Lecture 4

Epsilon (ε) – NFA

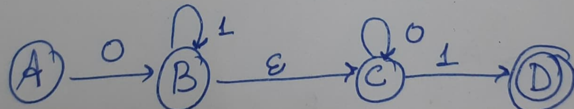
- ε → empty symbols

↳ $\{Q, \Sigma, q_0, F, \delta\}$

δ ↓ only this is different.

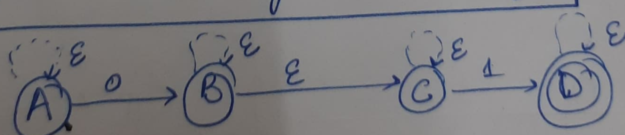
$Q \times \Sigma \cup \varepsilon \rightarrow 2^Q$

↓ State on seeing nothing or empty symbol can go to 2^Q.

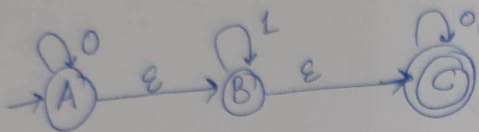
eg:- 

: ε-NFA

** $\boxed{\text{Every state on } \varepsilon \text{ goes to itself}}$



Conversion of ε-NFA $\longrightarrow$ NFA :



Rule : (i) for each State that we have, check where this state goes on ε^* and so on.

All the States that can be reached from a particular State only by seeing the ε symbol.

$$A \to A, \quad A \to B, \quad B \to B, \quad B \to C$$

$\therefore$ $A \to B \to C$ $\therefore$ (ε^* of A) = ABC

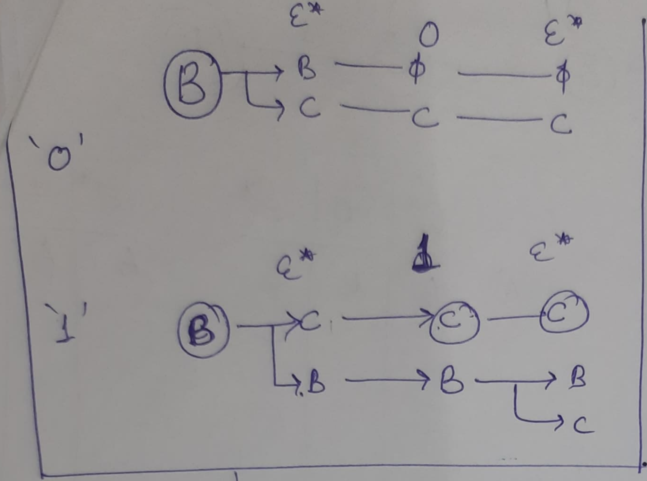
Q \ Σ	0	1
→ A	{A, B, C}	{B, C}
B	C	{B,C}
C	C	C

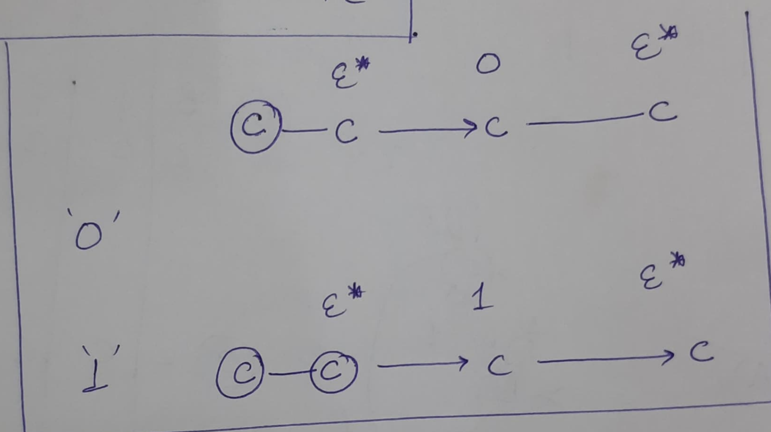
'0'

	ε^*	0	ε^*
A	A	A	A, B, C
	B	ϕ	×
	C	C	C

'1'

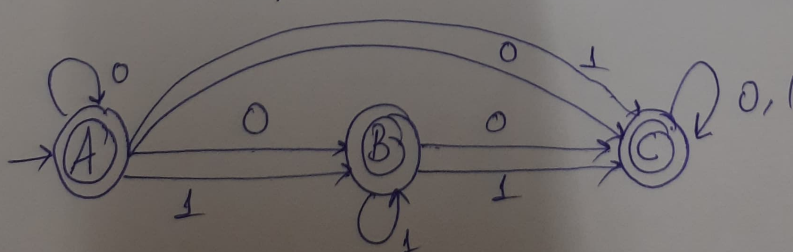
	ε^*	1	ε^*
A	A	ϕ	×
	B	B	B, C
	C	C	C



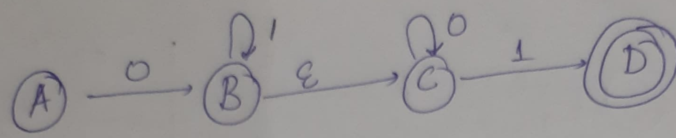


** Final state will be any state that can reach the final state only by seeing ε.

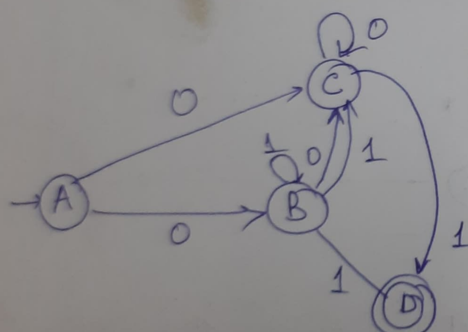
∴ A, B & C are all final state.



Eg2 :



	0	1
→A	B, C	ϕ
B	C	B, C, D
C	C	D
D	ϕ	ϕ



	ε^*	0	ε^*
A	A	B	B, C
B	B, C	ϕ, C	ϕ, C
C	C	C	C
D	D	ϕ	ϕ

ε^*	1	ε^*
A	A	ϕ
B, C	B, D	B, C, D
C	D	D
D	ϕ	ϕ

$$q_3 = \underbrace{q_2}_{\text{eq(v)}} a$$

$$\Rightarrow \underbrace{q_1}_{\text{eq(vi)}} a(b+ab)^* a$$

$$\boxed{q_3 \Rightarrow (a+a(b+ab)^* b)^* a(b+ab)^* a}$$

Now all are in input a,b ∴ it is RE.