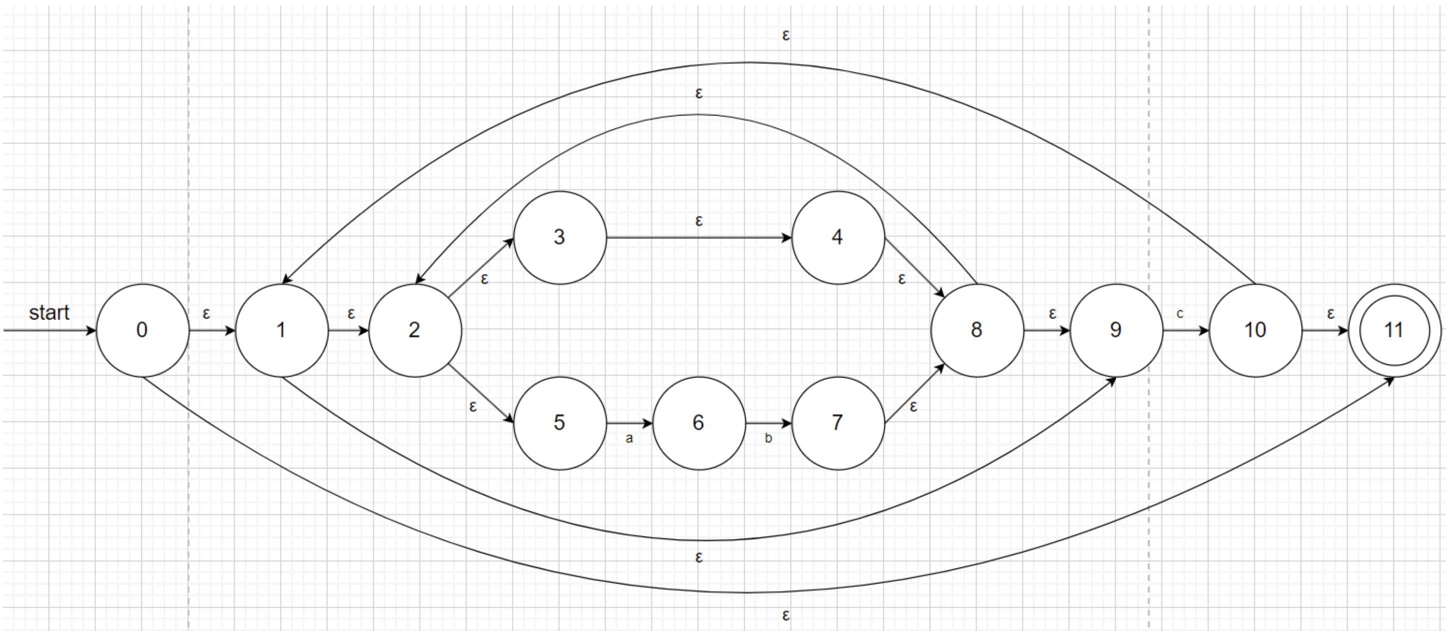
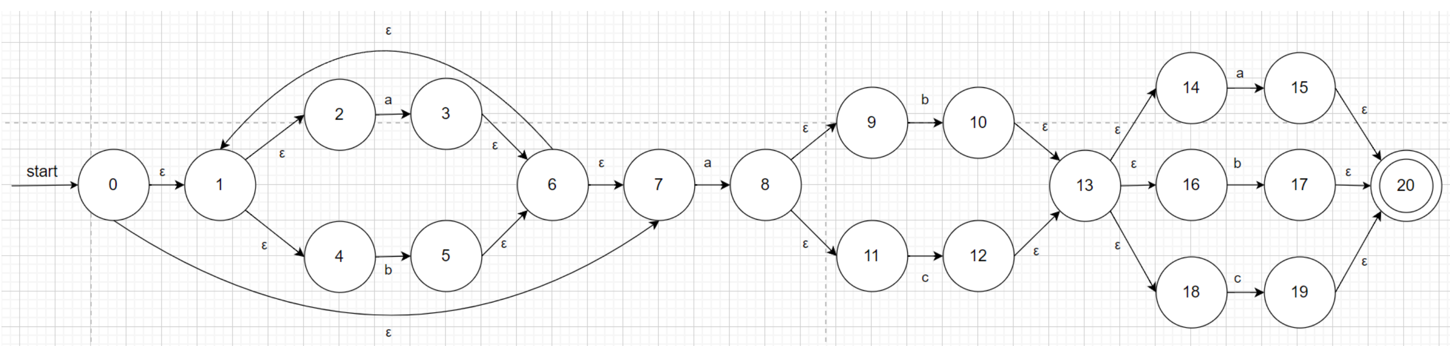
CS323 Asignment 2

Exercise 1

- NFA of `L(((ϵ|ab)*c)*)`



- NFA of `L((a|b)*a(b|c)(a|b|c))`



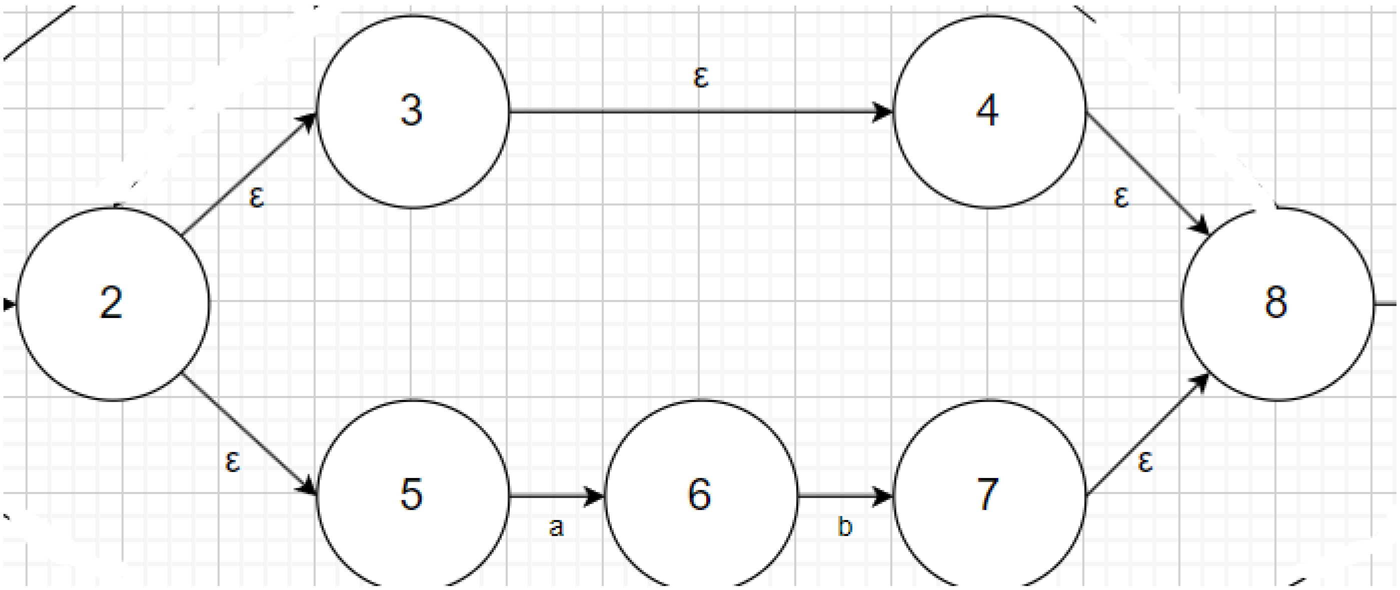
Both of them are not DFA.

Exercise 2

`L(((ϵ|ab)*c)*)`

1. Firstly, consider `l = (ϵ|ab)`.

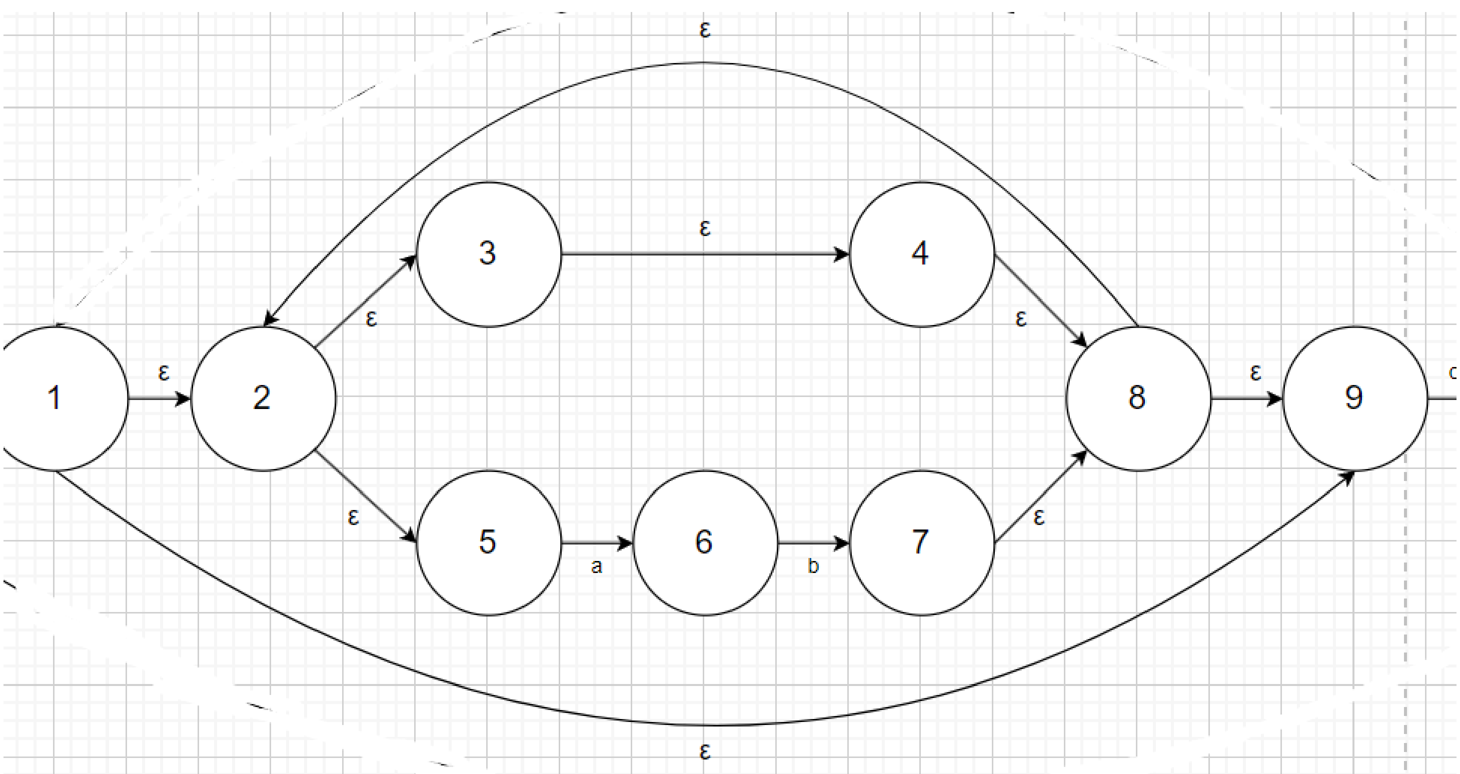
By the inductive rule: the union case, we have



where the state transition of 5 -> 6 -> 7 uses the inductive rule: the concatenation case.

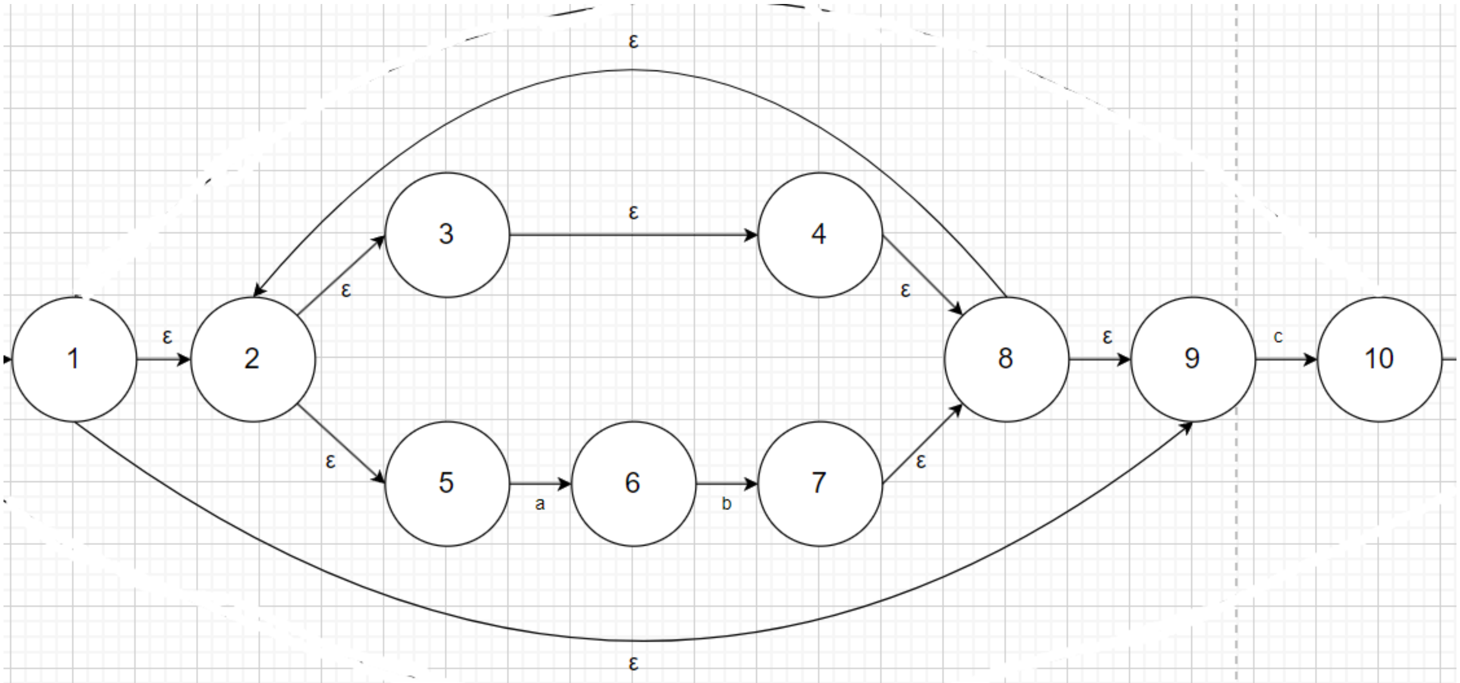
2. Secondly, consider `l' = l*`

By the inductive rule: the Kleene star case, we have

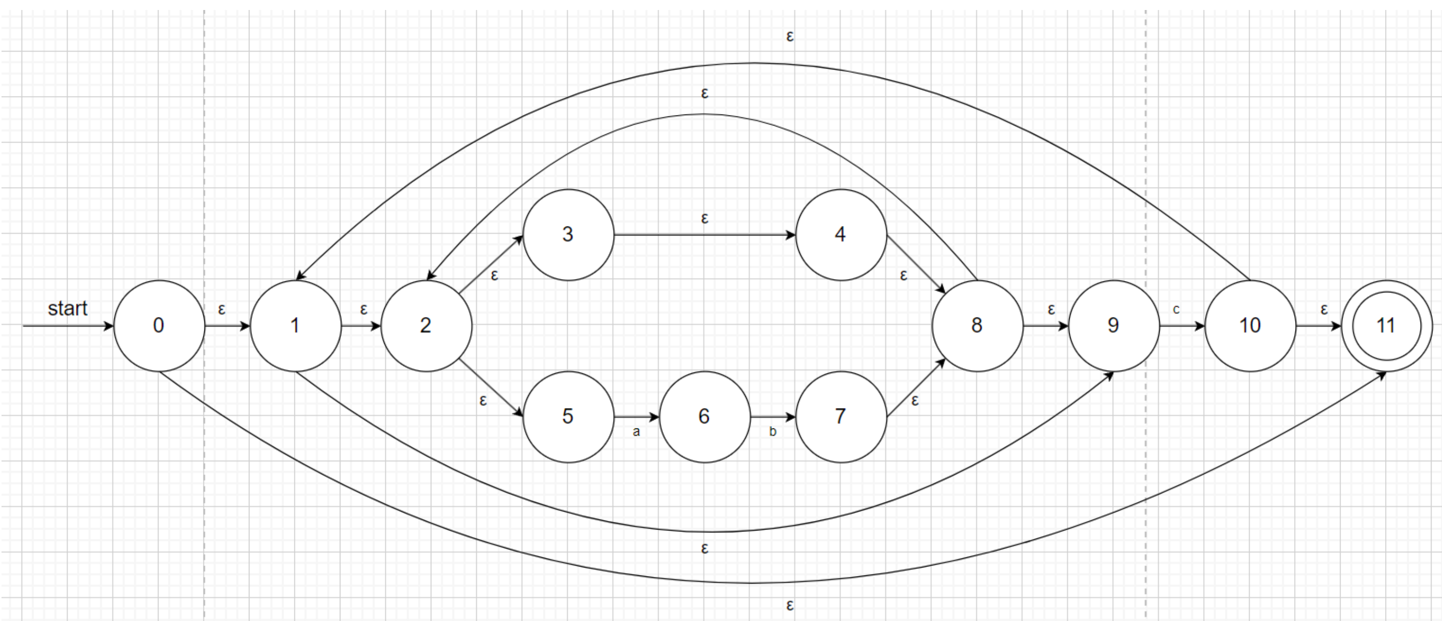


3. Thirdly, consider `l'' = l'c`

By the inductive rule: the concatenation case, we have



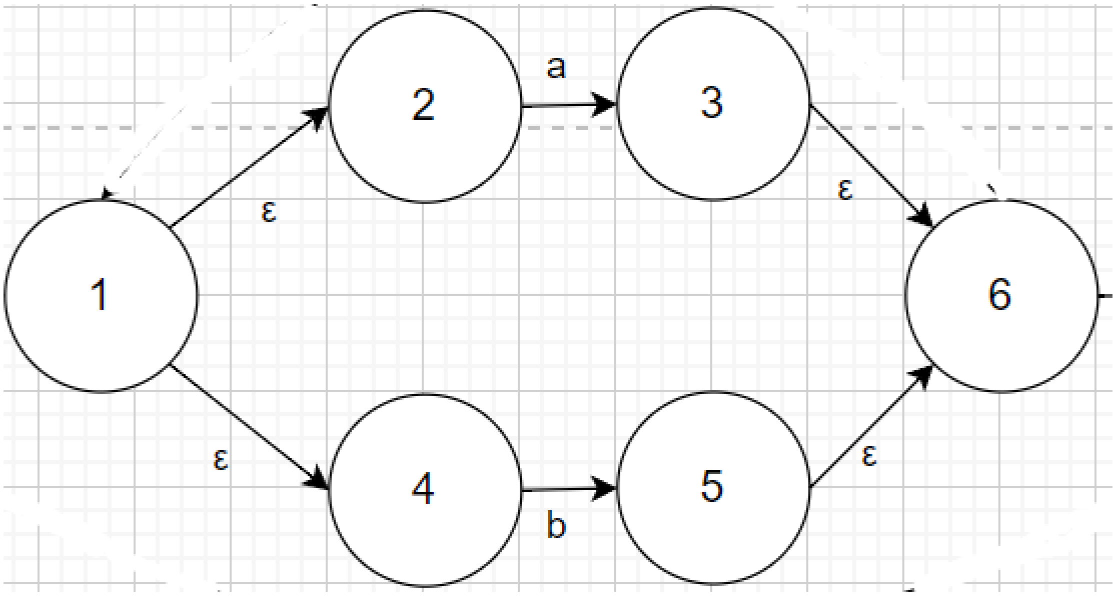
4. Fourthly, consider `l''' = l''*`



L((a|b)*a(b|c)(a|b|c))

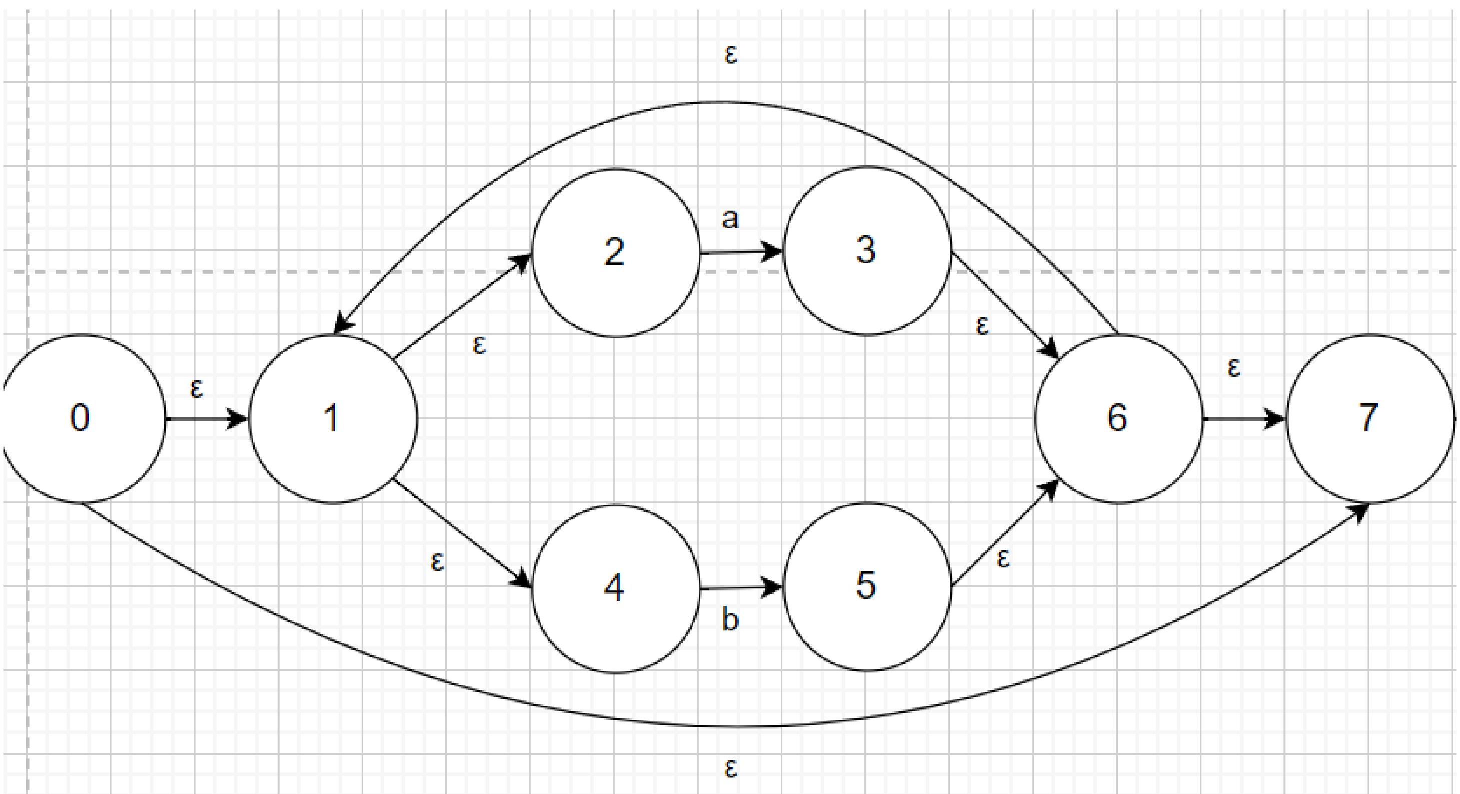
1. Firstly, consider `l = (a|b)`

By the inductive rule: the union case, we have



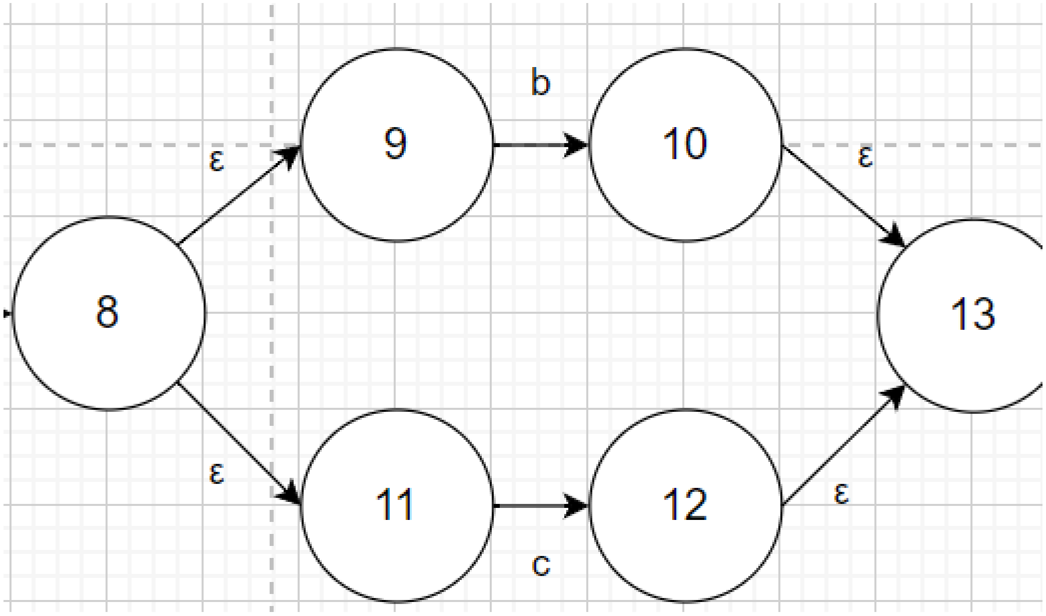
2. Secondly, consider `l' = l*`

By the inductive rule: the Kleene star case, we have

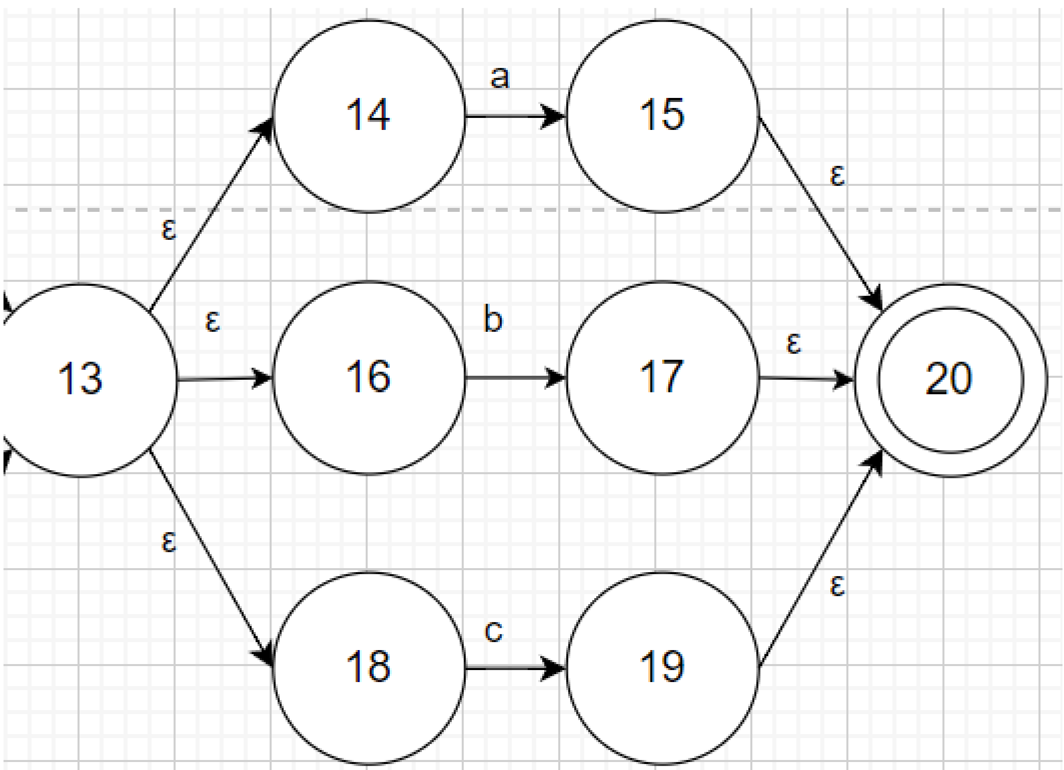


3. Thirdly, consider `l'' = (b|c)` and `l''' = (a|b|c)`

By the inductive rule: the union case, we have

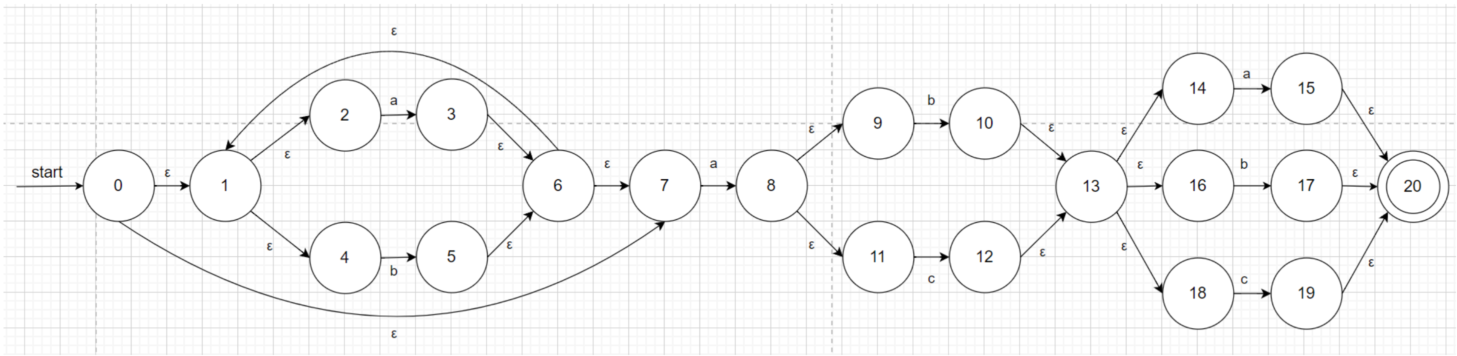


and



4. Fourthly, consider `l'''' = l'al''l'''`

By the inductive rule: the concatenation case, we have



Exercise 3

L(((ϵ|ab)*c)*)

Σ = {a, b, c}

1. A = ϵ-closure(0) = {0, 1, 2, 5, 3, 4, 8, 9, 11}
2. ϵ-closure(move[A, a]) = ϵ-closure({6}) = {6}, which is an unseen state, named B.
3. ϵ-closure(move[A, b]) = ϵ-closure({}) = {}
4. ϵ-closure(move[A, c]) = ϵ-closure({10}) = {10, 11, 1, 2, 5, 3, 4, 8, 9}, which is an unseen state, named C.
5. ϵ-closure(move[B, a]) = ϵ-closure({}) = {}
6. ϵ-closure(move[B, b]) = ϵ-closure({7}) = {7, 8, 9, 2, 5, 3, 4}, which is an unseen state, named D.
7. ϵ-closure(move[B, c]) = ϵ-closure({}) = {}
8. ϵ-closure(move[C, a]) = ϵ-closure({6}) = {6} = B
9. ϵ-closure(move[C, b]) = ϵ-closure({}) = {}
10. ϵ-closure(move[C, c]) = ϵ-closure({10}) = {10, 11, 1, 2, 3, 4, 8, 9, 5} = C
11. ϵ-closure(move[D, a]) = ϵ-closure({6}) = {6} = B
12. ϵ-closure(move[D, b]) = ϵ-closure({}) = {}
13. ϵ-closure(move[D, c]) = ϵ-closure({10}) = {10, 11, 1, 2, 5, 3, 4, 8, 9} = C

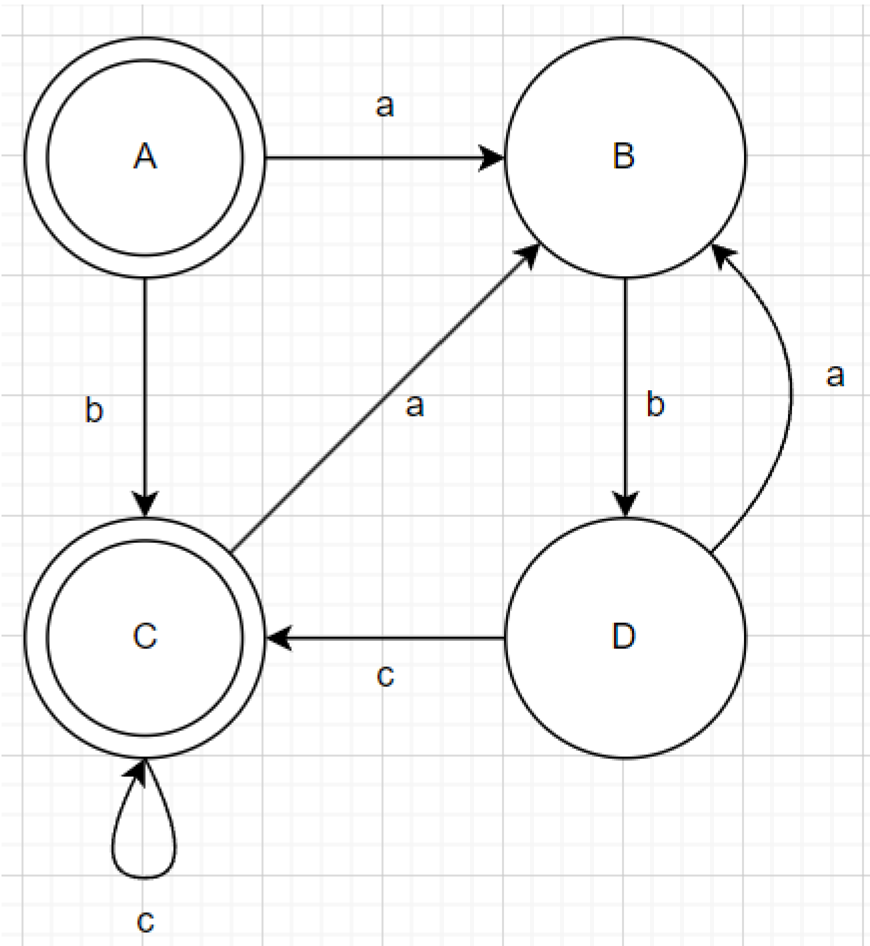
Above all, we have the following transition table.

- Start state: A, Accepting states: A, C

NFA state	DFA state	a	b	c
{0, 1, 2, 5, 3, 4, 8, 9, 11}	A	B		C
{6}	B		D	
{10, 11, 1, 2, 5, 3, 4, 8, 9}	C	B		C

NFA state	DFA state	a	b	c
{7, 8, 9, 2, 5, 3, 4}	D	B		C

So the DFA is as below.



L((a|b)*a(b|c)(a|b|c))

Σ = {a, b, c}

1. A = ϵ-closure(0) = {0, 1, 2, 4, 7}
2. ϵ-closure(move[A, a]) = ϵ-closure({3, 8}) = {3, 6, 7, 1, 2, 4, 8, 9, 11}, which is an unseen state, named B.
3. ϵ-closure(move[A, b]) = ϵ-closure({5}) = {5, 6, 7, 1, 2, 4}, which is an unseen state, named C.
4. ϵ-closure(move[A, c]) = ϵ-closure({}) = {}
5. ϵ-closure(move[B, a]) = ϵ-closure({3, 8}) = {3, 6, 7, 1, 2, 4, 8, 9, 11} = B
6. ϵ-closure(move[B, b]) = ϵ-closure({5, 10}) = {5, 6, 7, 1, 2, 4, 10, 13, 14, 16, 18}, which is an unseen state, named D.
7. ϵ-closure(move[B, c]) = ϵ-closure({12}) = {12, 13, 14, 16, 18}, which is an unseen state, named E.
8. ϵ-closure(move[C, a]) = ϵ-closure({3, 8}) = {3, 6, 7, 1, 2, 4, 8, 9, 11} = B.

9. ϵ-closure(move[C, b]) = ϵ-closure({5}) = {5, 6, 7, 1, 2, 4} = C
10. ϵ-closure(move[C, c]) = ϵ-closure({}) = {}
11. ϵ-closure(move[D, a]) = ϵ-closure({3, 8, 15}) = {3, 6, 7, 1, 2,4, 8, 9, 11, 15, 20}, which is an unseen state, named F.
12. ϵ-closure(move[D, b]) = ϵ-closure({5, 17}) = {5, 6, 7, 1, 2, 4, 17, 20}, which is an unseen state, named G.
13. ϵ-closure(move[D, c]) = ϵ-closure({19}) = {19, 20}, which is an unseen state, named H.
14. ϵ-closure(move[E, a]) = ϵ-closure({15}) = {15, 20}, which is an unseen state, named I.
15. ϵ-closure(move[E, b]) = ϵ-closure({17}) = {17, 20}, which is an unseen state, named J.
16. ϵ-closure(move[E, c]) = ϵ-closure({19}) = {19, 20} = H
17. ϵ-closure(move[F, a]) = ϵ-closure({3, 8}) = {3, 6, 7, 1, 2, 4, 8, 9, 11} = B.
18. ϵ-closure(move[F, b]) = ϵ-closure({5, 10, 17}) = {5, 6, 7, 1, 2, 4, 10, 13, 14, 16, 18, 17, 20}, which is an unseen state, named K.
19. ϵ-closure(move[F, c]) = ϵ-closure({12}) = {12, 13, 14, 16, 18} = E
20. ϵ-closure(move[G, a]) = ϵ-closure({3, 8}) = {3, 6, 7, 1, 2, 4, 8, 9, 11} = B.
21. ϵ-closure(move[G, b]) = ϵ-closure({5}) = {5, 6, 7, 1, 2, 4} = C
22. ϵ-closure(move[G, c]) = ϵ-closure({}) = {}
23. ϵ-closure(move[H, a]) = ϵ-closure({}) = {}
24. ϵ-closure(move[H, b]) = ϵ-closure({}) = {}
25. ϵ-closure(move[H, c]) = ϵ-closure({}) = {}
26. ϵ-closure(move[I, a]) = ϵ-closure({}) = {}
27. ϵ-closure(move[I, b]) = ϵ-closure({}) = {}
28. ϵ-closure(move[I, c]) = ϵ-closure({}) = {}
29. ϵ-closure(move[J, a]) = ϵ-closure({}) = {}
30. ϵ-closure(move[J, b]) = ϵ-closure({}) = {}
31. ϵ-closure(move[J, c]) = ϵ-closure({}) = {}
32. ϵ-closure(move[K, a]) = ϵ-closure({3, 8, 15}) = {3, 6, 7, 1, 2,4, 8, 9, 11, 15, 20} = F
33. ϵ-closure(move[K, b]) = ϵ-closure({5, 17}) = {5, 6, 7, 1, 2, 4, 17, 20} = G
34. ϵ-closure(move[K, c]) = ϵ-closure({19}) = {19, 20} = H

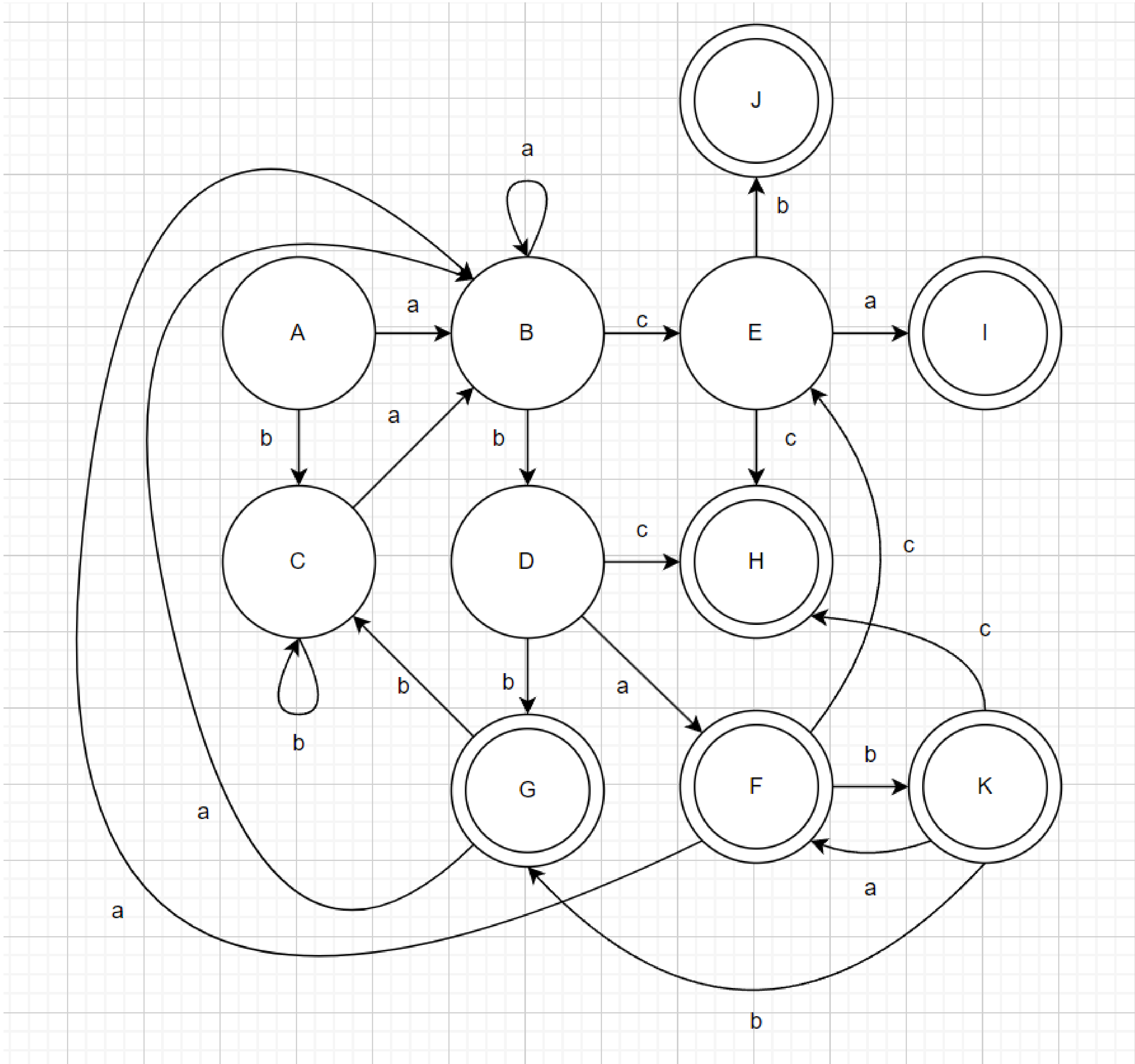
Above all, we have the following transition table.

- Start state: A, Accepting states: F, G, H, I, J, K

NFA state	DFA state	a	b	c
{0, 1, 2, 4, 7}	A	B	C	
{3, 6, 7, 1, 2, 4, 8, 9, 11}	B	B	D	E

NFA state	DFA state	a	b	c
{5, 6, 7, 1, 2, 4}	C	B	C	
{5, 6, 7, 1, 2, 4, 10, 13, 14, 16, 18}	D	F	G	H
{12, 13, 14, 16, 18}	E	I	J	H
{3, 6, 7, 1, 2,4, 8, 9, 11, 15, 20}	F	B	K	E
{5, 6, 7, 1, 2, 4, 17, 20}	G	B	C	
{19, 20}	H			
{15, 20}	I			
{17, 20}	J			
{5, 6, 7, 1, 2, 4, 10, 13, 14, 16, 18, 17, 20}	K	F	G	H

So the DFA is as below.



J
b
a
A
a
B
c
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I
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a
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C
D
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c
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K
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a
a
b