L(M) = at least two a's

L(M) = at most two a's

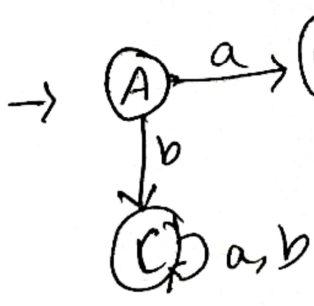


| & T32 same as T27, T28

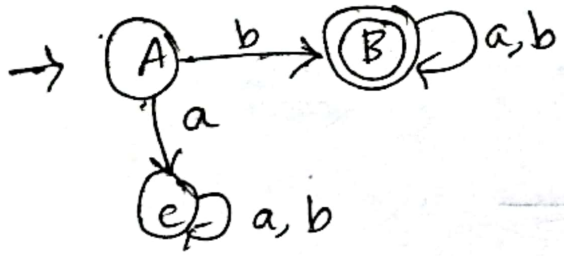
| T33 same as T27, T28

| T34

L(M) = set of strings with a

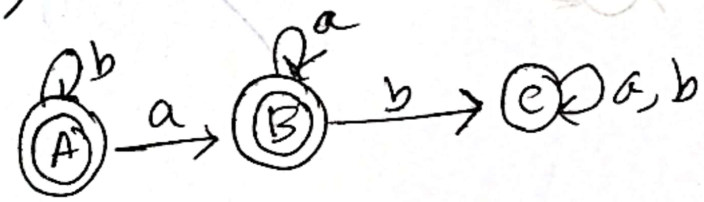


L(M) = does not start with 'a'



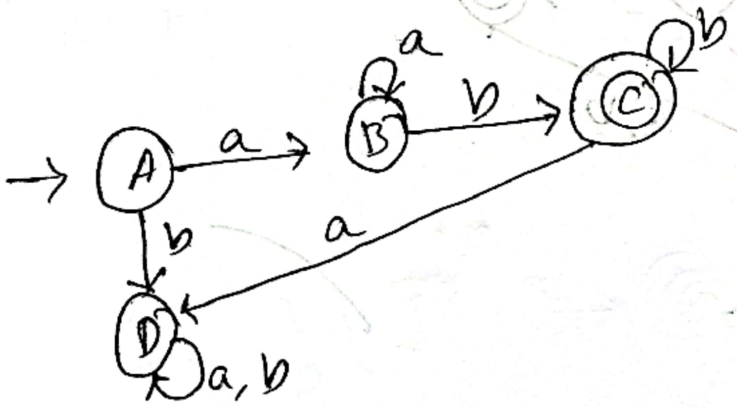
L(M) = contains substring 'a b'

L(M) = does not contain 'a b'



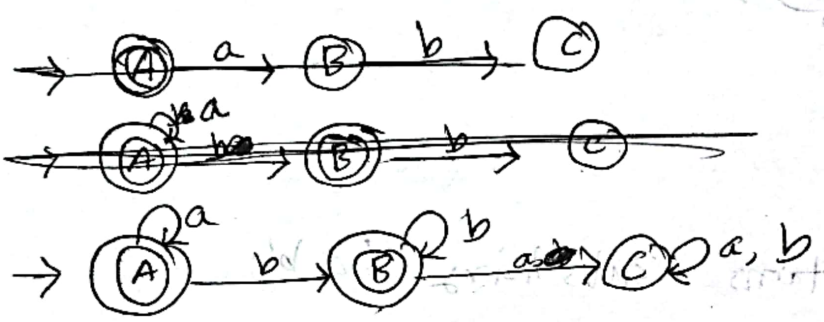
T35, –

$L = \{ a^m b^n \quad m, n \geq 1 \}$

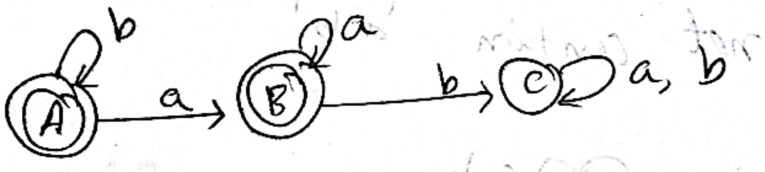


L36

$L = \{ a^m b^n \mid m, n >= 0 \}$

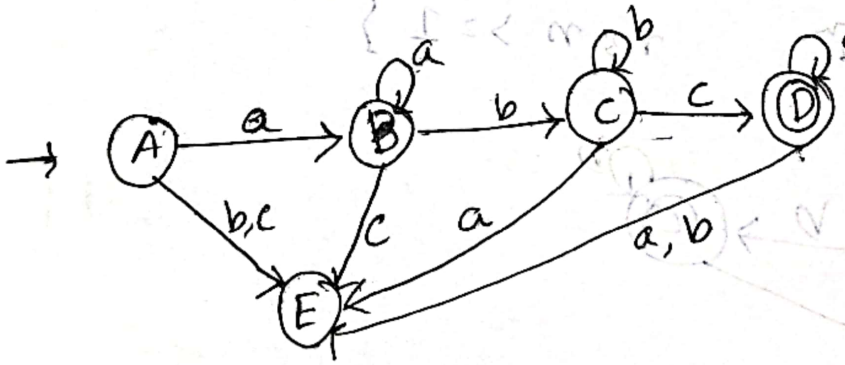


$L = \{ b^m a^n \mid m, n >= 0 \}$



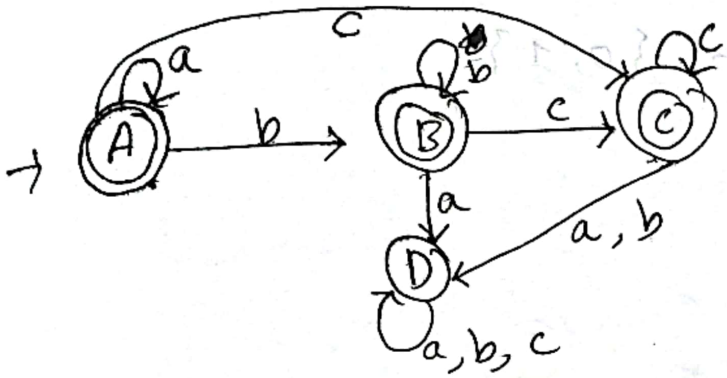
L37

$L = \{ a^m b^n c^l \mid m, n, l >= 1 \}$



| L38

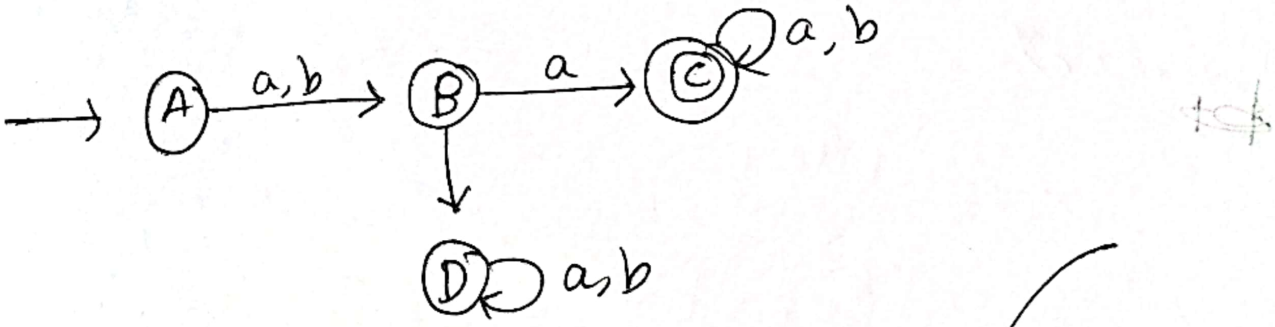
$L(m) = \{ a^m b^n c^t \mid a,b,c, \geq 0 \}$



| L39

$L(m)$ = { 2nd symbol must be a }

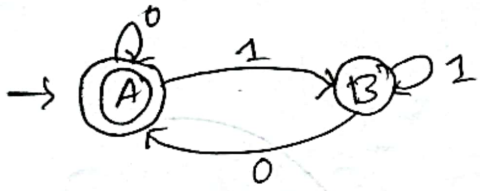
$\Sigma = \{ a, b \}$



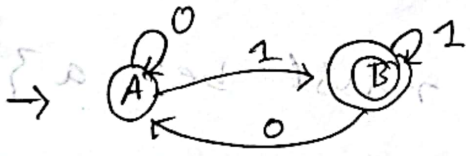
... ...

T 40

L = {w | w binary number is divisible by 2}, Σ = {0, 1}*

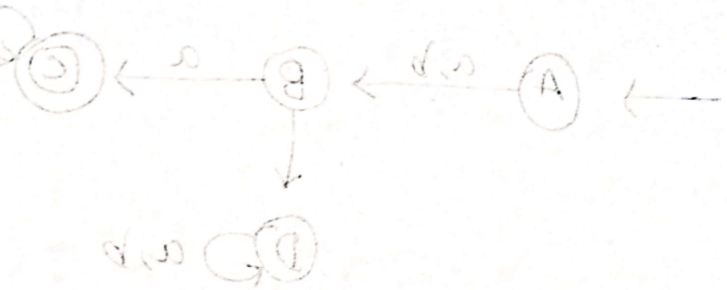


L = not divisible by 2



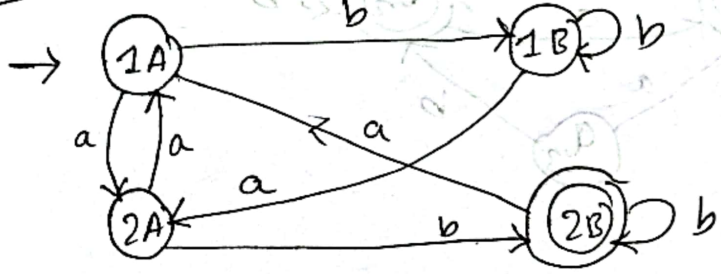
T 41 – T 49 ~~skilled~~ skipped Temporarily

~~pp~~



T50 Minimization of DFA

Ex

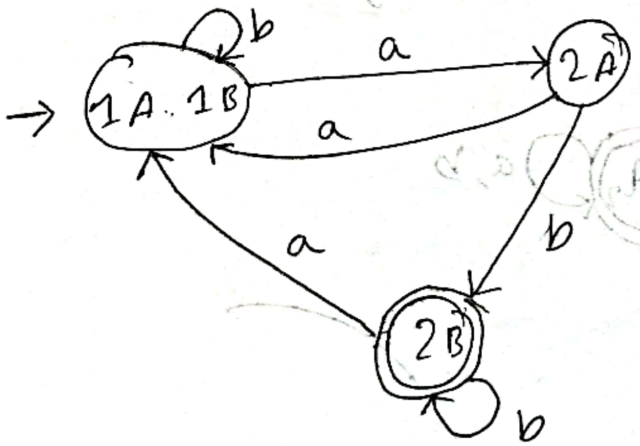


	a	b
1A	2A	1B
1B	2A	1B
2A	1A	(2B)
2B	1A	(2B)

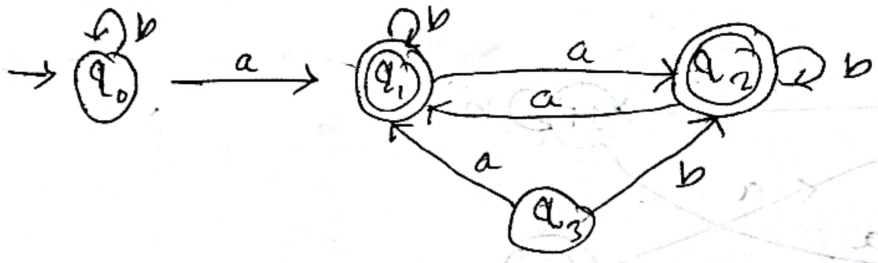
0 equivalent : {1A, 1B, 2A}, {2B}

1 - " : {1A, 1B}, {2A}, {2B}

2 " : {1A, 1B}, {2A}, {2B}



T51 DFA minimization



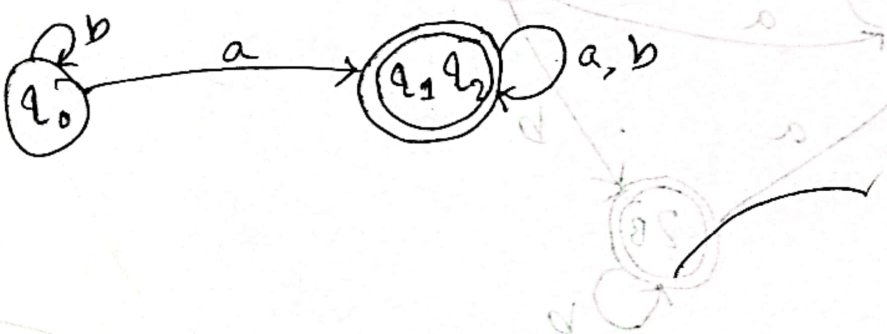
Sol

	a	b
q_0	$*q_1$	q_0
$*q_1$	$*q_2$	$*q_1$
$*q_2$	$*q_1$	$*q_2$

Equivalent

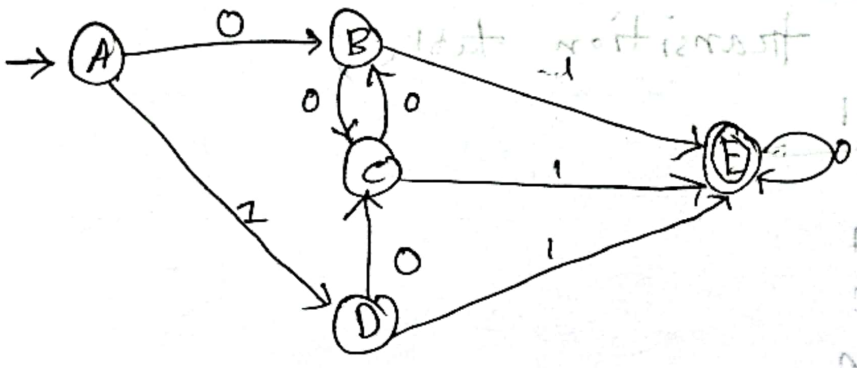
0 $\{q_0\}$ $\{q_1, q_2\}$

1 $\{q_0\}$ $\{q_1, q_2\}$



T52

Minimization of DFA



Sol

(1) / Transition table

	0	1
A	B	D
B	C	*E
C	B	*E
D	C	*E
*E	*E	*E

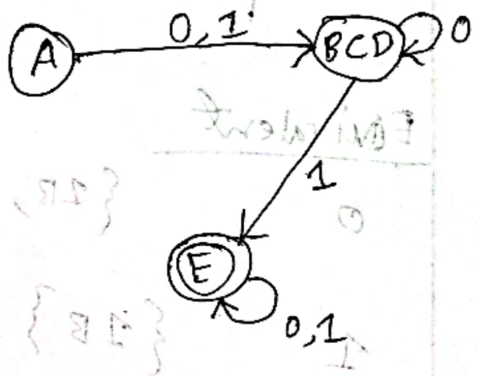
(2) Equivalent

0 $\{A, B, C, D\}$ $\{E\}$

1 $\{A\}$ $\{B, C, D\}$ $\{E\}$

2 $\{A\}$ $\{B, C, D\}$ $\{E\}$

(3) Now new DFA (mDFA),



T53 mDFA

Given state transition table,

	0	1
→ *1A	2B	*1A
1B	2C	*1A
1C	2C	1C
2A	2B	2A
2B	1C	2A
2C	1C	2C

Equivalent

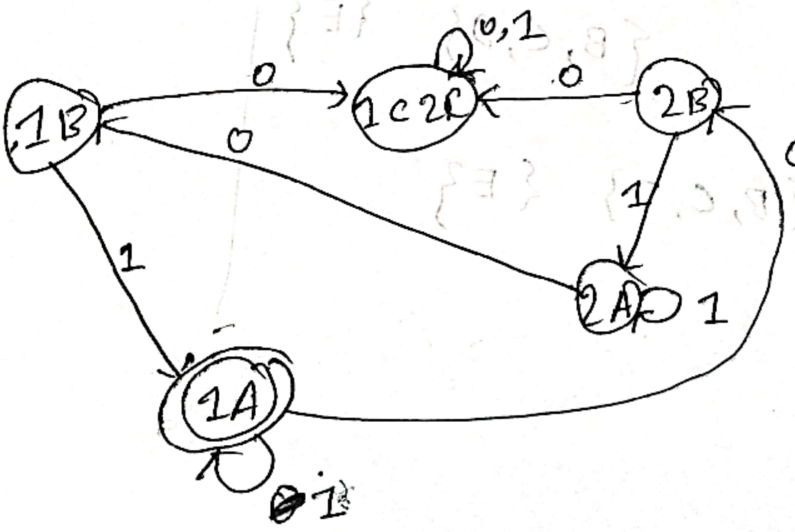
0 {2B, 1C, 2A, 2B, 2C} {1A}

1 {1B} {1C, 2A, 2B, 2C} {1A}

2 {1B} {1C, 2B, 2C} {2A} {1A}

3 {1B} {1C, 2C} {2B} {1A}

4 {1B} {1C, 2C} {2B} {2A} {1A}



T54 mDFA (Last ex)

Transition table

	a	b
1A	*2A	3B
* 2A	*2A	*2B
* 2B	*2B	2C
2C	2C	2C
3B	3B	3C
3C	3C	3C

Equivalent

0 {1A, 2C, 3B, 3C} {2A, 2B}

1 {1A} {2C, 3B, 3C} {2A} {2B}

2 {1A} {2C, 3B, 3C} {2A} {2B}