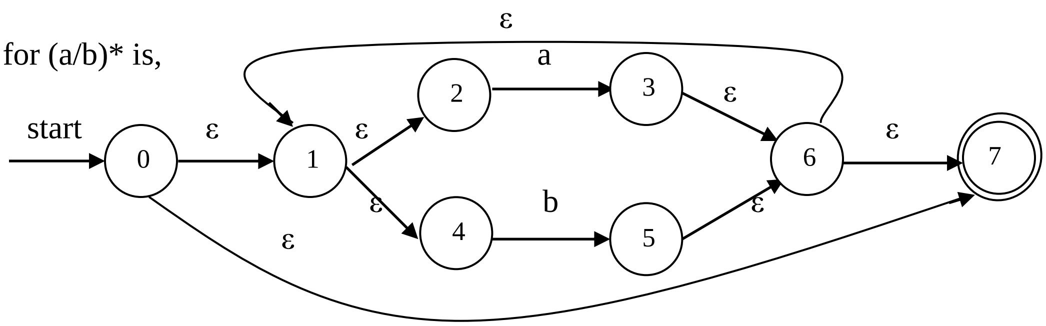
CONVERSION OF NFA INTO DFA

1. Convert the NFA (a/b)* into DFA?

Solution:

The NFA for (a/b)* is,



ε closure {0} = {0,1,2,4,7} -------------- A
Transition of input symbol an on A = {3}
Transition of input symbol b on A = {5}

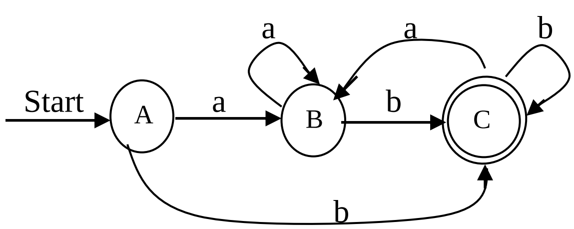
ε closure {3} = {3,6,1,2,4,7} ------------ B
Transition of input symbol a on B = {3 }
Transition of input symbol b on B = { 5 }

ε closure {5} = {5,6,1,2,4,7} ------------ C
Transition of input symbol a on C = { 3 }
Transition of input symbol b on C = { 5 }

Since A is the start state and state C is the only accepting state then, the **transition table** is,

State	Input symbol	
	a	b
A	B	C
B	B	C
C	B	C

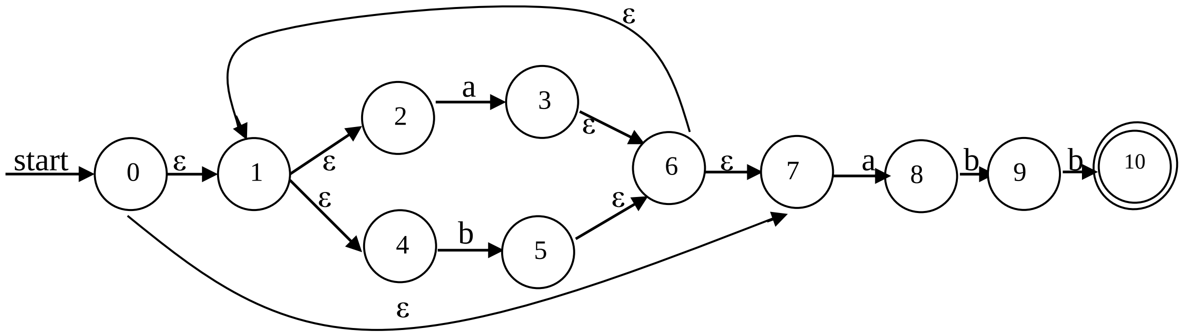
The DFA is,



2. Convert the NFA (a/b)*abb into DFA?

Solution:

The NFA for (a/b)*abb is,



ε closure {0} = { 0,1,2,4,7} -------------- A
Transition of input symbol a on A = { 3,8 }
Transition of input symbol b on A = { 5 }

ε closure {3,8} = { 3,6,7,1,2,4,8} -------------- B
Transition of input symbol a on B = { 8,3 }
Transition of input symbol b on B = { 5,9 }

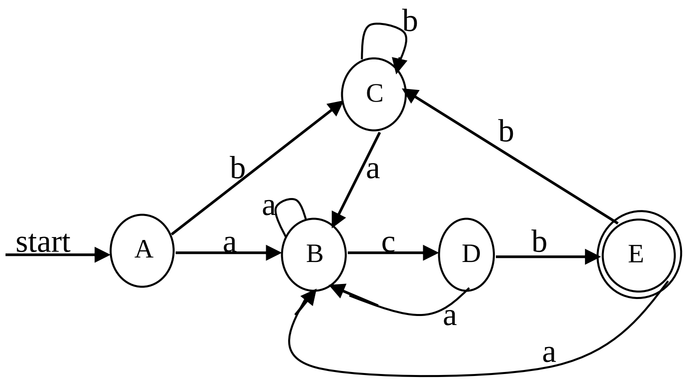
ε closure {5} = { 5,6,7,1,2,4} -------------- C
Transition of input symbol a on C = { 8,3 }
Transition of input symbol b on C = { 5 }

ε closure {5,9} = { 5,6,7,1,2,4,9} -------------- D
Transition of input symbol a on D = { 8,3 }
Transition of input symbol b on D = { 5,10 }

ε closure {5,10} = { 5,6,7,1,2,4,10} -------------- E
Transition of input symbol a on E = { 8,3 }
Transition of input symbol b on E = { 5 }

Since A is the start state and state E is the only accepting state then, the **transition table** is,

State	Input symbol	
	a	b
A	B	C
B	B	D
C	B	C
D	B	E
E	B	C

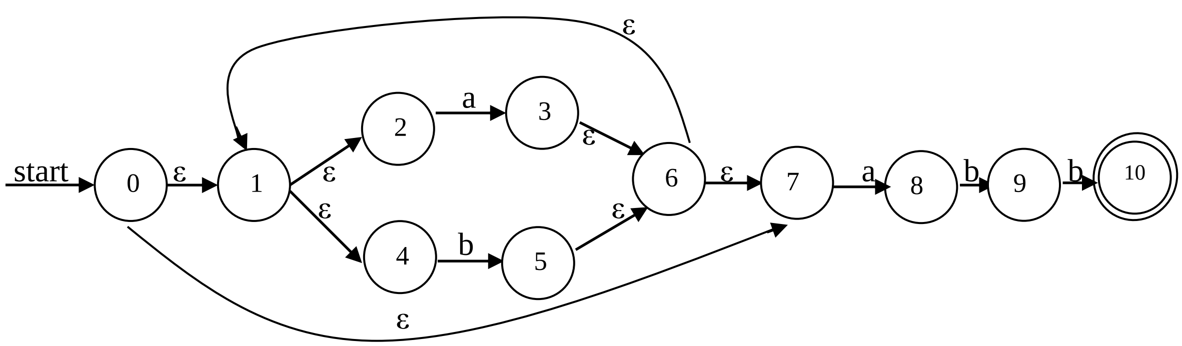


MINIMIZATION OF STATES

Problem 1: Construct a minimum state DFA for a regular expression (a/b)* abb

Solution:-

1. The NFA of (a/b)*abb is



2. Construct a DFA:

ε closure {0} = { 0,1,2,4,7} -------------- A
Transition of input symbol a on A = { 3,8 }
Transition of input symbol b on A = { 5 }

ε closure {3,8} = { 3,6,7,1,2,4,8} -------------- B
Transition of input symbol a on B = { 8,3 }
Transition of input symbol b on B = { 5,9 }

ε closure {5} = { 5,6,7,1,2,4} -------------- C
Transition of input symbol a on C = { 8,3 }

Transition of input symbol b on C = { 5 }

ε closure {5,9} = { 5,6,7,1,2,4,9} -------------- D
Transition of input symbol a on D = { 8,3 }
Transition of input symbol b on D = { 5,10 }

ε closure {5,10} = { 5,6,7,1,2,4,10} -------------- E
Transition of input symbol a on E = { 8,3 }
Transition of input symbol b on E = { 5 }

Since A is the start state and state E is the only accepting state then, the **transition table** is,

State	Input symbol	
	a	b
A	B	C
B	B	D
C	B	C
D	B	E
E	B	C

3. Minimizing the DFA

Let Π = ABCDE
The initial partition Π consists of two groups.
Π_1 = ABCD (that is the non – accepting states)
Π_2 = E (that is the accepting state)

So, (ABCD) (E)

AB

$A \xrightarrow{a} B$ $B \xrightarrow{a} B$

$A \xrightarrow{b} C$ $B \xrightarrow{b} D$

AC

$A \xrightarrow{a} B$ $C \xrightarrow{a} B$

$A \xrightarrow{b} C$ $C \xrightarrow{b} C$

AD

$A \xrightarrow{a} B$ $D \xrightarrow{a} B$

$A \xrightarrow{b} C$ $D \xrightarrow{b} E$

On input "a" each of these states has a transition to B, so they could all remain in one group as far as input a is concerned.
On input "b" A,B,C go to members of the group Π_1 (ABCD) while D goes to Π_2 (E) . Thus Π_1 group is split into two new groups.

Π_1 = ABC Π_2 = D , Π_3 = E
So, (ABC) (D) (E)

AB

$A \xrightarrow{a} B$ $B \xrightarrow{a} B$

$A \xrightarrow{b} C$ $B \xrightarrow{b} D$

Here B goes to Π_2. Thus Π_1 group is again split into two new groups. The new groups are,

Π_1 = AC Π_2 = B , Π_3 = D, Π_4 = E
So, (AC) (B) (D) (E)

Here we cannot split any of the groups consisting of the single state. The only possibility is try to split only (AC)

For AC

$A \xrightarrow{a} B$ $C \xrightarrow{a} B$

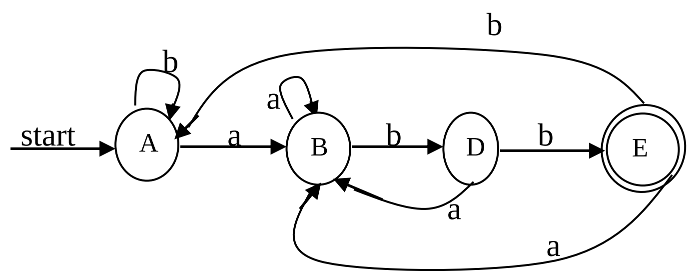
$A \xrightarrow{b} C$ $C \xrightarrow{b} C$

But A and C go the same state B on input a, and they go to the same state C on input b.
Hence after this,
(AC) (B) (D) (E)
Here we choose A as the representative for the group AC.
Thus A is the start state and state E is the only accepting state.

So the ***minimized transition table*** is,

State	Input symbol	
	a	b
A	B	A
B	B	D
D	B	E
E	B	A

Thus the minimized DFA is,



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