## Conversion Regular Expression to minimised DFA.

* Regular Expression can be converted into minimised finite automata using following steps:

Step-1 Convert Regular Expression to ε-NFA using Thompson construction Method (Rules).

Step-2 Convert ε-NFA to DFA using Subset Construction Method (Rules).

Step 3 Minimization Process. (Minimised DFA).

Conversion Regular Expression to NFA using Thompson Construction Method (Rule).

* Thompson Construction

| Regular Expression | Finite Automata |
|---|---|
| $\epsilon$ (null) |  |
| a |  |
| b |  |

→ Regular Expression consists of (Union, concatenation, Kleene Closure) operation.

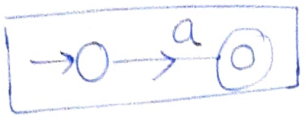
1) Union Operation :— Suppose $r_1$ is represented by $M_1$ and $r_2$ is represented by $M_2$.

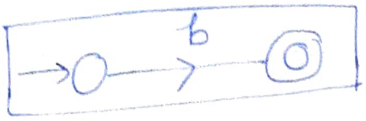
So, Add two new states, one is initial state and other one is final state.

Four $\epsilon$- closure.

1. New inital state to initial state of $M_1$.
2. New inital state to initial state of $M_2$.
3. Final state of $M_1$ to new final state.
4. Final state of $M_2$ to new final state.

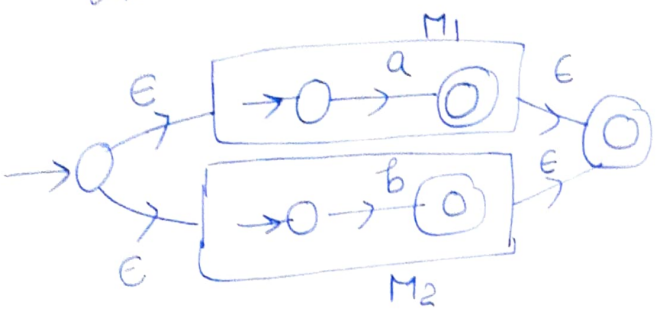
Example (a|b)

a  $M_1$

b  $M_2$

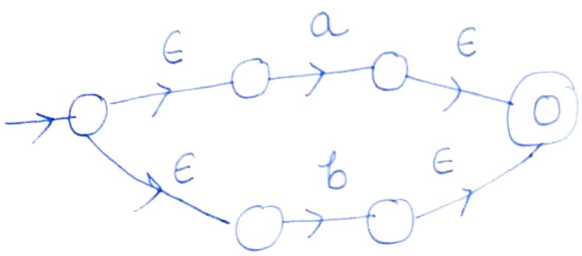
And new two state (initial, final state).

Then, flow rules.




Make final Transition Digram.

$(a|b)^*$



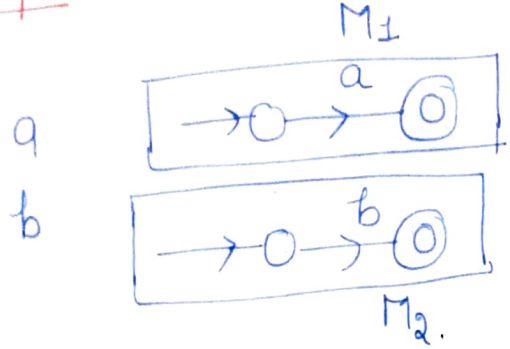

Transition Digram.

(2) Concatenation Operation :- Suppose $r_1$ is represented by $M_1$ and $r_2$ is represented by $M_2$.

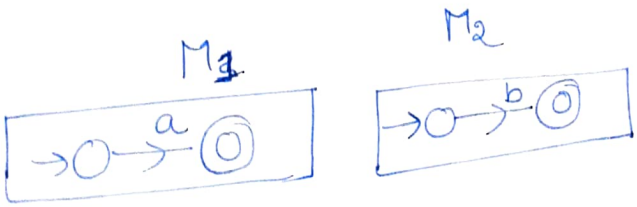
(i) Number of states in $r_1 r_2$ is reduced by one.

(ii) Merge final state of $M_1$ with inital state of $M_2$.

Example ab




Reduced the state $M_1$ and $M_2$.
Merge final state of $M_1$ with inital state of $M_2$.





Transition Digram

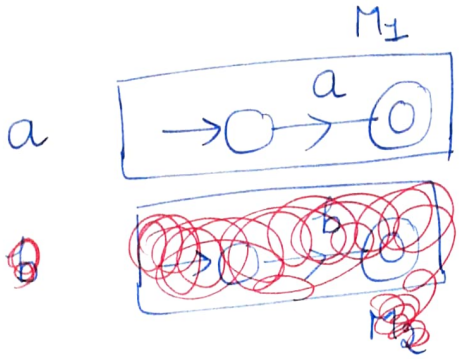
③ Kleene Operation : Suppose $r_1$ is represented by 1.

So, Add two states that is (initial and final) state.

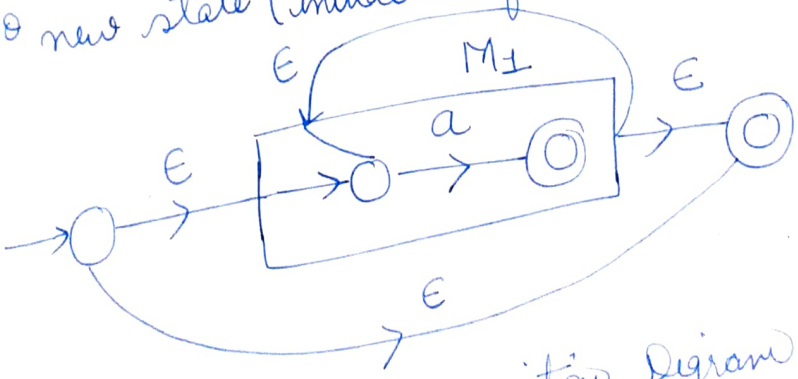
Four ∈ - closure.

① New initial state to initial state of $M_1$.
② New initial state to new final state.
③ Final state of $M_1$ to new final state.
④ Final state of $M_1$ to initial state of $M_1$.

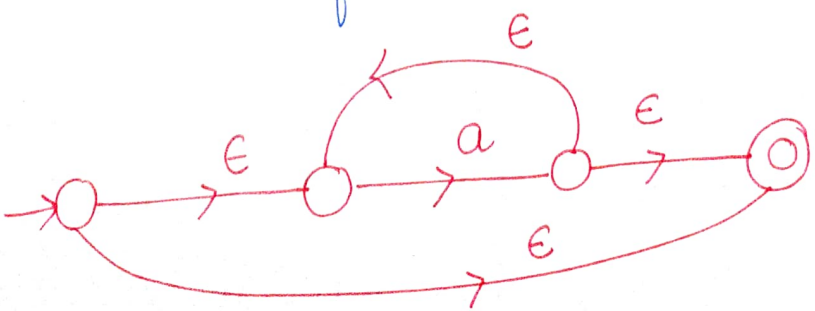
Example (a)




Add two new state (initial and final state).



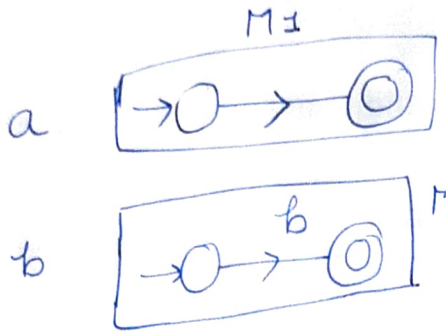

Make final Transition Digram



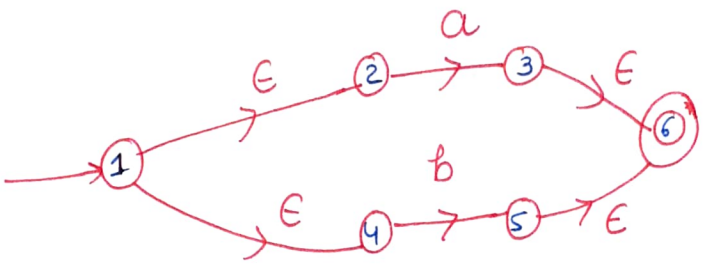

(a)*

(5)

Ques-1 Convert Regular Expression (a|b) to ϵ-NFA using Thompson Construction method (Rules).




- Add two new states.

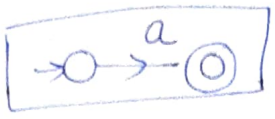


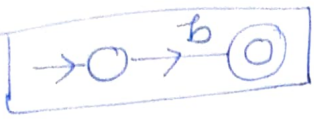

Transition Digram

Question 2. Convert following Regular Expression to ϵ-NFA using Thompson Construction method (Rules).

1) $a(a|b)^*b$
2) $(a|b)^*$
3) $(ab|ba)^*$
4) $(a|b)^*abb$

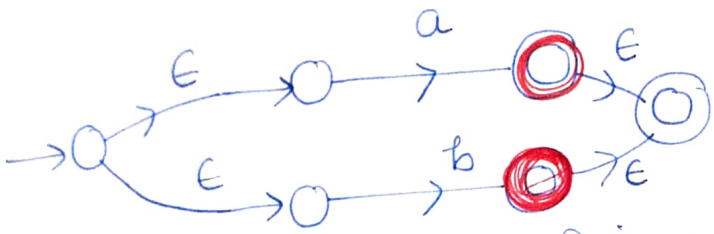
① $a(a|b)^* b$

a  $M_1$

b  $M_2$

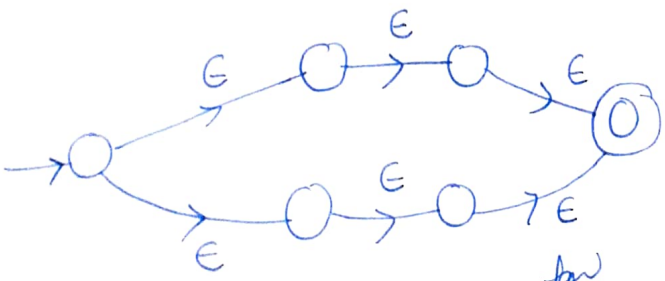
→ make transition diagram for $(a|b)$ using (TC) method.

$(a|b)$

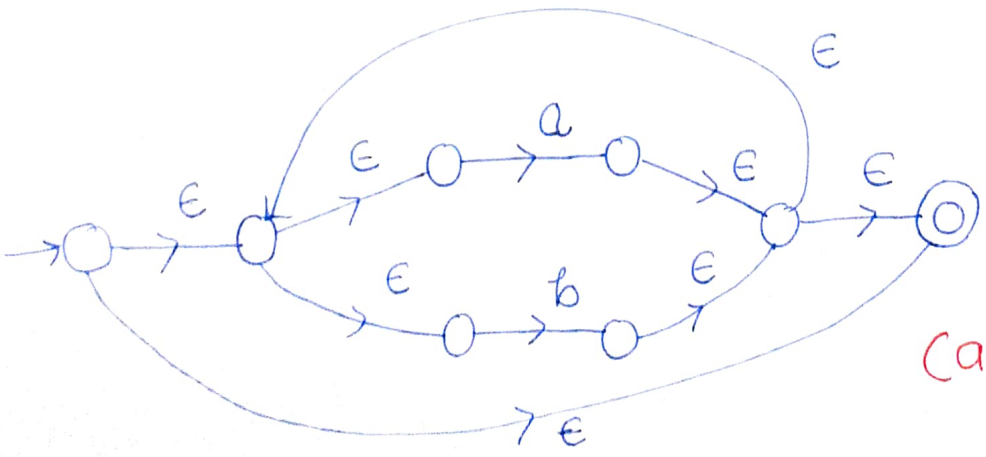


final transition diagram

$(a|b)$



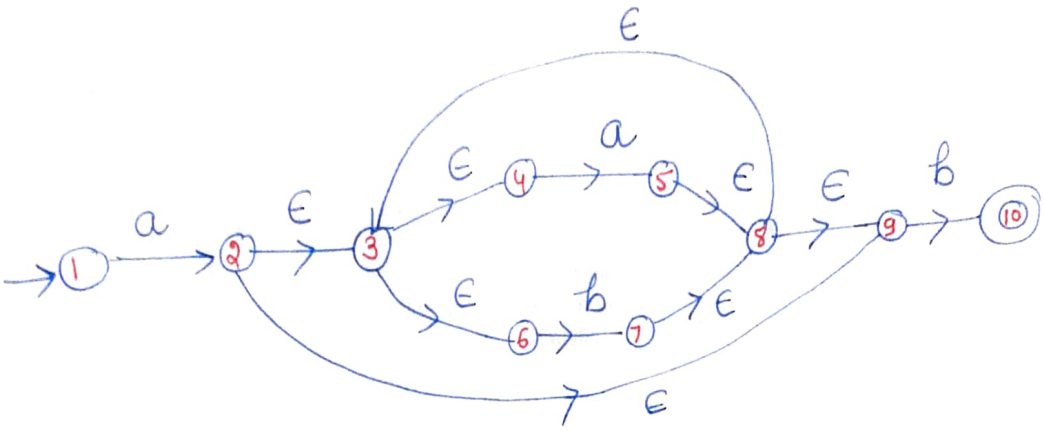
→ Now make transition for $(a|b)^*$ RE.



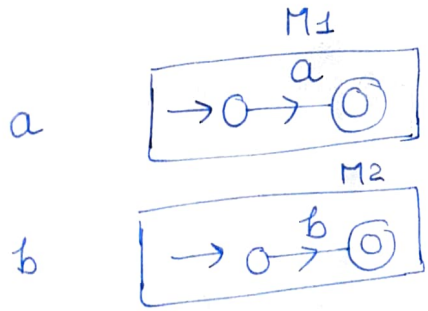
(1)

$(a|b)^*$

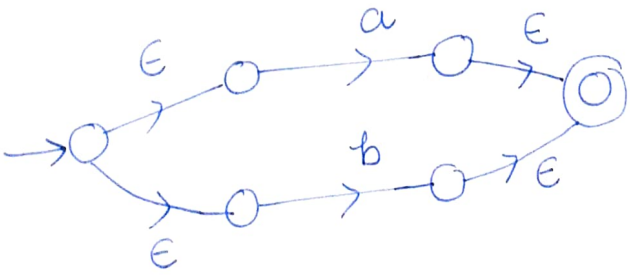
Now make transition Digram for a (a|b)*b



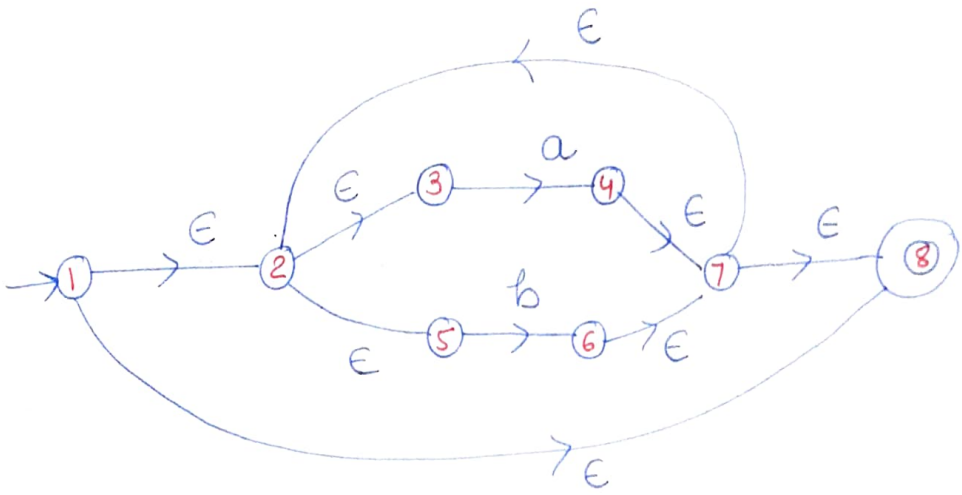

(a|b)*




→ Make transition Digram for (a|b). using (TC) method.

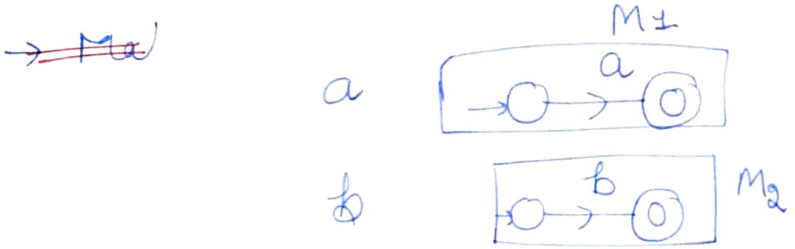



→ Make transition Digram for (a|b)*

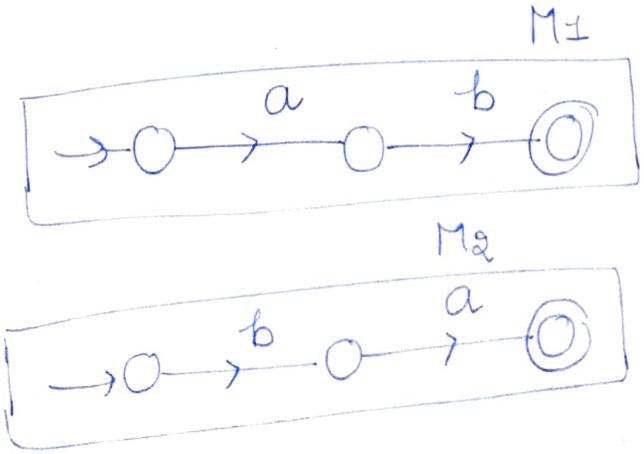



) $(ab|ba)^*$

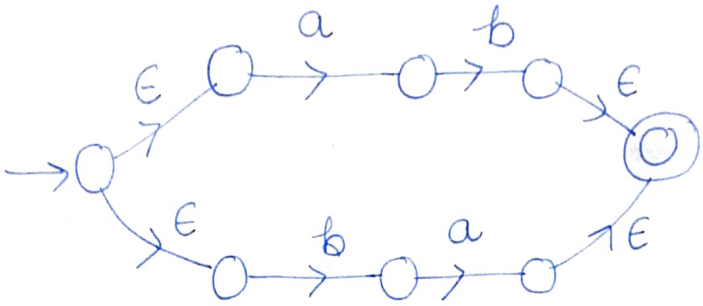
Convert $(ab|ba)^*$ to NFA using Thompson construction method.



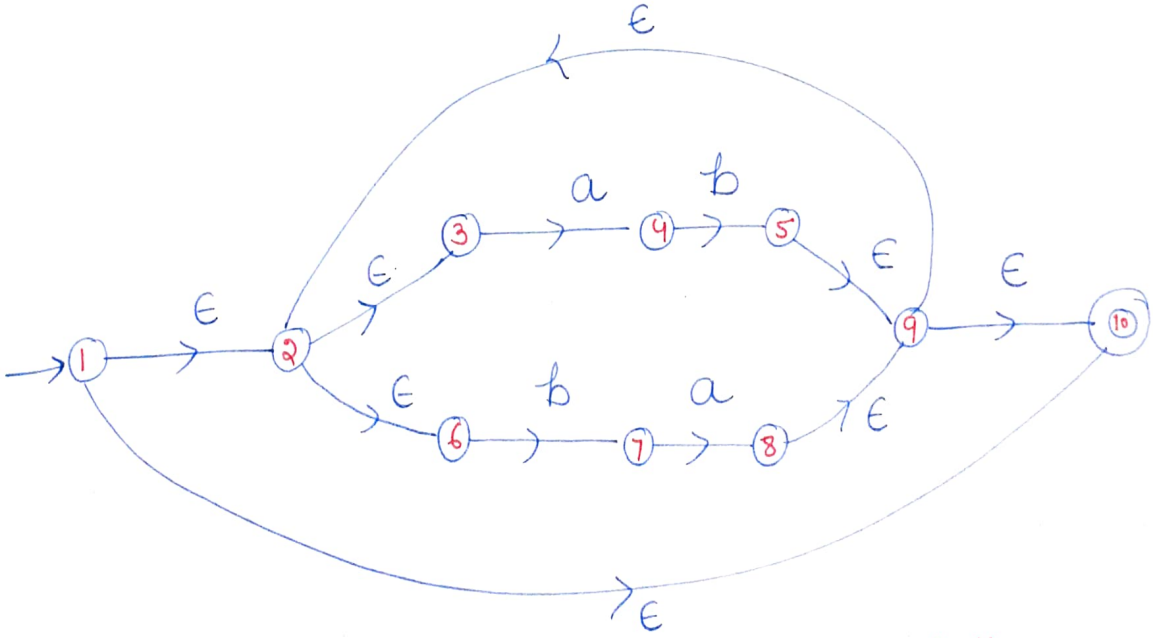

→ make transition digram for (ab)|(ba)



→ Make transition Digram for (ab|ba)



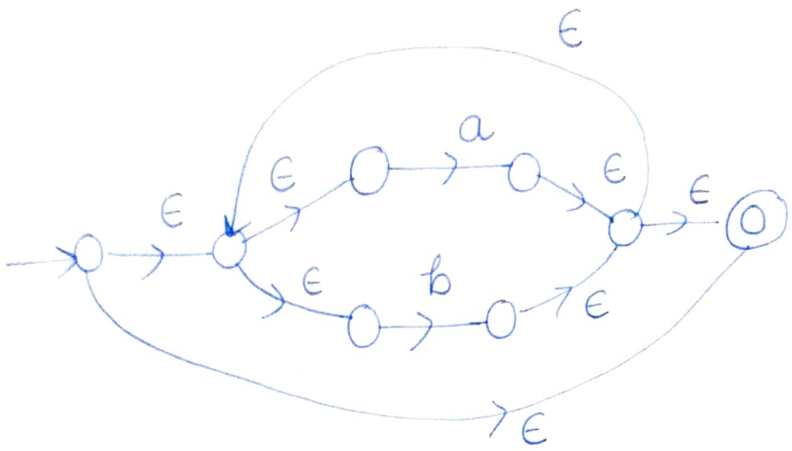

→ Make transition Digram for (ab|ba)*




final transition Digram of (ab|ba)*

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

Make transition Digram of $(a|b)^*$ by using thompson construction method.




Now make final transition Digram of $(a|b)^* abb$ by using thompson construction method.