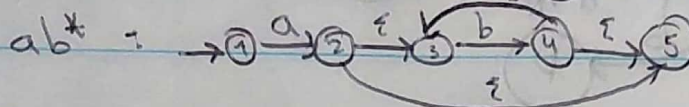
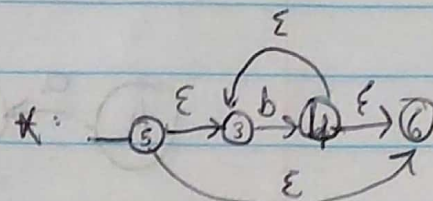
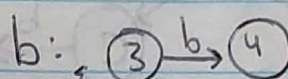
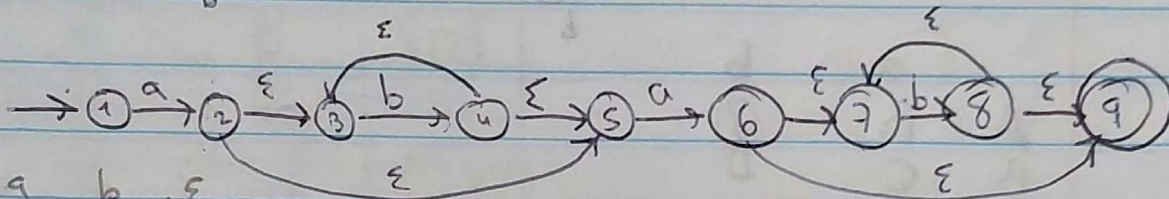


$ab^*ab^*$

AFN



$ab^*ab^*$



	a	b	$\epsilon$
1	{2}	$\emptyset$	$\emptyset$
2	$\emptyset$	$\emptyset$	{3, 5}
3	$\emptyset$	{4}	$\emptyset$
4	$\emptyset$	$\emptyset$	{5, 3}
5	{6}	$\emptyset$	$\emptyset$
6	$\emptyset$	$\emptyset$	{7, 9}
7	$\emptyset$	{8}	$\emptyset$
8	$\emptyset$	$\emptyset$	{9, 7}
9	$\emptyset$	$\emptyset$	$\emptyset$

AFD

$$\epsilon\text{-closure}(\{1\}) = \{1\} = A$$

$$\epsilon\text{-closure}(\text{move}(A, a)) = \epsilon\text{-closure}(\{2\}) = \{2, 3, 5\} = B$$

$$\epsilon\text{-closure}(\text{move}(A, b)) = \epsilon\text{-closure}(\{\emptyset\}) = \{\emptyset\}$$

$$\epsilon\text{-closure}(\text{move}(B, a)) = \epsilon\text{-closure}(\{6\}) = \{6, 7, 9\} = C$$

$$\epsilon\text{-closure}(\text{move}(B, b)) = \epsilon\text{-closure}(\{4\}) = \{4, 5, 3\} = D$$

$$\epsilon\text{-closure}(\text{move}(C, a)) = \epsilon\text{-closure}(\{\emptyset\}) = \{\emptyset\}$$

$$\epsilon\text{-closure}(\text{move}(C, b)) = \epsilon\text{-closure}(\{8\}) = \{8, 7, 9\} = E$$

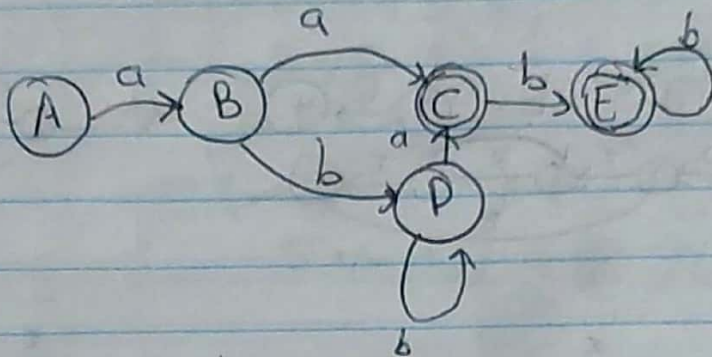
$$\epsilon\text{-closure}(\text{move}(D, a)) = \epsilon\text{-closure}(\{6\}) = \{6, 7, 9\} = C$$

$$\epsilon\text{-closure}(\text{move}(D, b)) = \epsilon\text{-closure}(\{4\}) = D$$

$$\epsilon\text{-closure}(\text{move}(E, a)) = \epsilon\text{-closure}(\{\emptyset\}) = \{\emptyset\}$$

$$\epsilon\text{-closure}(\text{move}(E, b)) = \epsilon\text{-closure}(\{8\}) = E$$

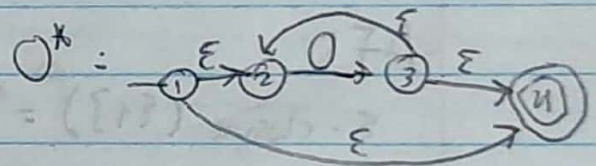
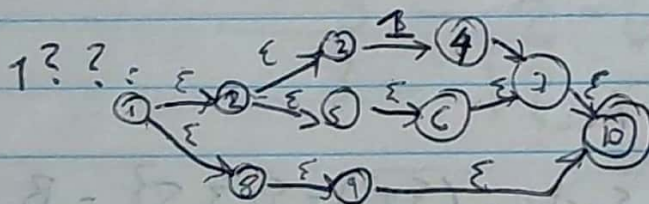
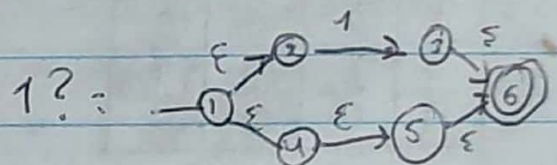
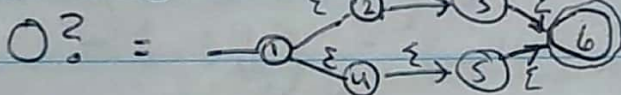
$\epsilon$	/
a	/
b	/
$\emptyset$	/
A	/



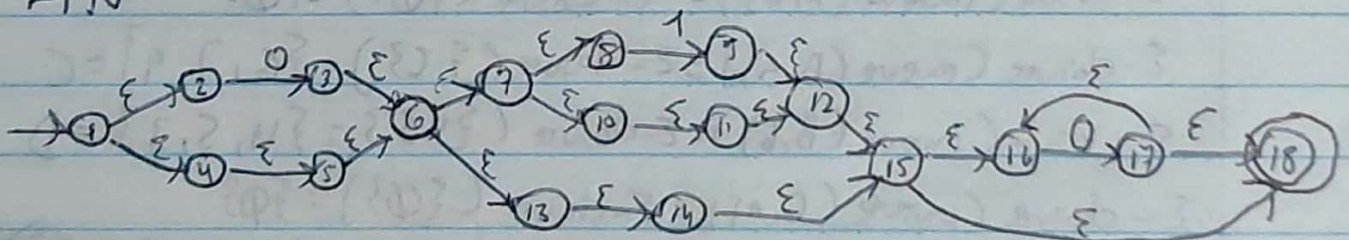
	a	b
A	B	$\emptyset$
B	C	D
C	$\emptyset$	E
D	C	D
E	$\emptyset$	E

$\emptyset^? (1^?)^? \emptyset^*$

$\emptyset^? = (\epsilon)$



AFN





	0	1	$\Sigma$
1	$\emptyset$	$\emptyset$	$\{2, 4\}$
2	$\{3\}$	$\emptyset$	$\emptyset$
3	$\emptyset$	$\emptyset$	$\{6\}$
4	$\emptyset$	$\emptyset$	$\{5\}$
5	$\emptyset$	$\emptyset$	$\{6\}$
6	$\emptyset$	$\emptyset$	$\{7, 13\}$
7	$\emptyset$	$\emptyset$	$\{8, 10\}$
8	$\emptyset$	$\{9\}$	$\emptyset$
9	$\emptyset$	$\emptyset$	$\{12\}$
10	$\emptyset$	$\emptyset$	$\{11\}$
11	$\emptyset$	$\emptyset$	$\{12\}$
12	$\emptyset$	$\emptyset$	$\{15\}$
13	$\emptyset$	$\emptyset$	$\{14\}$
14	$\emptyset$	$\emptyset$	$\{15\}$
15	$\emptyset$	$\emptyset$	$\{16, 18\}$
16	$\{17\}$	$\emptyset$	$\emptyset$
17	$\emptyset$	$\emptyset$	$\{18, 16\}$
18	$\emptyset$	$\emptyset$	$\emptyset$

AFD

D  
C  
B  
A

$$\Sigma\text{-closure}(\{1\}) = \{1, 2, 4, 5, 6, 7, 8, 10, 14, 12, 13, 14, 15, 16, 18\} = A$$

$$\Sigma\text{-closure}(\text{mueva}(A, 0)) = \Sigma\text{-closure}(\{3, 17\}) = \{3, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18\} = B$$

$$\Sigma\text{-closure}(\text{mueva}(A, 1)) = \Sigma\text{-closure}(\{9\}) = \{12, 15, 9, 16, 18\} = C$$

$$\Sigma\text{-closure}(\text{mueva}(B, 0)) = \Sigma\text{-closure}(\{17\}) = \{17, 16, 18\} = D$$

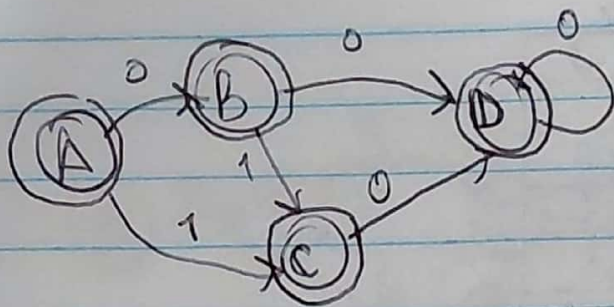
$$\Sigma\text{-closure}(\text{mueva}(B, 1)) = \Sigma\text{-closure}(\{9\}) = C$$

$$\Sigma\text{-closure}(\text{mueva}(C, 0)) = \Sigma\text{-closure}(\{12\}) = D$$

$$\Sigma\text{-closure}(\text{mueva}(C, 1)) = \Sigma\text{-closure}(\{\emptyset\}) = \emptyset$$

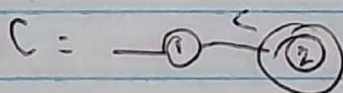
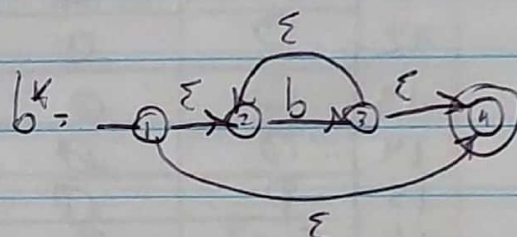
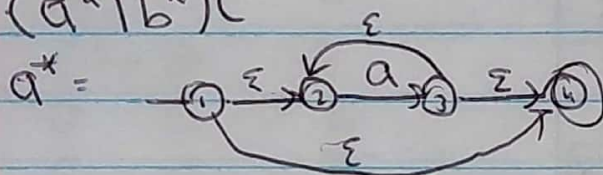
$$\Sigma\text{-closure}(\text{mueva}(D, 0)) = \Sigma\text{-closure}(\{17\}) = D$$

$$\Sigma\text{-closure}(\text{mueva}(D, 1)) = \Sigma\text{-closure}(\{\emptyset\}) = \emptyset$$

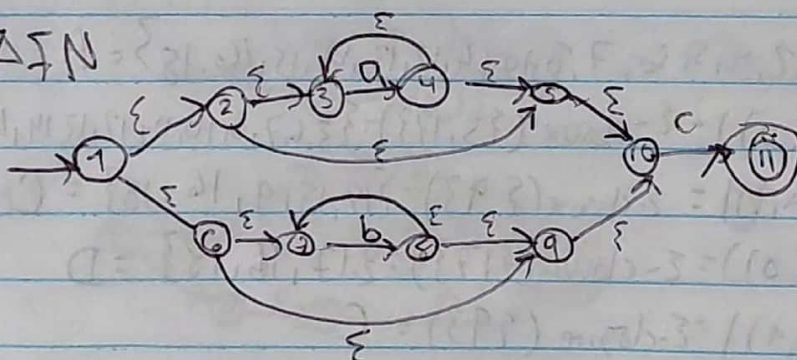


	0	1
A	B	C
B	D	C
C	D	$\emptyset$
D	D	$\emptyset$

$(a^*1b^*)c$



$A \cap N$



	a	b	c	$\epsilon$
1	$\emptyset$	$\emptyset$	$\emptyset$	$\{2, 6\}$
2	$\emptyset$	$\emptyset$	$\emptyset$	$\{3, 5\}$
3	$\{4\}$	$\emptyset$	$\emptyset$	$\emptyset$
4	$\emptyset$	$\emptyset$	$\emptyset$	$\{5, 3\}$
5	$\emptyset$	$\emptyset$	$\emptyset$	$\{10\}$
6	$\emptyset$	$\emptyset$	$\emptyset$	$\{7, 9\}$
7	$\emptyset$	$\{8\}$	$\emptyset$	$\emptyset$
8	$\emptyset$	$\emptyset$	$\emptyset$	$\{9, 7\}$
9	$\emptyset$	$\emptyset$	$\emptyset$	$\{10\}$
10	$\emptyset$	$\emptyset$	$\{11\}$	$\emptyset$
11	$\emptyset$	$\emptyset$	$\emptyset$	$\emptyset$



AFD

D  
C  
B  
A

$$\Sigma\text{-closure}(\{1\}) = \{2, 3, 5, 1, 6, 7, 9, 10\} = A$$

$$\Sigma\text{-closure}(\text{mueve}(A, a)) = \Sigma\text{-closure}(\{4\}) = \{4, 3, 5, 10\} = B$$

$$\Sigma\text{-closure}(\text{mueve}(A, b)) = \Sigma\text{-closure}(\{8\}) = \{8, 7, 9, 10\} = C$$

$$\Sigma\text{-closure}(\text{mueve}(A, c)) = \Sigma\text{-closure}(\{11\}) = \{11\} = D$$

$$\Sigma\text{-closure}(\text{mueve}(B, a)) = \Sigma\text{-closure}(\{4\}) = B$$

$$\Sigma\text{-closure}(\text{mueve}(B, b)) = \Sigma\text{-closure}(\{\emptyset\}) = \emptyset$$

$$\Sigma\text{-closure}(\text{mueve}(B, c)) = \Sigma\text{-closure}(\{11\}) = \{11\} = D$$

$$\Sigma\text{-closure}(\text{mueve}(C, a)) = \Sigma\text{-closure}(\{\emptyset\}) = \emptyset$$

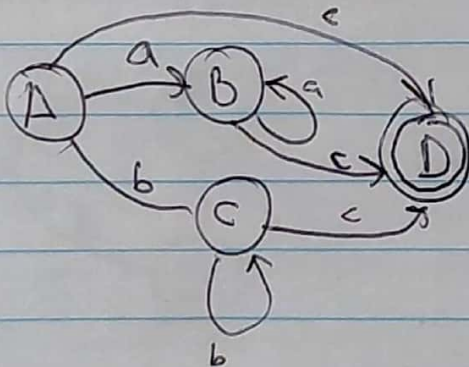
$$\Sigma\text{-closure}(\text{mueve}(C, b)) = \Sigma\text{-closure}(\{8\}) = C$$

$$\Sigma\text{-closure}(\text{mueve}(C, c)) = \Sigma\text{-closure}(\{11\}) = \{11\} = D$$

$$\Sigma\text{-closure}(\text{mueve}(D, a)) = \Sigma\text{-closure}(\{\emptyset\}) = \emptyset$$

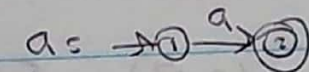
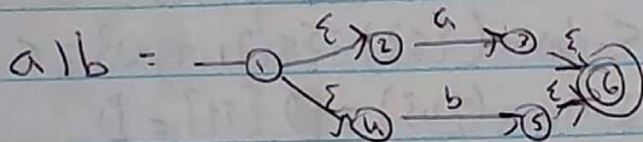
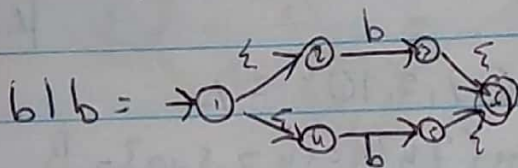
$$\Sigma\text{-closure}(\text{mueve}(D, b)) = \Sigma\text{-closure}(\{\emptyset\}) = \emptyset$$

$$\Sigma\text{-closure}(\text{mueve}(D, c)) = \Sigma\text{-closure}(\{\emptyset\}) = \emptyset$$

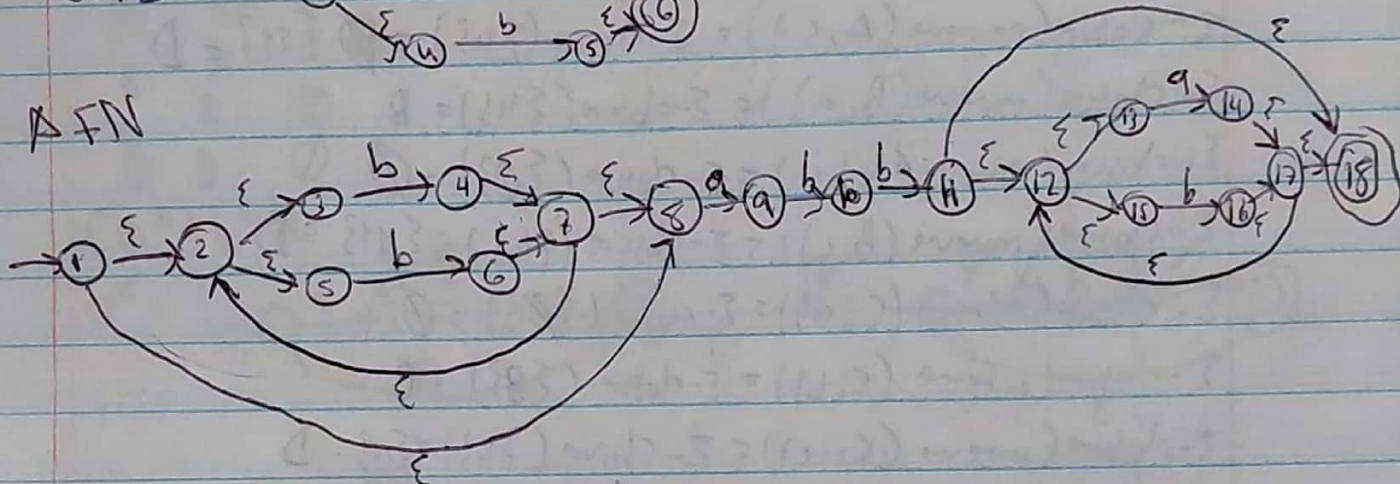


	a	b	c
A	B	C	D
B	B	$\emptyset$	D
C	$\emptyset$	C	D
D	$\emptyset$	$\emptyset$	$\emptyset$

$(b|b)^*abb(a|b)^*$



$\Delta$  FN



	a	b	$\epsilon$
1	$\emptyset$	$\emptyset$	$\{2,8\}$
2	$\emptyset$	$\emptyset$	$\{3,5\}$
3	$\emptyset$	$\{4\}$	$\emptyset$
4	$\emptyset$	$\emptyset$	$\{7\}$
5	$\emptyset$	$\{6\}$	$\emptyset$
6	$\emptyset$	$\emptyset$	$\{7\}$
7	$\emptyset$	$\emptyset$	$\{8,12\}$
8	$\{9\}$	$\emptyset$	$\emptyset$
9	$\emptyset$	$\{10\}$	$\emptyset$
10	$\emptyset$	$\{11\}$	$\emptyset$
11	$\emptyset$	$\emptyset$	$\{12,18\}$
12	$\emptyset$	$\emptyset$	$\{13,15\}$
13	$\{14\}$	$\emptyset$	$\emptyset$
14	$\emptyset$	$\emptyset$	$\{17\}$
15	$\emptyset$	$\{16\}$	$\emptyset$
16	$\emptyset$	$\emptyset$	$\{17\}$
17	$\emptyset$	$\emptyset$	$\{18,12\}$
18	$\emptyset$	$\emptyset$	$\emptyset$



# AFD

$$\Sigma\text{-closure}(\{13\}) = \{1, 2, 3, 5, 8\} = A$$

$$\Sigma\text{-closure}(\text{mueva}(A, a)) = \Sigma\text{-closure}(\{9\}) = \{9\} = B$$

$$\Sigma\text{-closure}(\text{mueva}(A, b)) = \Sigma\text{-closure}(\{4, 6\}) = \{4, 7, 8, 6, 2, 3, 5\} = C$$

$$\Sigma\text{-closure}(\text{mueva}(B, a)) = \Sigma\text{-closure}(\{\emptyset\}) = \emptyset$$

$$\Sigma\text{-closure}(\text{mueva}(B, b)) = \Sigma\text{-closure}(\{10\}) = \{10\} = D$$

$$\Sigma\text{-closure}(\text{mueva}(C, a)) = \Sigma\text{-closure}(\{9\}) = B$$

$$\Sigma\text{-closure}(\text{mueva}(C, b)) = \Sigma\text{-closure}(\{4, 6\}) = C$$

$$\Sigma\text{-closure}(\text{mueva}(D, a)) = \Sigma\text{-closure}(\{\emptyset\}) = \emptyset$$

$$\Sigma\text{-closure}(\text{mueva}(D, b)) = \Sigma\text{-closure}(\{11\}) = \{11, 12, 13, 15, 18\} = E$$

$$\Sigma\text{-closure}(\text{mueva}(E, a)) = \Sigma\text{-closure}(\{14\}) = \{17, 12, 14, 13, 15, 18\} = F$$

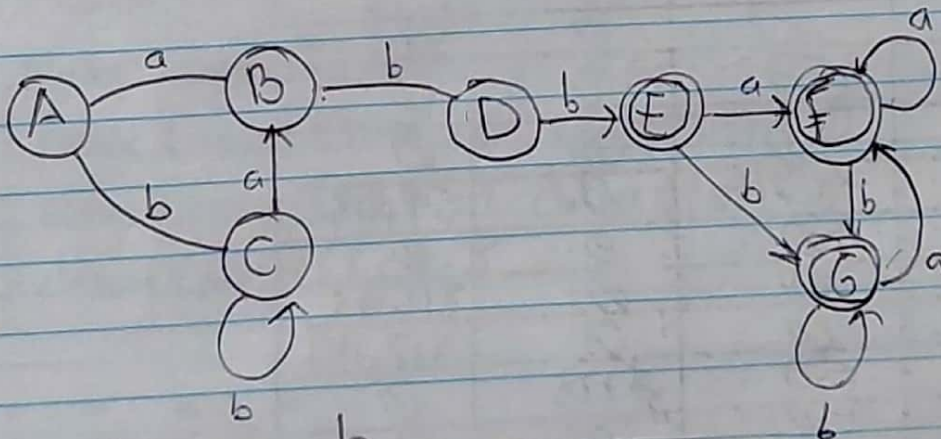
$$\Sigma\text{-closure}(\text{mueva}(E, b)) = \Sigma\text{-closure}(\{16\}) = \{16, 17, 12, 13, 15, 18\} = G$$

$$\Sigma\text{-closure}(\text{mueva}(F, a)) = \Sigma\text{-closure}(\{14\}) = F$$

$$\Sigma\text{-closure}(\text{mueva}(F, b)) = \Sigma\text{-closure}(\{16\}) = G$$

$$\Sigma\text{-closure}(\text{mueva}(G, a)) = \Sigma\text{-closure}(\{14\}) = F$$

$$\Sigma\text{-closure}(\text{mueva}(G, b)) = \Sigma\text{-closure}(\{16\}) = G$$



A  
B  
C  
D  
E  
F  
G

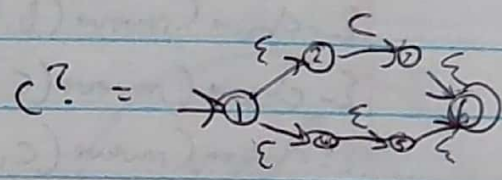
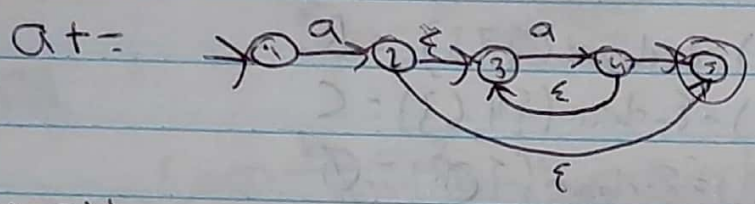
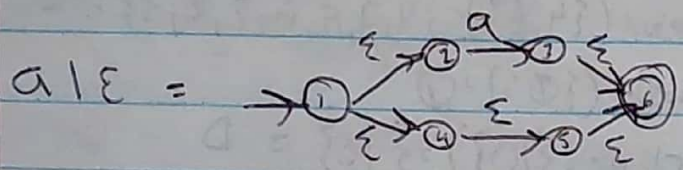
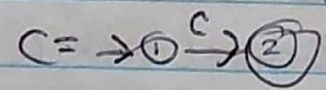
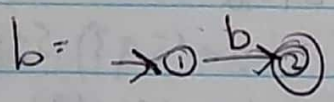
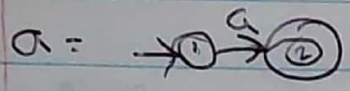
a  
B  
∅  
B  
∅  
F  
F

b  
∅  
C  
D  
E  
G  
G

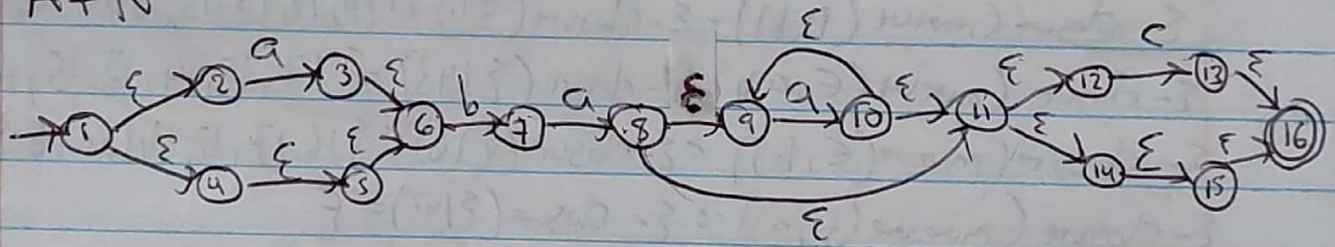


$(a|\epsilon)b(a^+)c?$

$r^+ = r r^*$   $r? = (r|\epsilon)$



AFN



	a	b	c	$\epsilon$
1	$\emptyset$	$\emptyset$	$\emptyset$	$\{2,4,3\}$
2	$\{3\}$	$\emptyset$	$\emptyset$	$\emptyset$
3	$\emptyset$	$\emptyset$	$\emptyset$	$\{6\}$
4	$\emptyset$	$\emptyset$	$\emptyset$	$\{5\}$
5	$\emptyset$	$\emptyset$	$\emptyset$	$\{6\}$
6	$\emptyset$	$\{7\}$	$\emptyset$	$\emptyset$
7	$\{8\}$	$\emptyset$	$\emptyset$	$\emptyset$
8	$\emptyset$	$\emptyset$	$\emptyset$	$\{9,11\}$
9	$\{10\}$	$\emptyset$	$\emptyset$	$\emptyset$
10	$\emptyset$	$\emptyset$	$\emptyset$	$\{11,9\}$
11	$\emptyset$	$\emptyset$	$\emptyset$	$\{12,14\}$
12	$\emptyset$	$\emptyset$	$\{13\}$	$\emptyset$
13	$\emptyset$	$\emptyset$	$\emptyset$	$\{16\}$
14	$\emptyset$	$\emptyset$	$\emptyset$	$\{15\}$
15	$\emptyset$	$\emptyset$	$\emptyset$	$\{16\}$
16	$\emptyset$	$\emptyset$	$\emptyset$	$\emptyset$



$\Delta F D$

$\begin{matrix} D \\ B \\ A \end{matrix}$	$\begin{matrix} F \\ E \end{matrix}$
---	--------------------------------------

$$\Sigma\text{-closure}(\{13\}) = \{1, 2, 4, 5, 6\} = A$$

$$\Sigma\text{-closure}(\text{mueva}(A, a)) = \Sigma\text{-closure}(\{3\}) = \{3, 6\} = B$$

$$\Sigma\text{-closure}(\text{mueva}(A, b)) = \Sigma\text{-closure}(\{7\}) = \{7\} = C$$

$$\Sigma\text{-closure}(\text{mueva}(A, c)) = \Sigma\text{-closure}(\emptyset) = \emptyset$$

$$\Sigma\text{-closure}(\text{mueva}(B, a)) = \Sigma\text{-closure}(\{0\}) = \emptyset$$

$$\Sigma\text{-closure}(\text{mueva}(B, b)) = \Sigma\text{-closure}(\{7\}) = C$$

$$\Sigma\text{-closure}(\text{mueva}(B, c)) = \Sigma\text{-closure}(\emptyset) = \emptyset$$

$$\Sigma\text{-closure}(\text{mueva}(C, a)) = \Sigma\text{-closure}(\{8\}) = \{8, 9, 11, 12, 14, 15, 16\} = D$$

$$\Sigma\text{-closure}(\text{mueva}(C, b)) = \Sigma\text{-closure}(\{0\}) = \emptyset$$

$$\Sigma\text{-closure}(\text{mueva}(C, c)) = \Sigma\text{-closure}(\{0\}) = \emptyset$$

$$\Sigma\text{-closure}(\text{mueva}(D, a)) = \Sigma\text{-closure}(\{10\}) = \{10, 11, 9, 12, 14, 15, 16\} = E$$

$$\Sigma\text{-closure}(\text{mueva}(D, b)) = \Sigma\text{-closure}(\{0\}) = \emptyset$$

$$\Sigma\text{-closure}(\text{mueva}(D, c)) = \Sigma\text{-closure}(\{13\}) = \{13, 16\} = F$$

$$\Sigma\text{-closure}(\text{mueva}(E, a)) = \Sigma\text{-closure}(\{10\}) = E$$

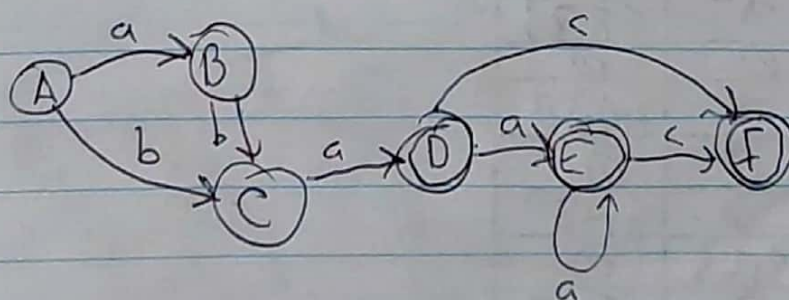
$$\Sigma\text{-closure}(\text{mueva}(E, b)) = \Sigma\text{-closure}(\{0\}) = \emptyset$$

$$\Sigma\text{-closure}(\text{mueva}(E, c)) = \Sigma\text{-closure}(\{13\}) = F$$

$$\Sigma\text{-closure}(\text{mueva}(F, a)) = \Sigma\text{-closure}(\{0\}) = \emptyset$$

$$\Sigma\text{-closure}(\text{mueva}(F, b)) = \Sigma\text{-closure}(\{0\}) = \emptyset$$

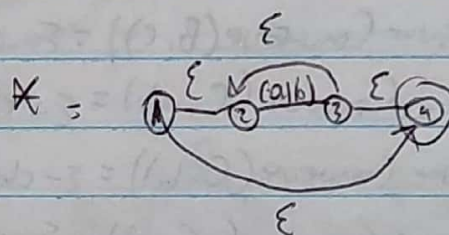
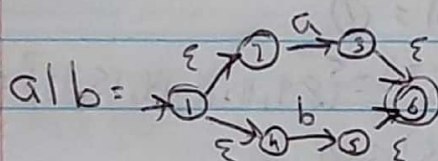
$$\Sigma\text{-closure}(\text{mueva}(F, c)) = \Sigma\text{-closure}(\{0\}) = \emptyset$$



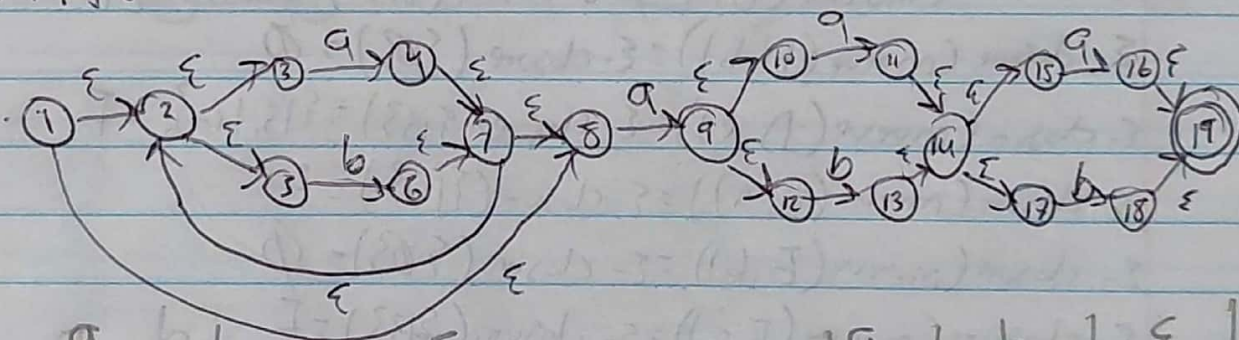


	a	b	c
A	B	C	$\emptyset$
B	$\emptyset$	C	$\emptyset$
C	D	$\emptyset$	$\emptyset$
D	E	$\emptyset$	F
E	E	$\emptyset$	F
F	$\emptyset$	$\emptyset$	$\emptyset$

$(alb)^* a (alb) (alb)$



AFN



	a	b	$\epsilon$
1	$\emptyset$	$\emptyset$	$\{2, 8\}$
2	$\emptyset$	$\emptyset$	$\{3, 5\}$
3	$\{4\}$	$\emptyset$	$\emptyset$
4	$\emptyset$	$\emptyset$	$\{7\}$
5	$\emptyset$	$\{6\}$	$\emptyset$
6	$\emptyset$	$\emptyset$	$\{7\}$
7	$\emptyset$	$\emptyset$	$\{8, 2\}$
8	$\{9\}$	$\emptyset$	$\emptyset$
9	$\emptyset$	$\emptyset$	$\{10, 12\}$
10	$\{11\}$	$\emptyset$	$\emptyset$
11	$\emptyset$	$\emptyset$	$\{14\}$
12	$\emptyset$	$\{13\}$	$\emptyset$
13	$\emptyset$	$\emptyset$	$\{14\}$
14	$\emptyset$	$\emptyset$	$\{15, 17\}$
15	$\{16\}$	$\emptyset$	$\emptyset$
16	$\emptyset$	$\emptyset$	$\{19\}$



ABCEDEFGHI

DFD

$$\varepsilon\text{-closure}(\{13\}) = \{1, 2, 3, 5, 8\} = A$$

$$\varepsilon\text{-closure}(\text{move}(A, a)) = \varepsilon\text{-closure}(\{4, 9\}) = \{4, 7, 2, 3, 5, 8, 9, 10, 17\} = B$$

$$\varepsilon\text{-closure}(\text{move}(A, b)) = \varepsilon\text{-closure}(\{6\}) = \{6, 7, 2, 3, 5, 8\} = C$$

$$\varepsilon\text{-closure}(\text{move}(B, a)) = \varepsilon\text{-closure}(\{4, 9, 11\}) = \{4, 7, 2, 3, 5, 8, 9, 10, 12, 11, 14, 15, 17\} = D$$

$$\varepsilon\text{-closure}(\text{move}(B, b)) = \varepsilon\text{-closure}(\{6, 13\}) = \{6, 7, 2, 3, 5, 8, 13, 14, 15, 17\} = E$$

$$\varepsilon\text{-closure}(\text{move}(C, a)) = \varepsilon\text{-closure}(\{4, 9\}) = B$$

$$\varepsilon\text{-closure}(\text{move}(C, b)) = \varepsilon\text{-closure}(\{6\}) = C$$

$$\varepsilon\text{-closure}(\text{move}(D, a)) = \varepsilon\text{-closure}(\{4, 9, 11, 16\}) = \{4, 7, 2, 3, 5, 8, 9, 10, 12, 11, 14, 15, 17, 16, 19\} = F$$

$$\varepsilon\text{-closure}(\text{move}(D, b)) = \varepsilon\text{-closure}(\{6, 13, 18\}) = \{6, 7, 2, 3, 5, 8, 13, 14, 15, 17, 18, 19\} = G$$

$$\varepsilon\text{-closure}(\text{move}(E, a)) = \varepsilon\text{-closure}(\{4, 9, 16\}) = \{4, 7, 2, 3, 5, 8, 9, 10, 12, 16, 19\} = H$$

$$\varepsilon\text{-closure}(\text{move}(E, b)) = \varepsilon\text{-closure}(\{6, 18\}) = \{6, 7, 2, 3, 5, 8, 18, 19\} = I$$

$$\varepsilon\text{-closure}(\text{move}(F, a)) = \varepsilon\text{-closure}(\{4, 9, 11, 16\}) = F$$

$$\varepsilon\text{-closure}(\text{move}(F, b)) = \varepsilon\text{-closure}(\{6, 13, 18\}) = G$$

$$\varepsilon\text{-closure}(\text{move}(G, a)) = \varepsilon\text{-closure}(\{4, 9, 16\}) = H$$

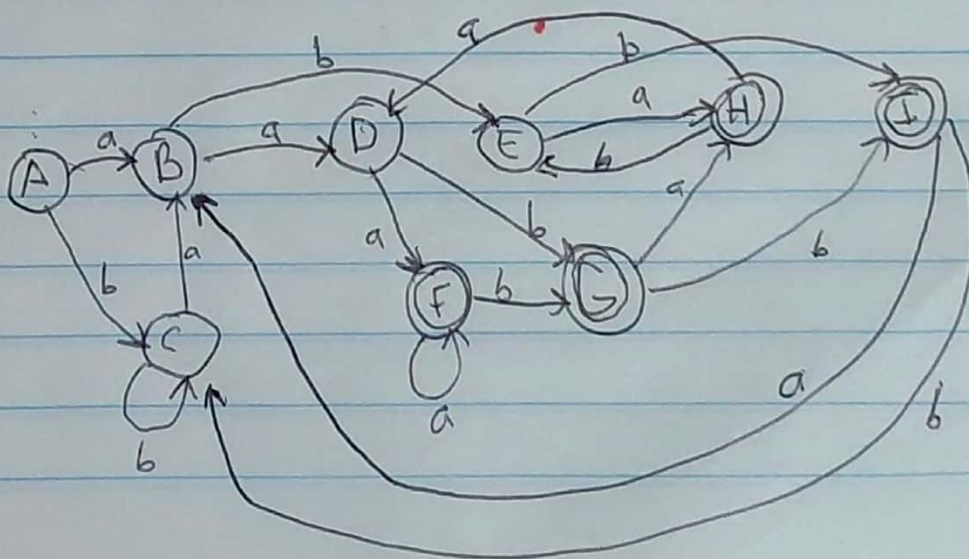
$$\varepsilon\text{-closure}(\text{move}(G, b)) = \varepsilon\text{-closure}(\{6, 18\}) = I$$

$$\varepsilon\text{-closure}(\text{move}(H, a)) = \varepsilon\text{-closure}(\{4, 9, 11\}) = D$$

$$\varepsilon\text{-closure}(\text{move}(H, b)) = \varepsilon\text{-closure}(\{6, 13\}) = E$$

$$\varepsilon\text{-closure}(\text{move}(I, a)) = \varepsilon\text{-closure}(\{4, 9\}) = B$$

$$\varepsilon\text{-closure}(\text{move}(I, b)) = \varepsilon\text{-closure}(\{6\}) = C$$





	a	b
A	b	c
B	d	e
C	b	c
D	f	g
E	h	i
F	f	g
G	h	i
H	d	e
I	b	c

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$A = (8, 7, 2, 5, 1) \rightarrow (8, 7)$  nodes = 3  
 $B = (7, 1, 2, 5, 8) \rightarrow (7, 1)$  nodes = 3  
 $C = (8, 7, 2, 5, 1) \rightarrow (8, 7)$  nodes = 3  
 $D = (7, 1, 2, 5, 8) \rightarrow (7, 1)$  nodes = 3  
 $E = (8, 7, 2, 5, 1) \rightarrow (8, 7)$  nodes = 3  
 $F = (7, 1, 2, 5, 8) \rightarrow (7, 1)$  nodes = 3  
 $G = (8, 7, 2, 5, 1) \rightarrow (8, 7)$  nodes = 3  
 $H = (7, 1, 2, 5, 8) \rightarrow (7, 1)$  nodes = 3  
 $I = (8, 7, 2, 5, 1) \rightarrow (8, 7)$  nodes = 3

