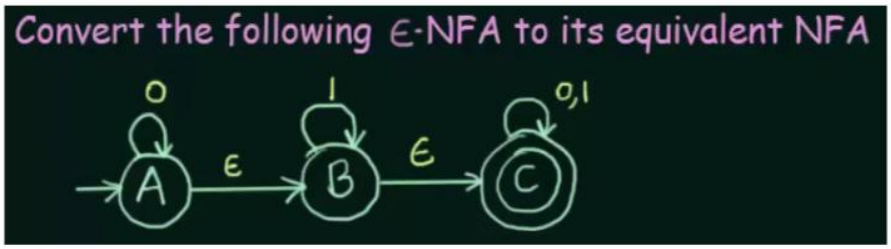
ϵ - NFA to NFA

Core concept:

Every state on ϵ goes to itself



NOTE:

ϵ-Closure (ϵ^*) - All the states that can be reached from a particular state only by seeing the ϵ symbol

	ϵ^*	0	ϵ^*
A	A	A	A,B,C
	B	ϕ	
	C	C	C

	ϵ^*	1	ϵ^*
A	A	ϕ	
	B	B	B,C
	C	C	C

	ϵ^*	0	ϵ^*
B	B	ϕ	
	C	C	C

	ϵ^*	1	ϵ^*
B	B	B	B,C
	C	C	C

	ϵ^*	0	ϵ^*
C	C	C	C

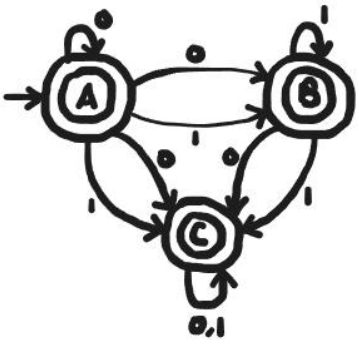
	ϵ^*	1	ϵ^*
C	C	C	C

→

	0	1
→ A	A,B,C	B,C
B	C	B,C
C	C	C

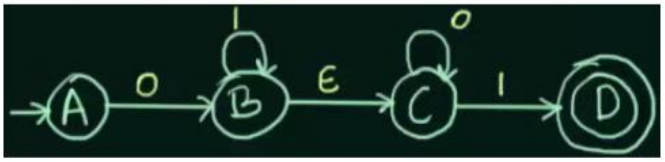
What will be the final state?
Any state that can reach the final state by seeing epsilon is a final state

	0	1
→ * A	A,B,C	B,C
* B	C	B,C
* C	C	C



ϵ - NFA to NFA

Convert the following ϵ-NFA to its equivalent NFA



	ϵ^*	0	ϵ^*
A	A	B	B.C

	ϵ^*	1	ϵ^*
A	A	ϕ	

	ϵ^*	0	ϵ^*
B	B	ϕ	
	C	C	C

	ϵ^*	1	ϵ^*
B	B	B	B.C
	C	D	D

	ϵ^*	0	ϵ^*
C	C	C	C

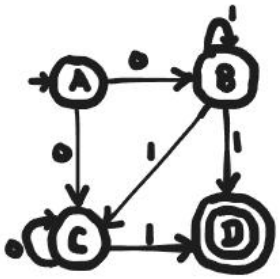
	ϵ^*	1	ϵ^*
C	C	D	D

	ϵ^*	0	ϵ^*
D	D	ϕ	

	ϵ^*	1	ϵ^*
	D	ϕ	

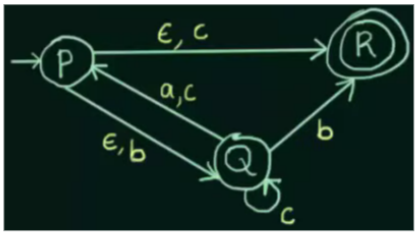
→

	0	1
→A	B.C	ϕ
B	C	B.C.D
C	C	D
*D	ϕ	ϕ



ϵ - NFA to NFA

Convert the following ϵ-NFA to its equivalent NFA



	ϵ^*	a	ϵ^*
P	P	ϕ	
	R	ϕ	
	Q	P	P,R,Q

	ϵ^*	b	ϵ^*
P	P	Q	Q
	R	ϕ	
	Q	R	R

	ϵ^*	c	ϵ^*
P	P	R	R
	R	ϕ	
	Q	Q	Q

	ϵ^*	a	ϵ^*
Q	Q	P	P,R,Q

	ϵ^*	b	ϵ^*
Q	Q	R	R

	ϵ^*	c	ϵ^*
Q	Q	Q	Q

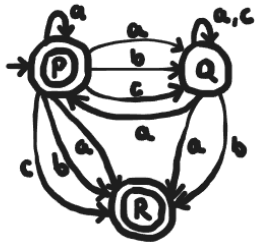
	ϵ^*	a	ϵ^*
R	R	ϕ	

	ϵ^*	a	ϵ^*
R	R	ϕ	

	ϵ^*	a	ϵ^*
R	R	ϕ	

→

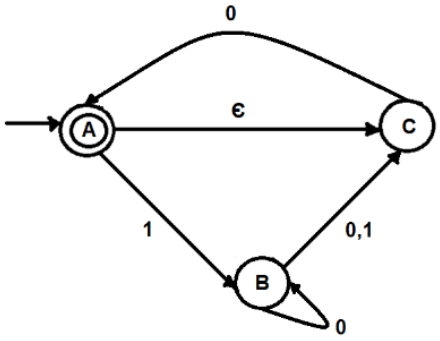
	a	b	c
→P	P,Q,R	Q,R	Q,R
Q	P,Q,R	R	Q
*R	ϕ	ϕ	ϕ



EXAMPLE

- Convert the following Є-NFA into NFA

1.



	ϵ*	0	ϵ*
A	A	ϕ	
	C	A	A,C

	ϵ*	1	ϵ*
A	A	B	B
	C	ϕ	

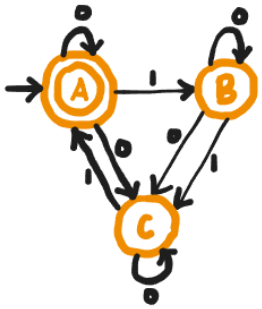
	ϵ*	0	ϵ*
B	B	B,C	B,C

	ϵ*	1	ϵ*
B	B	C	C

	ϵ*	0	ϵ*
C	C	A	A,C

	ϵ*	1	ϵ*
C	C	ϕ	

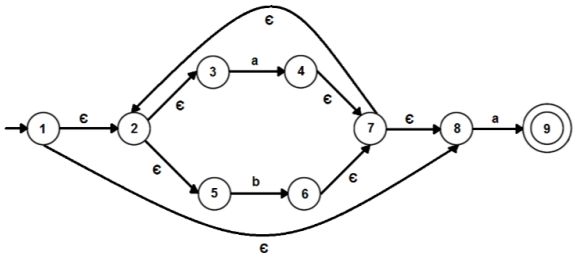
	0	1
→*A	A,C	B
B	B,C	C
C	A,C	ϕ



EXAMPLE

- Convert the following Є-NFA into NFA

2.



	ϵ*	a	ϵ*
1	1	ϕ	
	2	ϕ	
	3	4	4,2,3,5,7,8
	5	ϕ	
	8	9	9

	ϵ*	b	ϵ*
1	1	ϕ	
	2	ϕ	
	3	ϕ	
	5	6	6,2,3,5,7,8
	8	ϕ	

	ϵ*	a	ϵ*
6	6	ϕ	
	7	ϕ	
	8	9	9

	ϵ*	b	ϵ*
6	6	ϕ	
	7	ϕ	
	8	ϕ	

	ϵ*	a	ϵ*
2	2	ϕ	
	3	4	4,2,3,5,7,8

	ϵ*	b	ϵ*
2	2	ϕ	
	3	ϕ	

	ϵ*	a	ϵ*
7	7	ϕ	
	1	ϕ	
	2	ϕ	
	3	4	4,2,3,5,7,8
	5	ϕ	
	8	9	9

	ϵ*	b	ϵ*
7	7	ϕ	
	1	ϕ	
	2	ϕ	
	3	ϕ	
	5	6	6,2,3,5,7,8
	8	ϕ	

	ϵ*	a	ϵ*
3	3	4	4,2,3,5,7,8

	ϵ*	b	ϵ*
3	3	ϕ	ϕ

	ϵ*	a	ϵ*
8	8	9	9

	ϵ*	b	ϵ*
8	8	ϕ	

	ϵ*	a	ϵ*
4	4	ϕ	
	7	ϕ	
	8	9	9

	ϵ*	b	ϵ*
4	4	ϕ	
	7	ϕ	
	8	ϕ	

	ϵ*	a	ϵ*
9	9	ϕ	

	ϵ*	b	ϵ*
9	9	ϕ	

	ϵ*	a	ϵ*
5	5	ϕ	

	ϵ*	b	ϵ*
5	5	6	6,2,3,5,7,8

	a	b
→1	1,2,3,4,5,7,8,9	2,3,5,6,7,8
2	1,2,3,4,5,7,8	ϕ
3	1,2,3,4,5,7,8	ϕ
4	9	ϕ
5	ϕ	2,3,5,6,7,8
6	9	ϕ
7	1,2,3,4,5,7,8,9	2,3,5,6,7,8
8	9	ϕ
*9	ϕ	ϕ