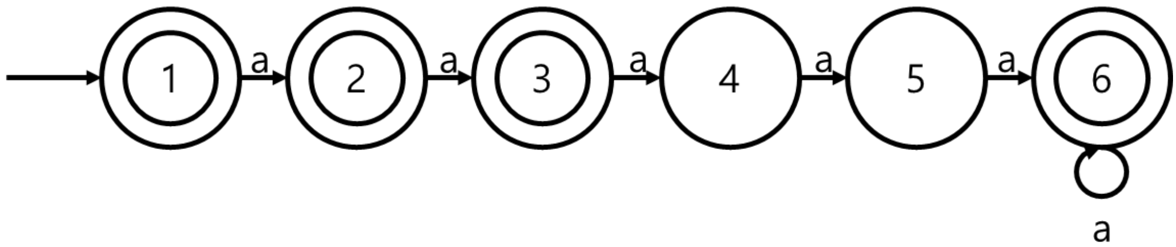
Assignment 3

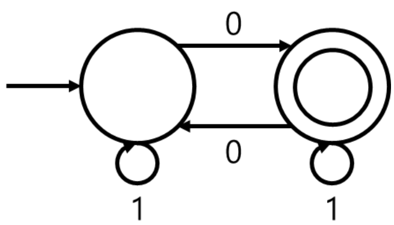
1. There is no explicit alphabet declaration, so I assume that alphabet is $\{a\}$

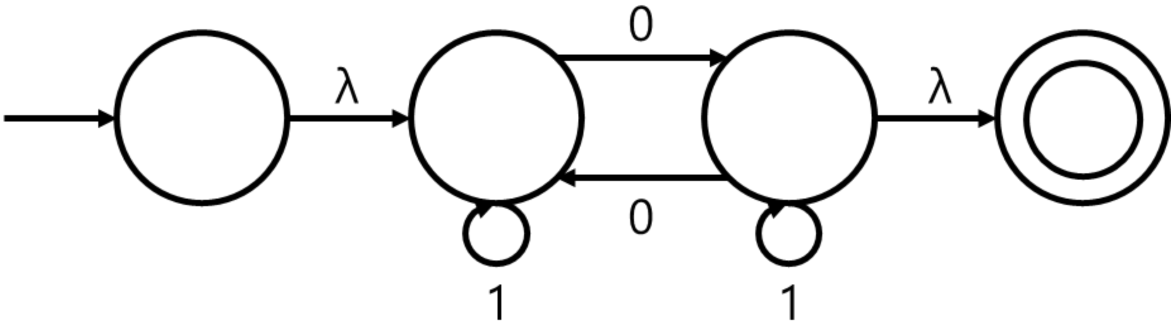


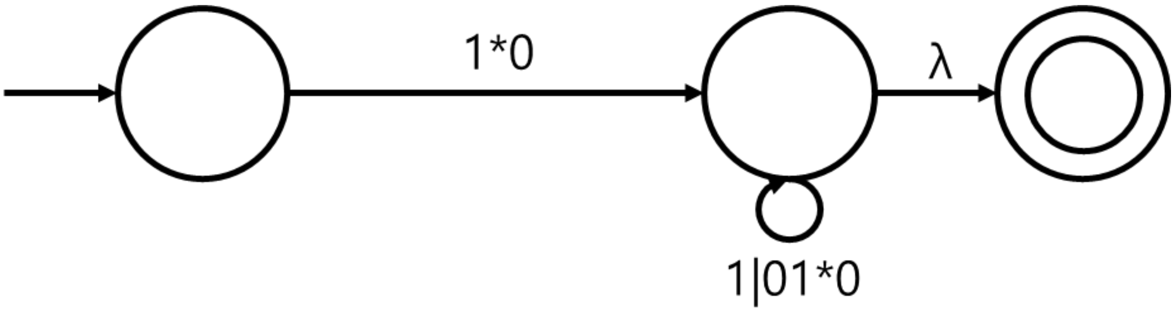
2	X				
3	X	X			
4	X	X	X		
5	X	X	X	X	
6	X	X	X	X	X
	1	2	3	4	5

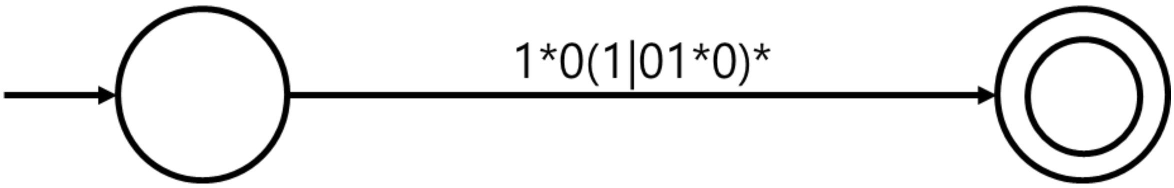
- 4 and 1, 2, 3, 6 are distinguishable since former is accepting state and latter is not.
- 5 and 1, 2, 3, 6 are distinguishable for the same reason.
- 4 and 5 are distinguishable since $\delta(5, a)$is accepting state and $\delta(4, a)$ is not.
- 6 and 3 are distinguishable since $\delta(6, a)$ is accepting state and $\delta(3, a)$ is not.
- Recursively, 2 and 6 are distinguishable since $\delta(6, a)$ and $\delta(2, a)$ are distinguishable.
- Recursively, 1 and 6 are distinguishable since $\delta(6, a)$ and $\delta(1, a)$ are distinguishable.
- 2 and 3 are distinguishable since $\delta(2, a)$ is accepting state and $\delta(3, a)$ is not.
- Recursively, 1 and 2 are distinguishable since $\delta(1, a)$ and $\delta(2, a)$ are distinguishable.
- 1 and 3 are distinguishable since $\delta(1, a)$ is accepting state and $\delta(3, a)$ is not.

2. $(\lambda|a|aa|aaa)(\lambda|b|bb|bbb|bbbb)$
3. It is similar to odd number parity check.





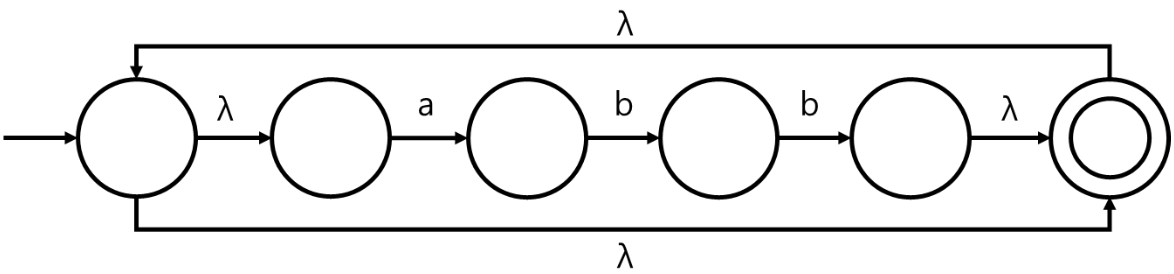




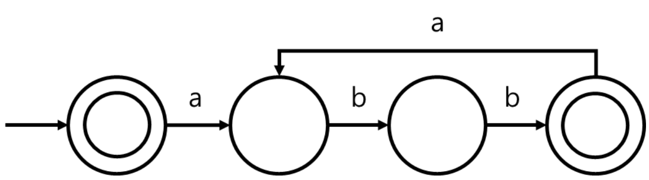
Therefore, the answer is $1^*0(1|01^*0)^*$

4. $L(abb)^* \cup L(a^*bb^*) = L((abb)^*|(a^*bb^*))$

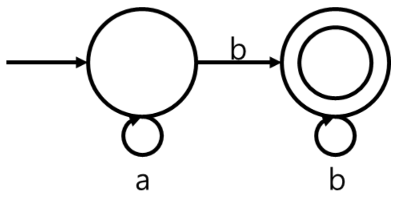
   $(abb)^*$ is below.



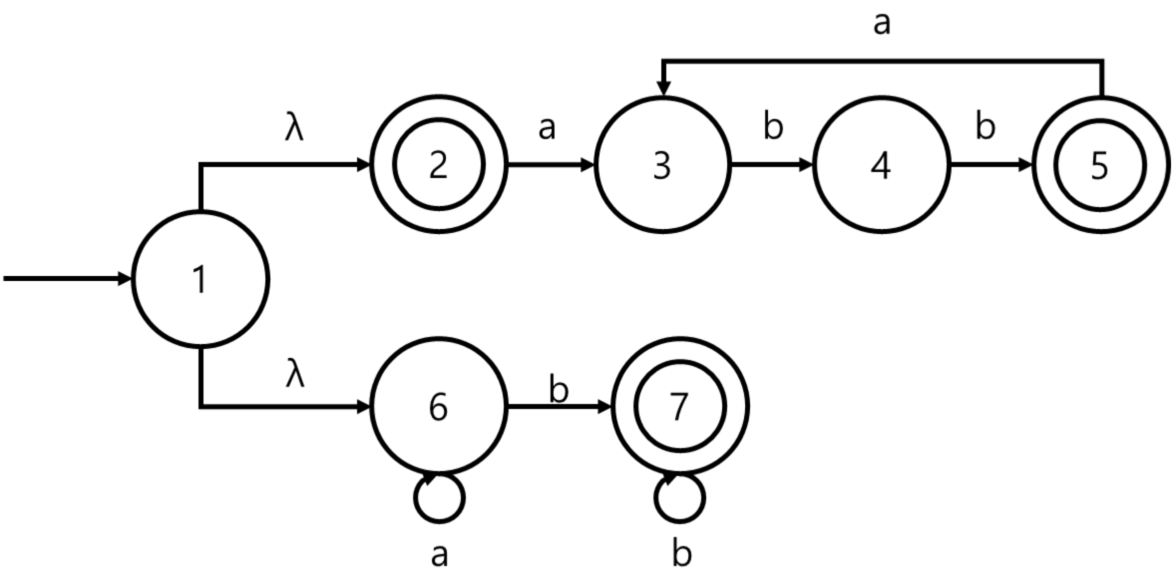
and it can be reduced like below.



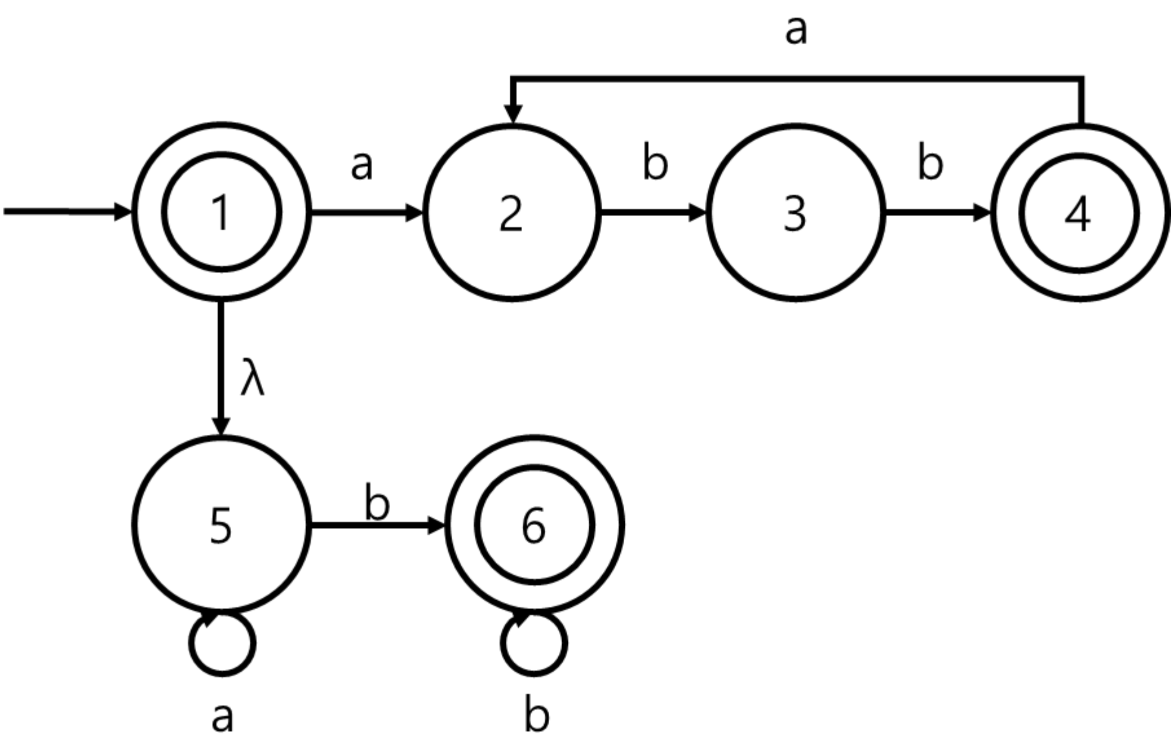
a^*bb^* can be reduced like below.



$(abb)^*|(a^*bb^*)$ is below.

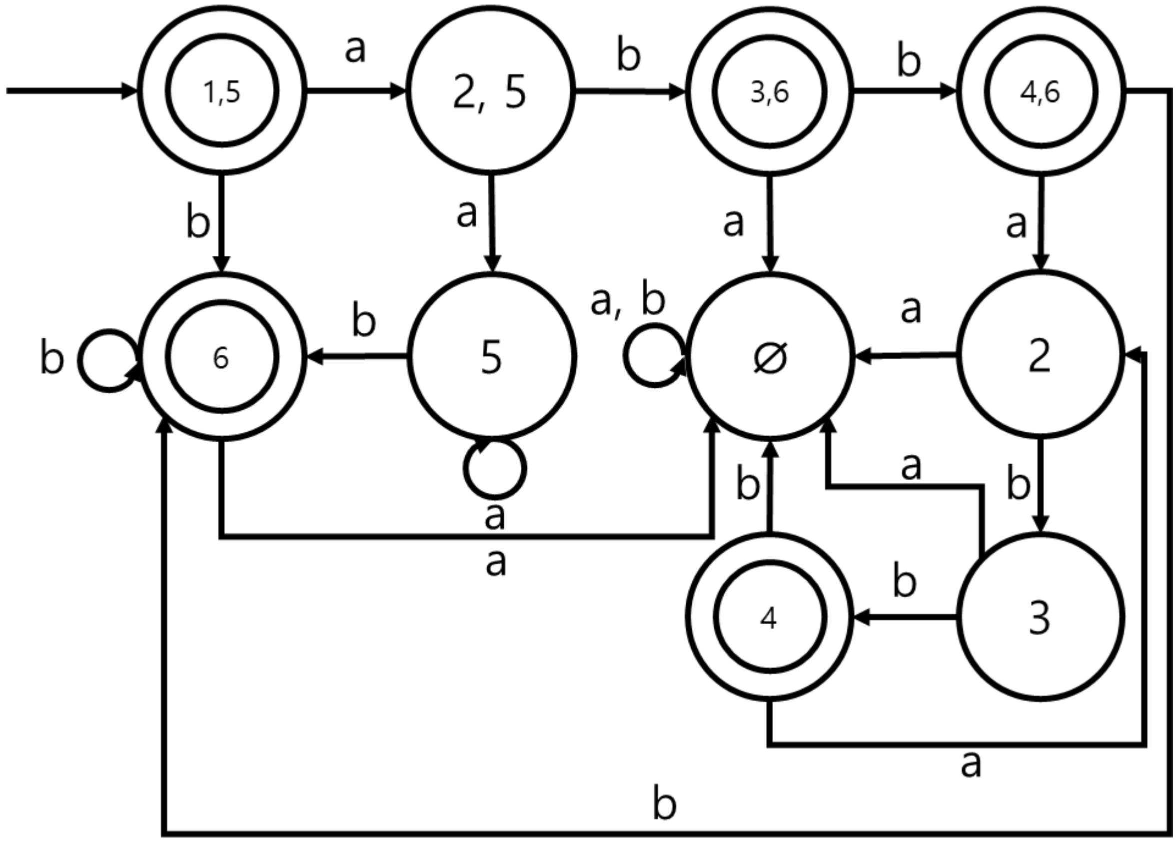


And can be reduced like below.

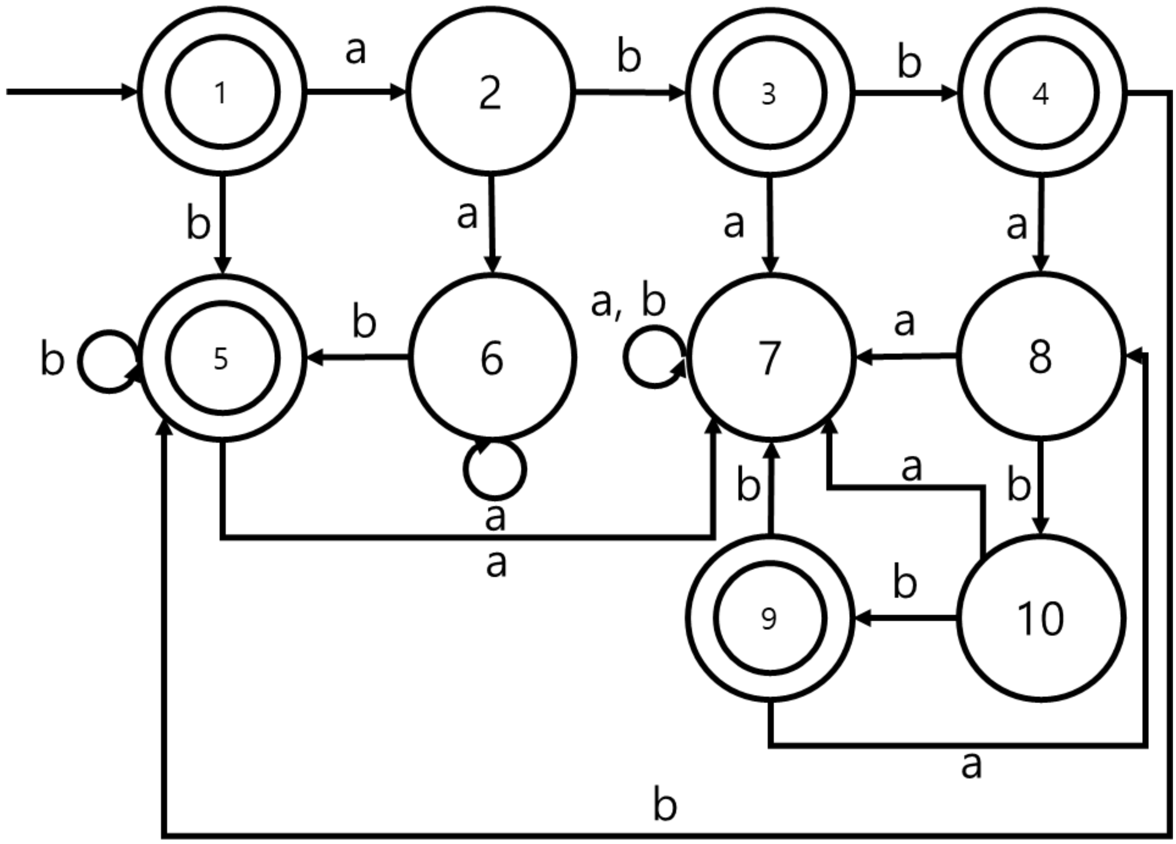


Now, convert above NFA to DFA. Cells that don't exist means that cells are unreachable from start state(1, 5). Accepting states are states that contain 1, 4, or 6. Therefore, Accepting States are (4), (6), (1, 5), (3, 6), (4, 6).

	a	b
∅	∅	∅
2	∅	3
3	∅	4
4	2	∅
5	5	6
6	∅	6
1, 5	2, 5	6
2, 5	5	3, 6
3, 6	∅	4, 6
4, 6	2	6



Finally, it's time to minimalize DFA. I renamed node(state) of above DFA.



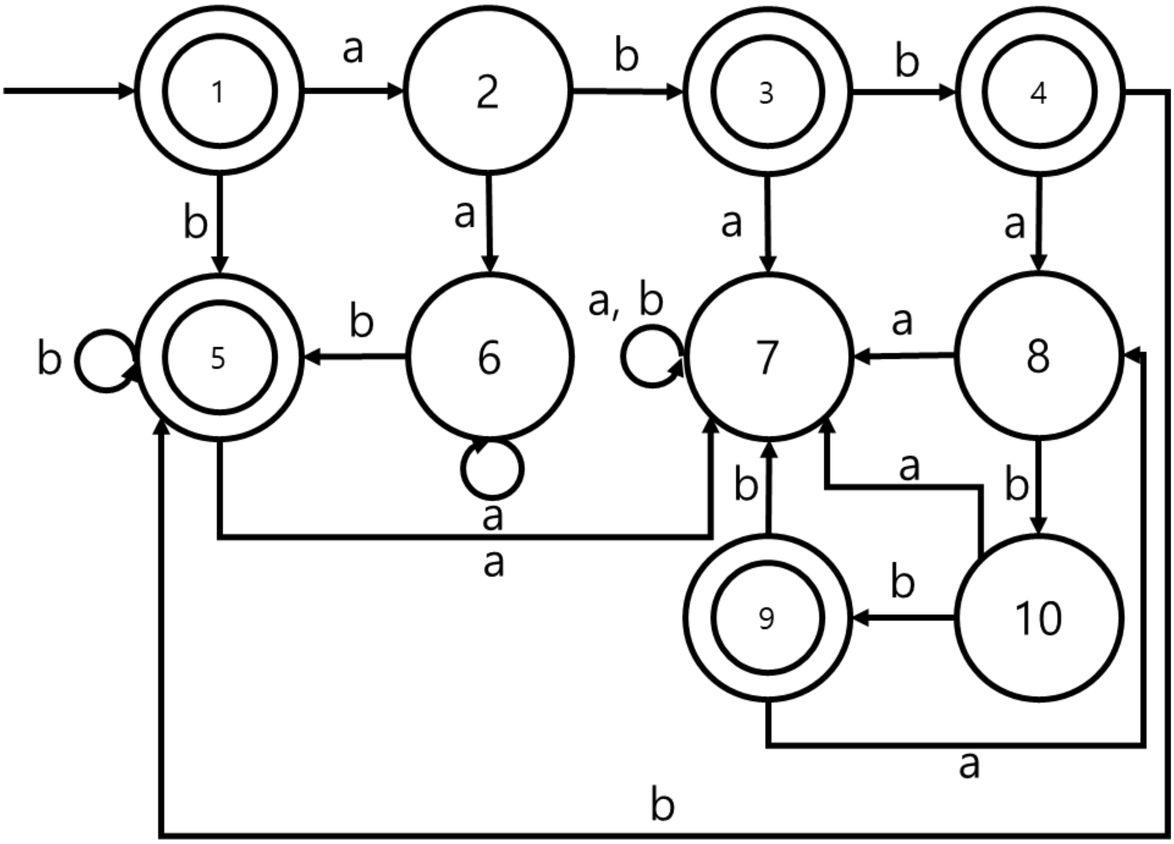
In below table, cells that marked “X” are distinguishable since one is accepting state and another one is not.

2	X						
3		X					
4		X					
5		X					
6	X		X	X	X		
7	X		X	X	X		
8	X		X	X	X		
9		X				X	X
10	X		X	X	X		
	1	2	3	4	5	6	7

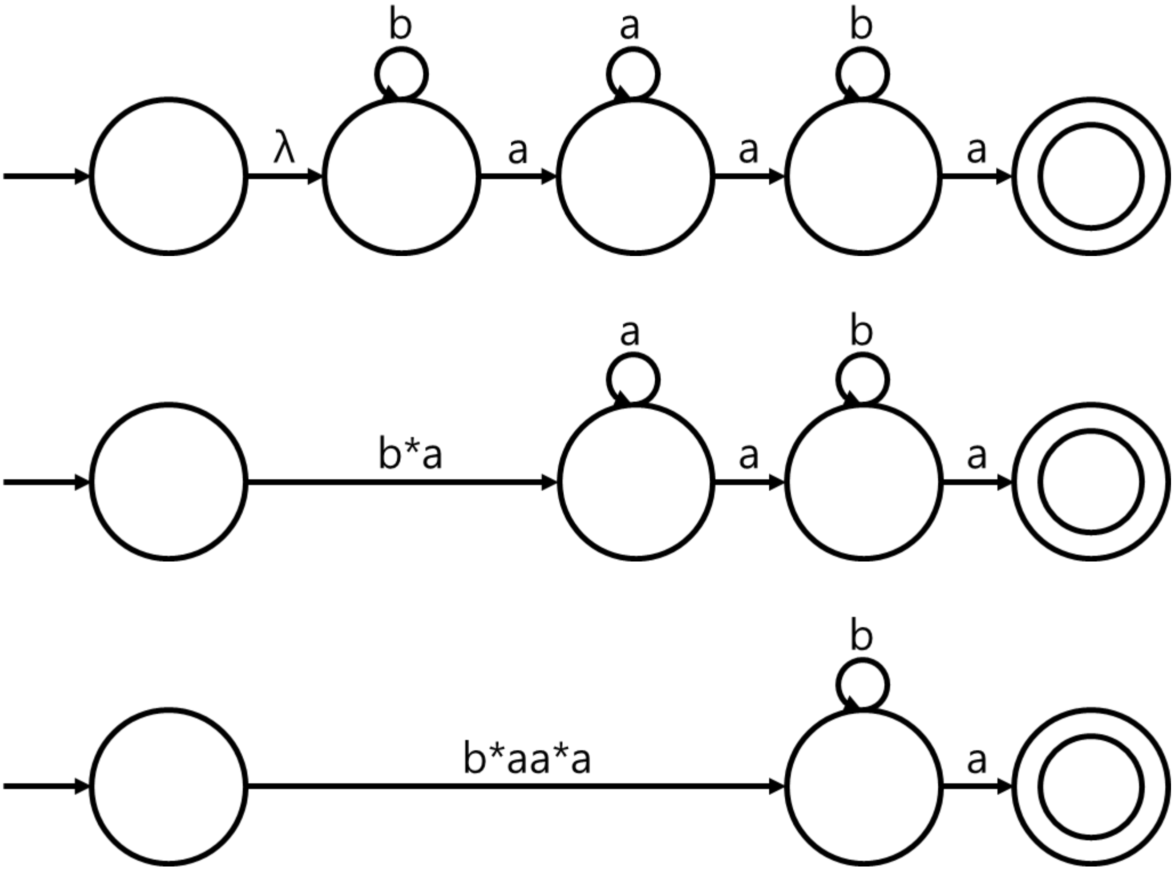
Now, complete table base on above.

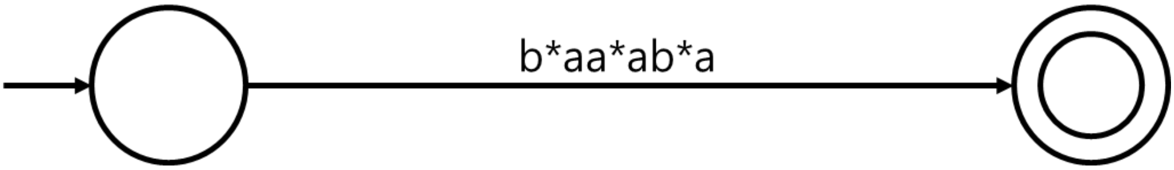
2	X						
3	X	X					
4	X	X	X				
5	X	X	X	X			
6	X	X	X	X	X		
7	X	X	X	X	X	X	
8	X	X	X	X	X	X	X
9	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X
	1	2	3	4	5	6	7

All states are distinguishable. Therefore, below DFA is minimal.



5. Automata can be rewritten like below.





Therefore, the corresponding regular expression is $b^*aa^*ab^*a$