PES UNIVERSITY ONLINE

Automata Formal Languages & Logic

Preet Kanwal

Department of Computer Science & Engineering

Automata Formal Languages & Logic

Unit 2

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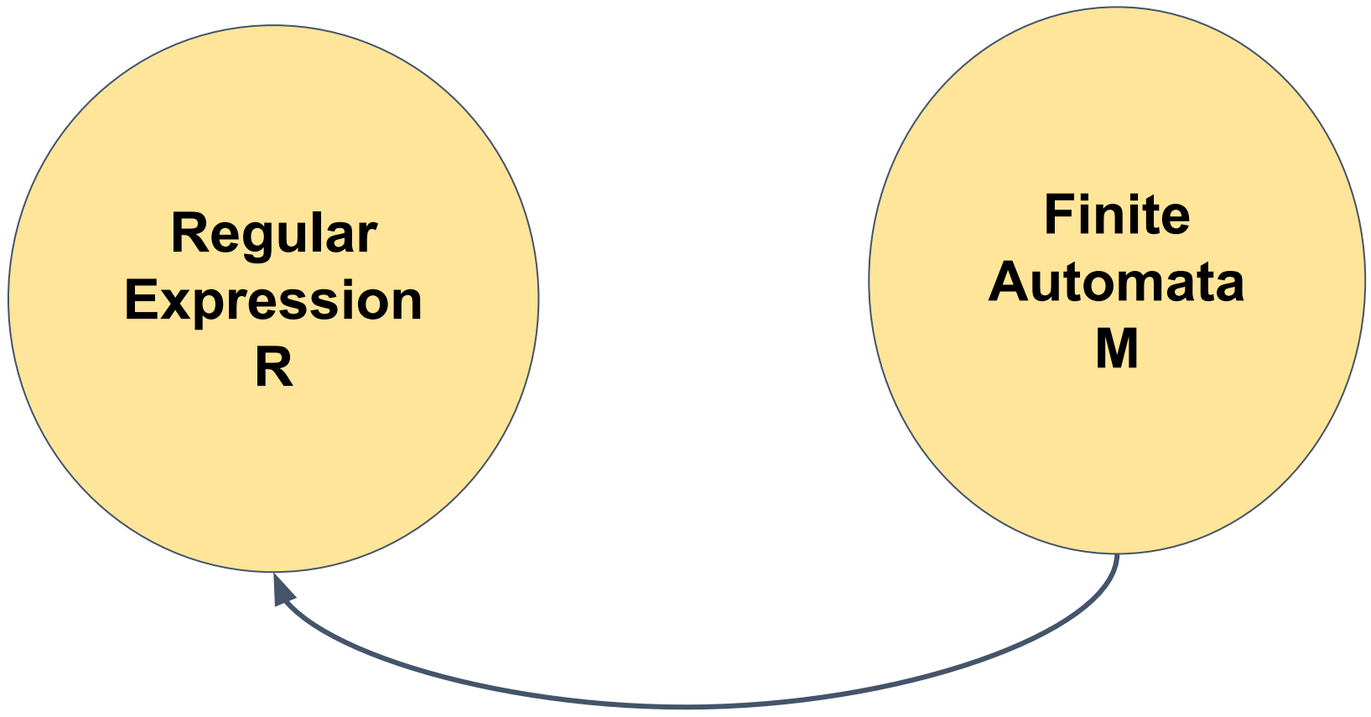
Department of Mechanical Engineering



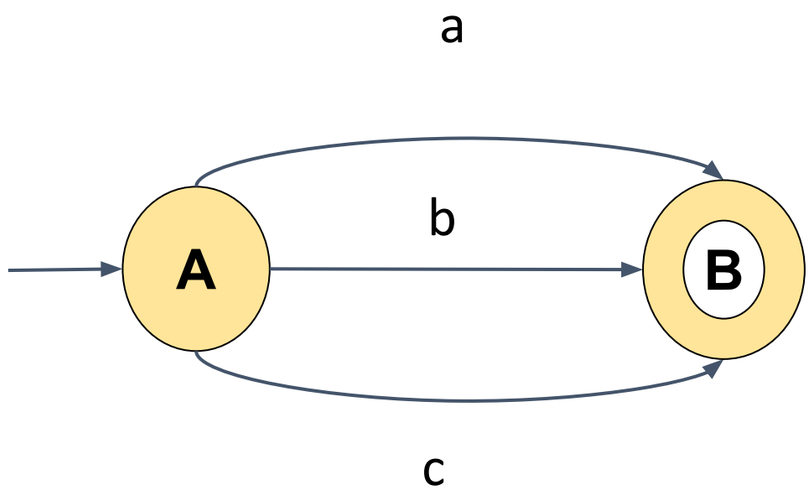
State Elimination Algorithm

State Elimination Method

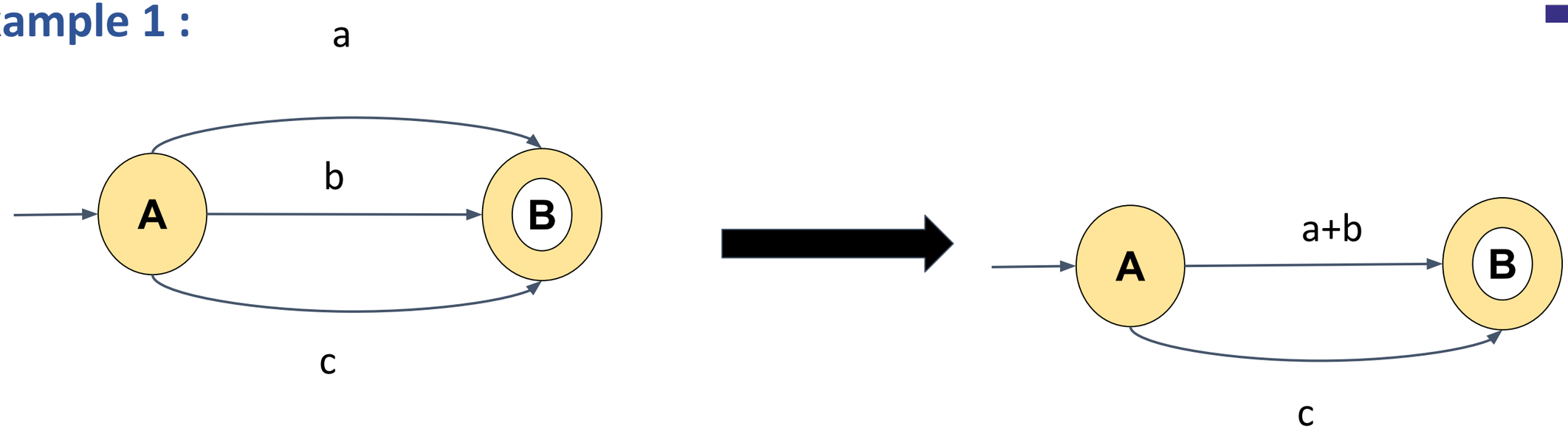
Start with an FA for the language L.

- Add a new start state qs and accept state qf to the FA.
- Add ε-transitions from each original accepting state to qf , then mark them as not accepting.
- Repeatedly remove states other than qs and qf from the FA by "shortcutting" them until only two states remain: qs and qf .
- The transition from qs to qf is then a regular expression for the FA.

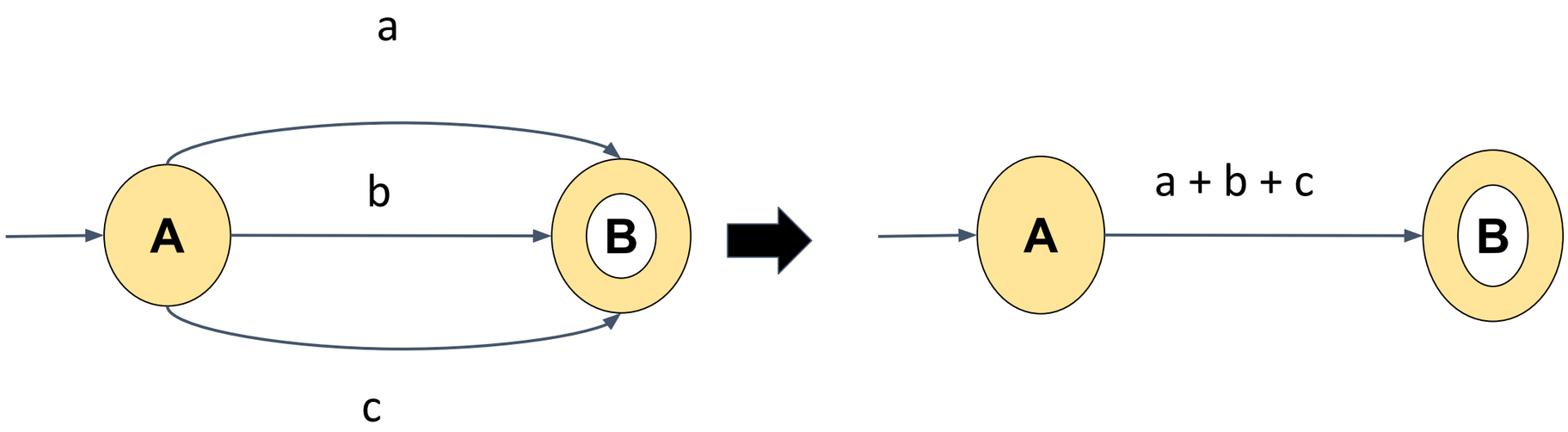
Example 1 :



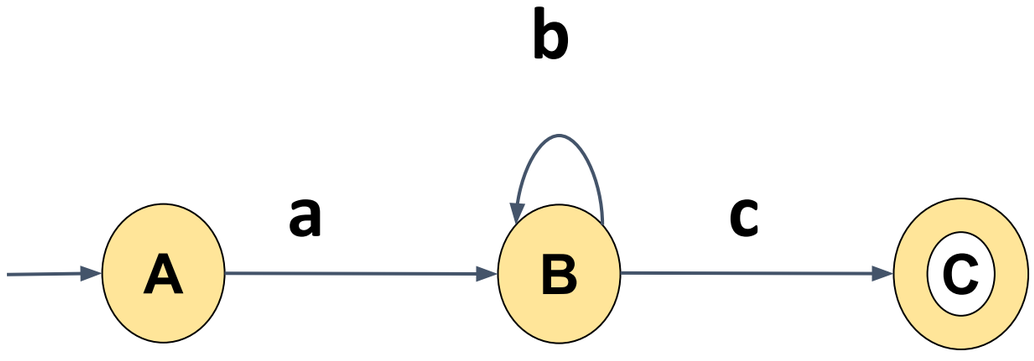
Example 1 :



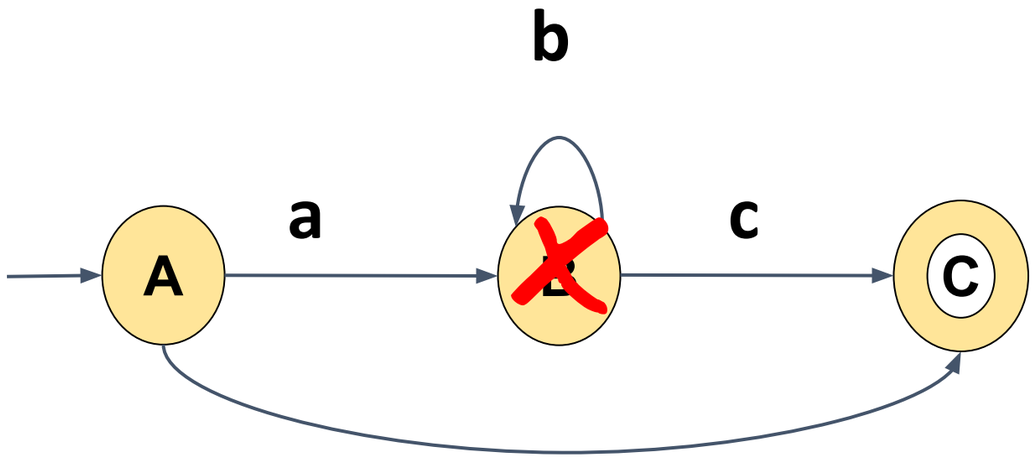
Example 1 :



Example 2 :



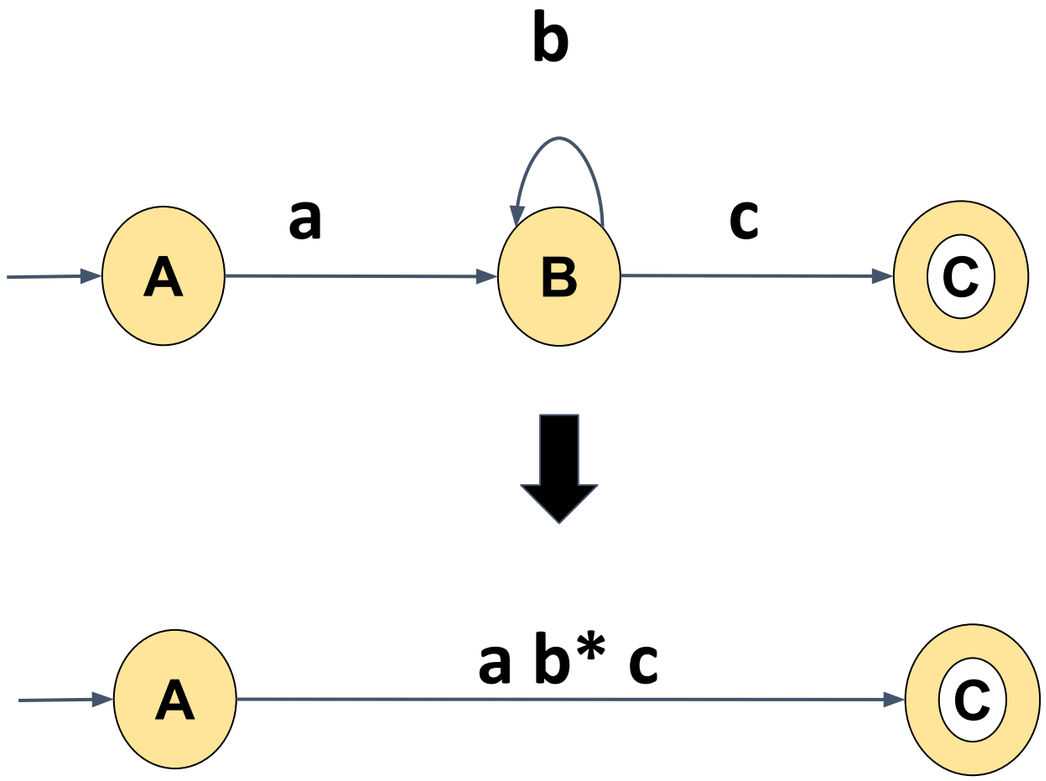
Example 2 :



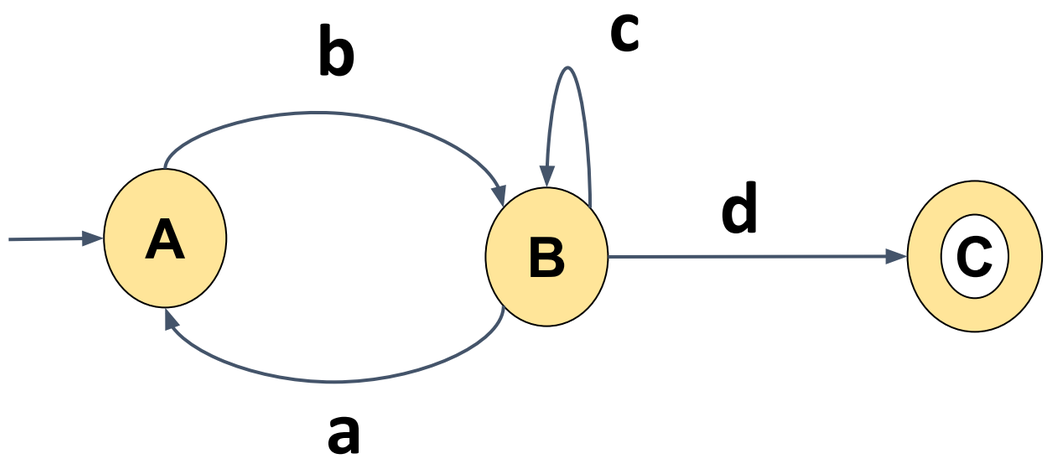
Eliminate B

a b* c

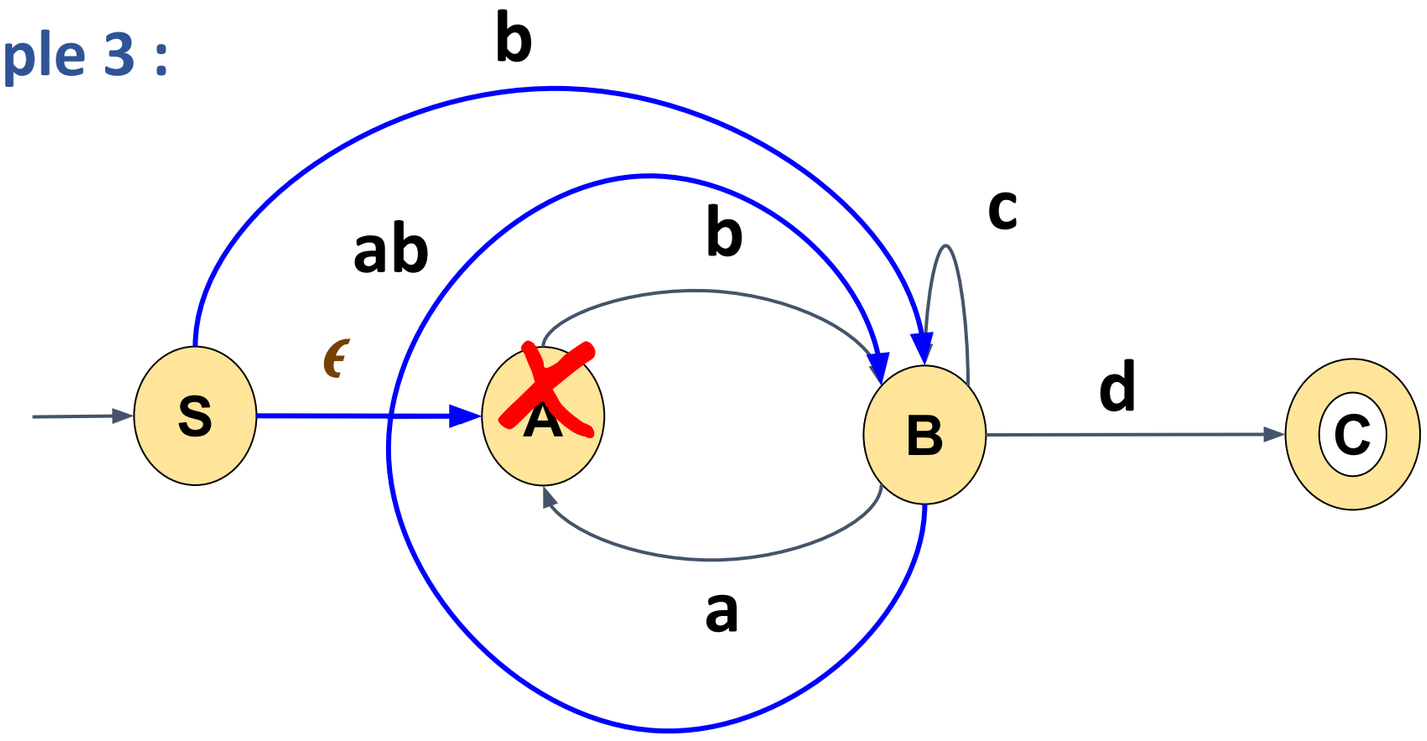
Example 2 :



Example 3 :

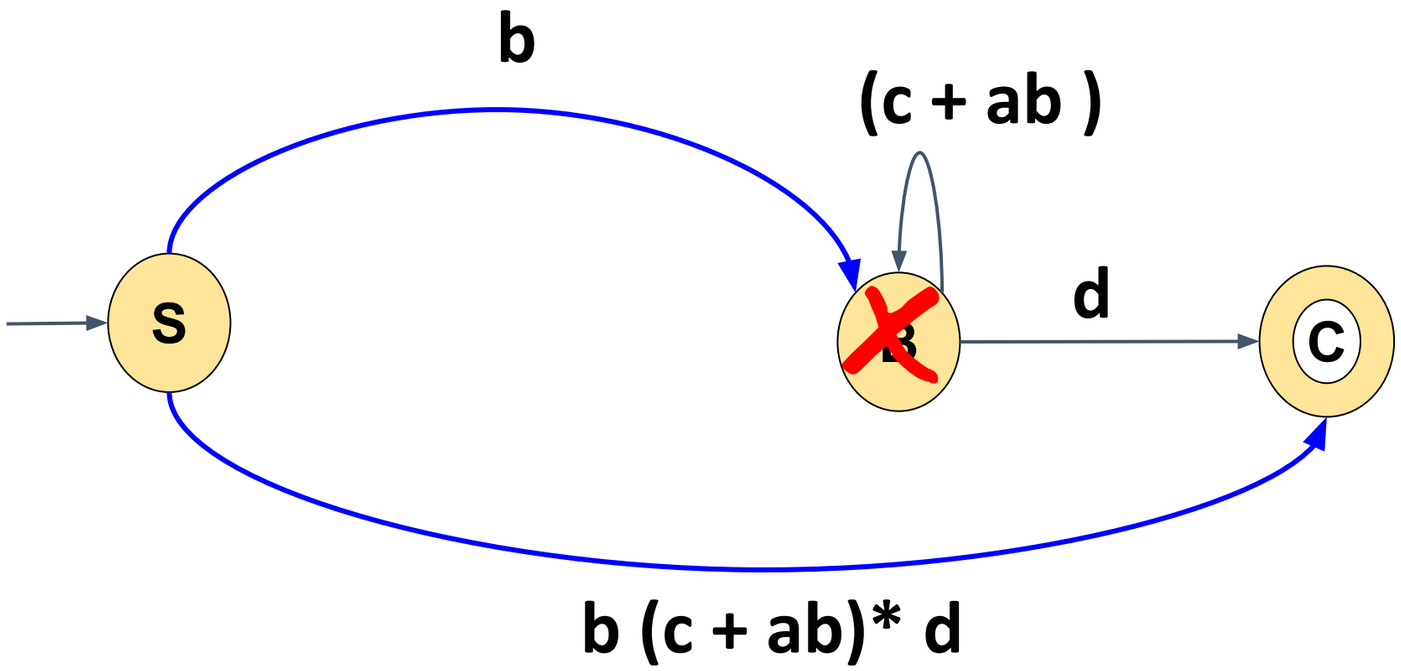


Example 3 :



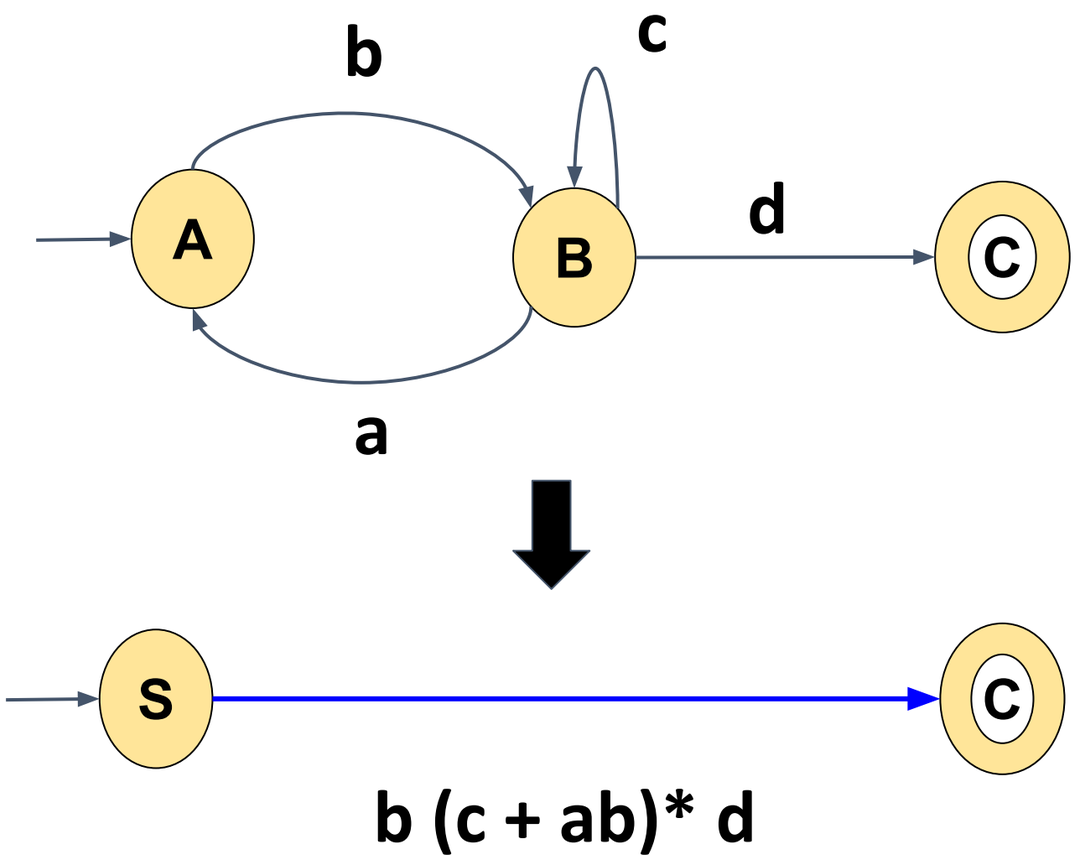
1. Eliminate A

Example 3 :



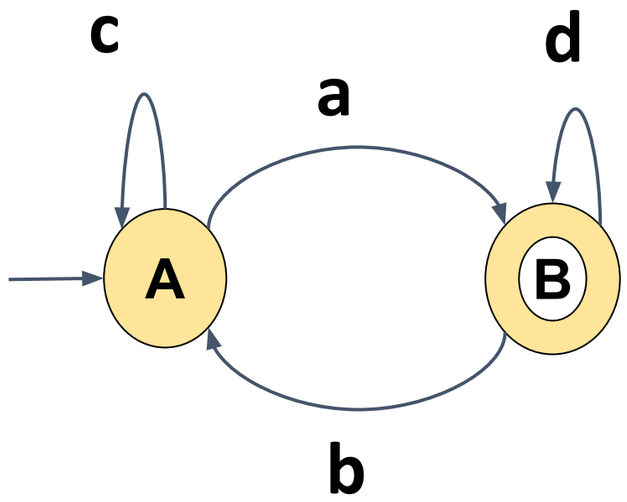
1. Eliminate A
2. Eliminate B

Example 3 :

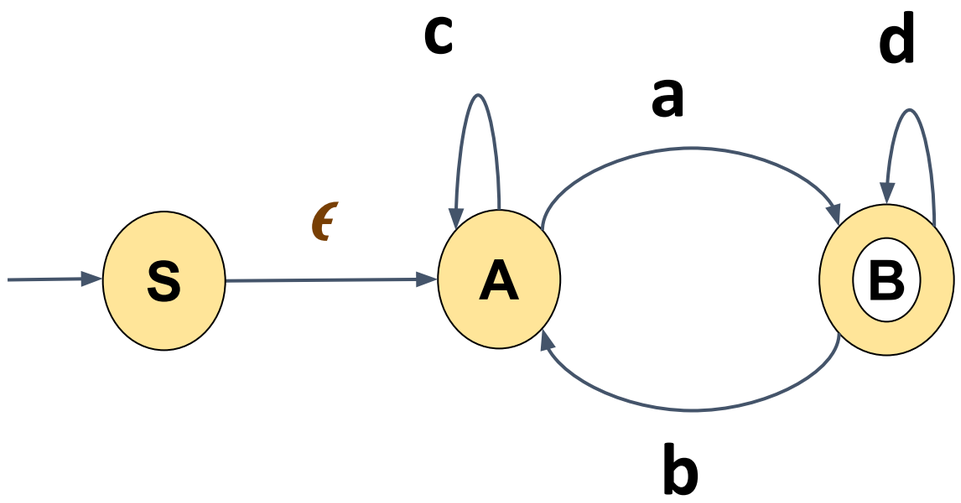


b (c + ab)* d

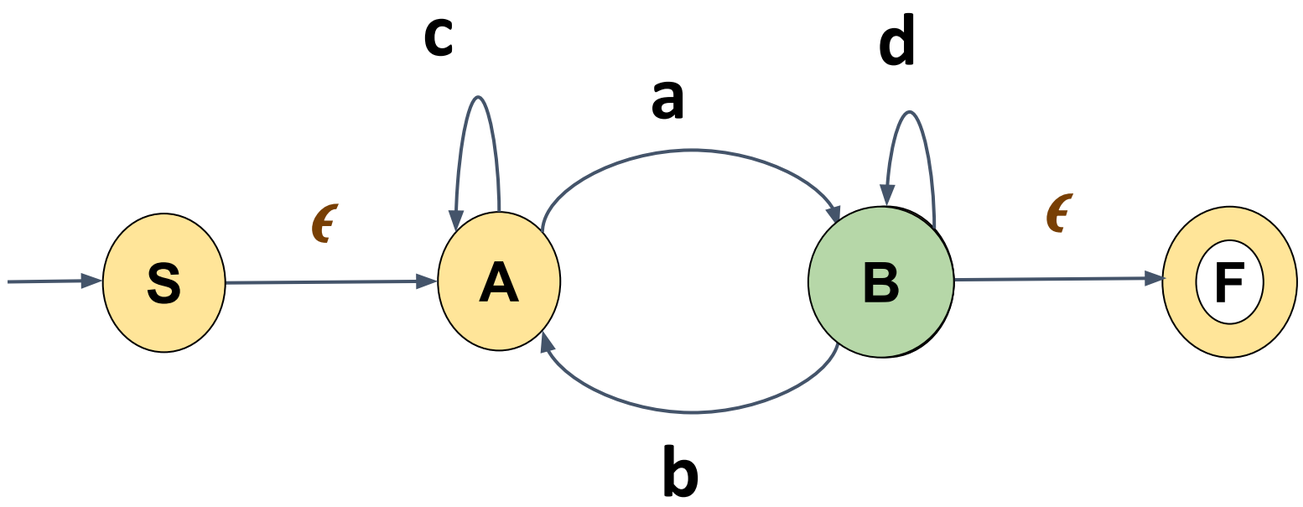
Example 4 :



Example 4 :

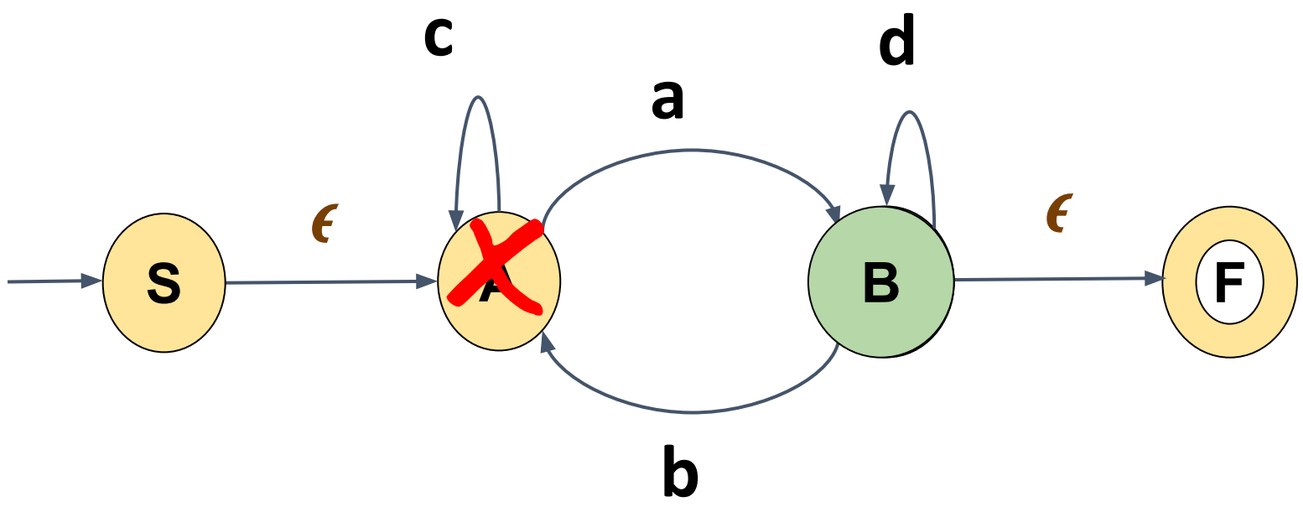


Example 4 :



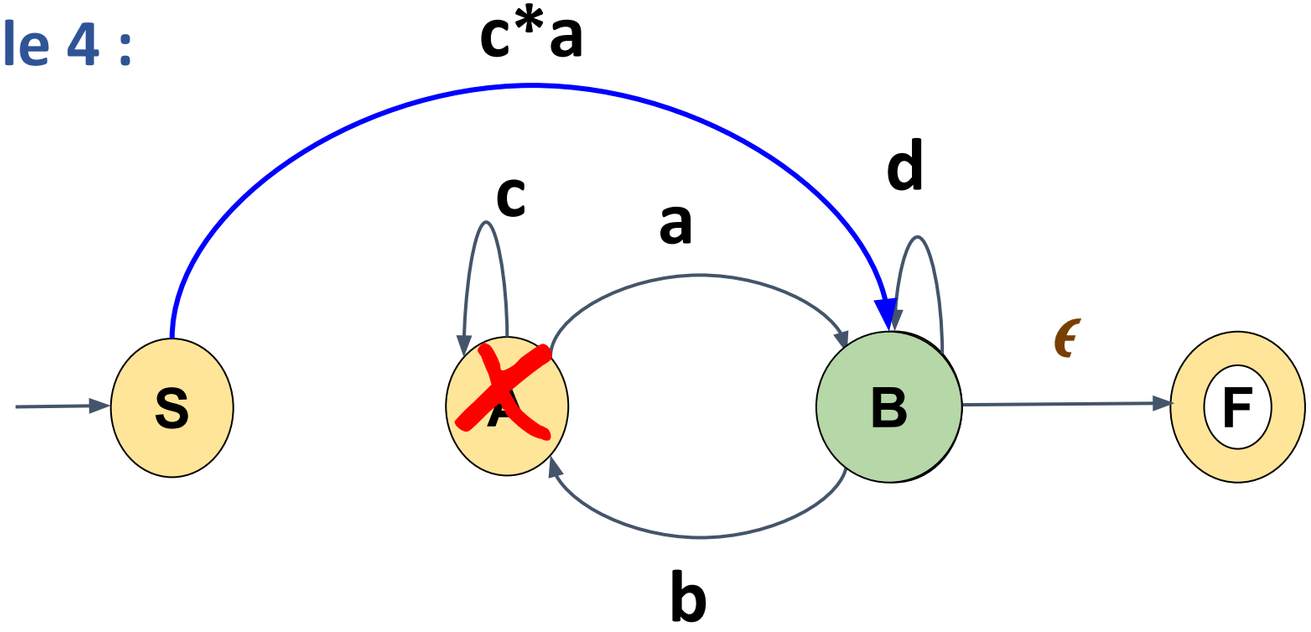
A new Final state F is introduced as there is an Outgoing edge to the existing Final State B.

Example 4 :



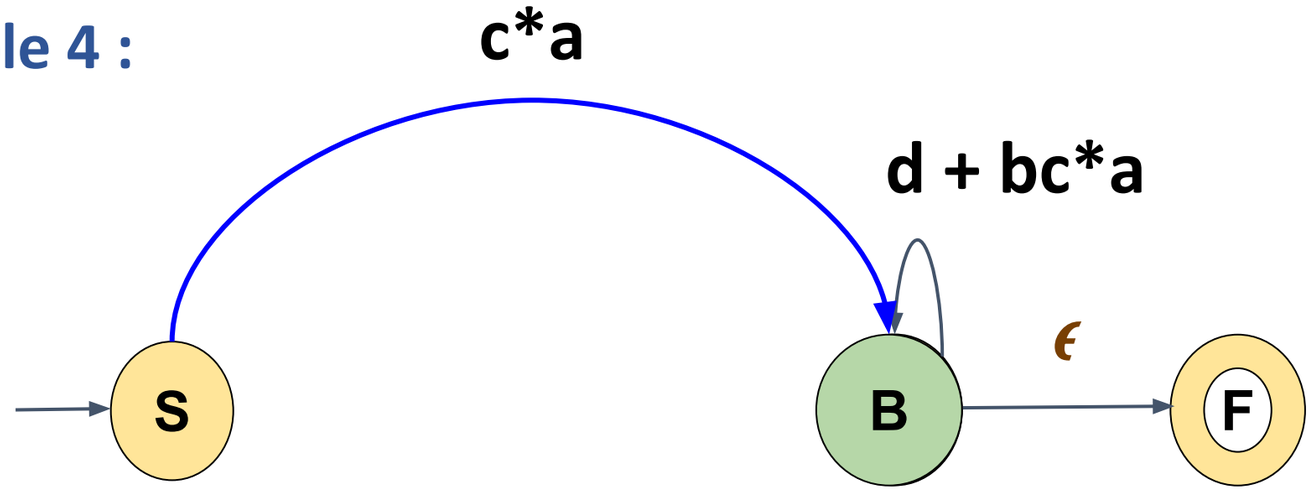
1. Eliminate A

Example 4 :



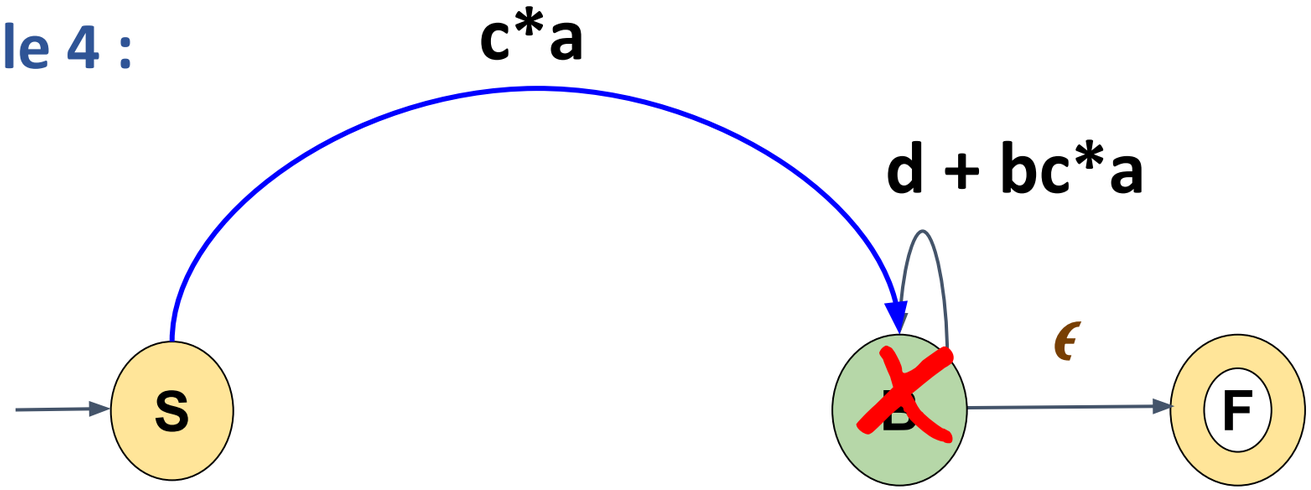
1. Eliminate A

Example 4 :



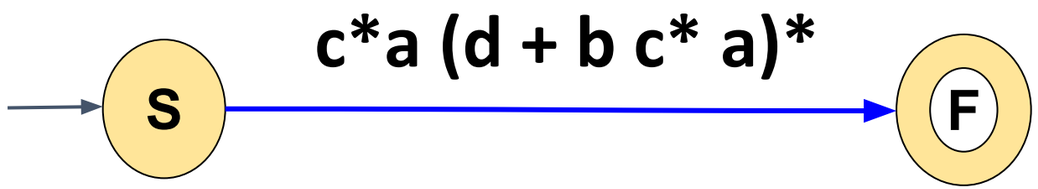
1. Eliminate A

Example 4 :



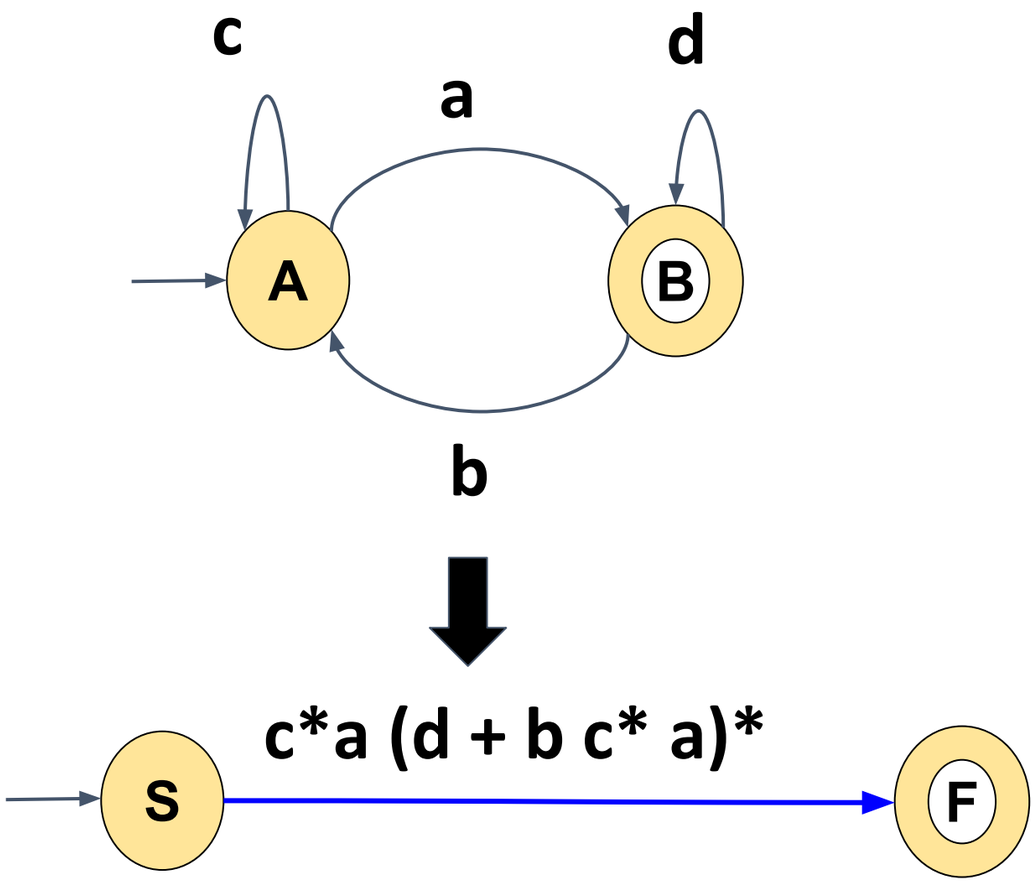
1. Eliminate A
2. Eliminate B

Example 4 :

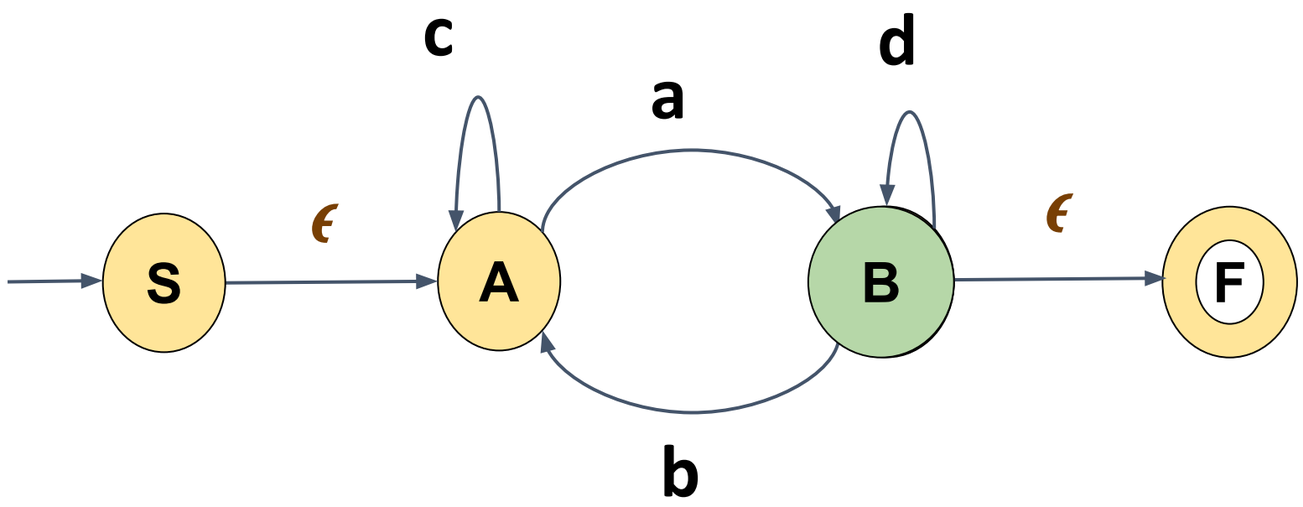


1. Eliminate A
2. Eliminate B

Example 4 :



Example 4 :



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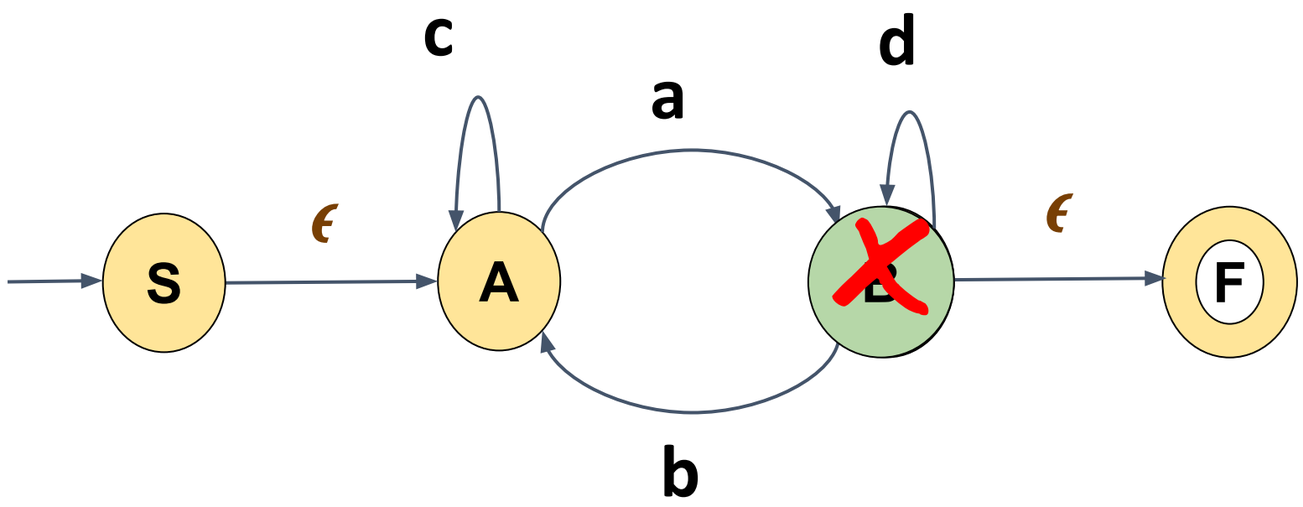
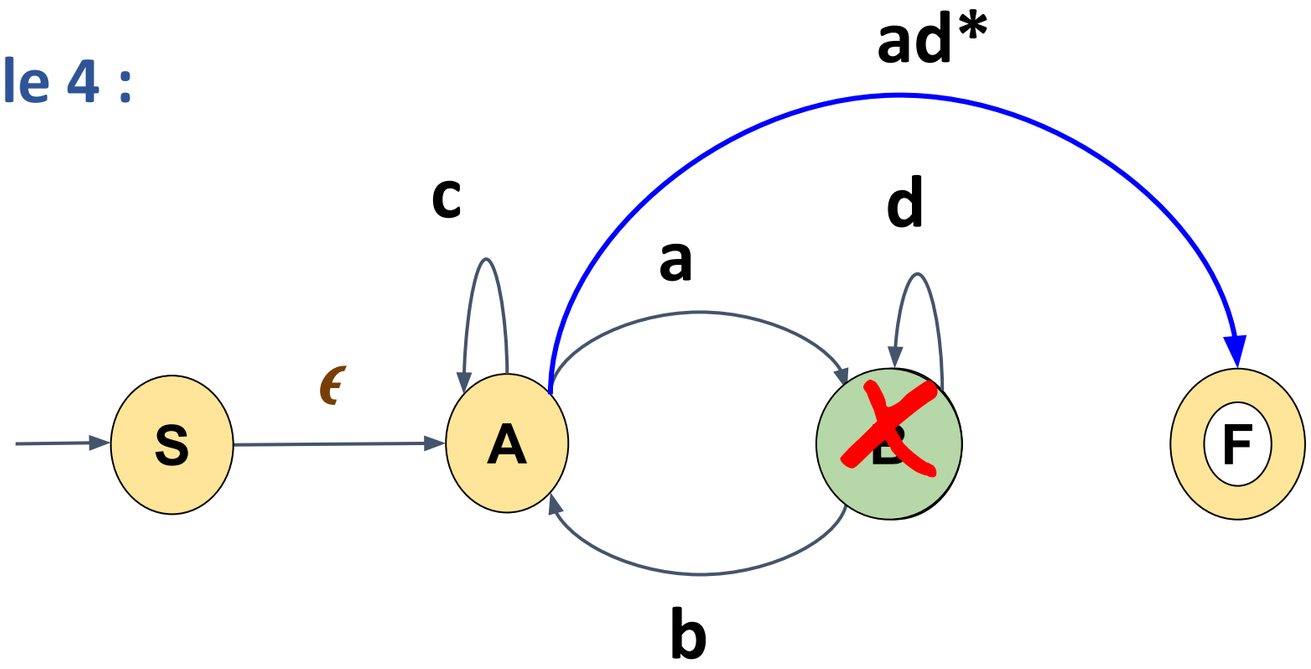


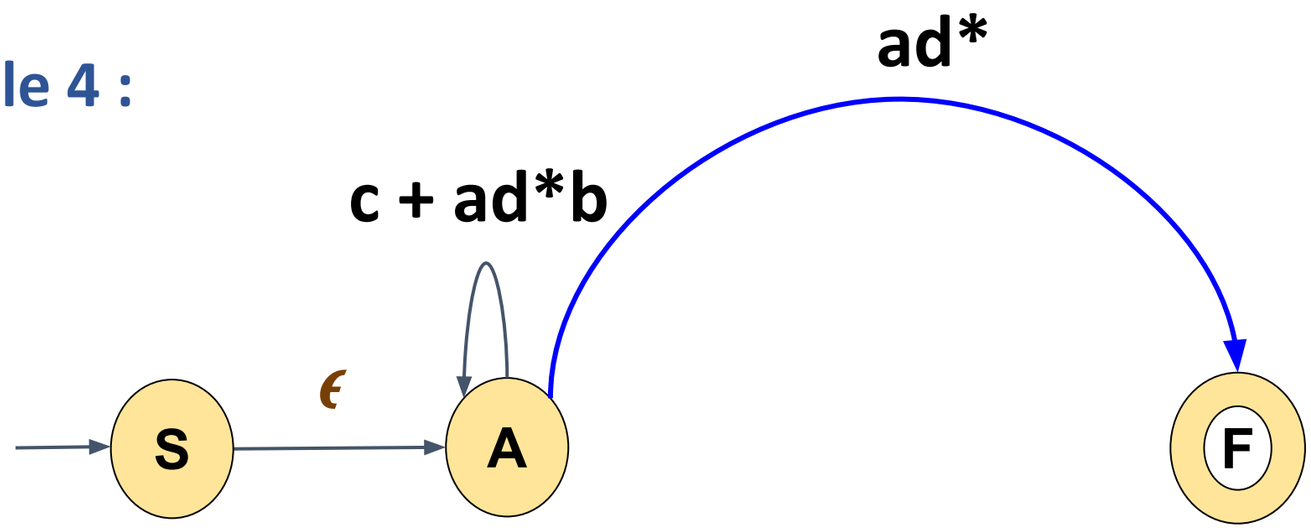
1. Eliminate B

Example 4 :



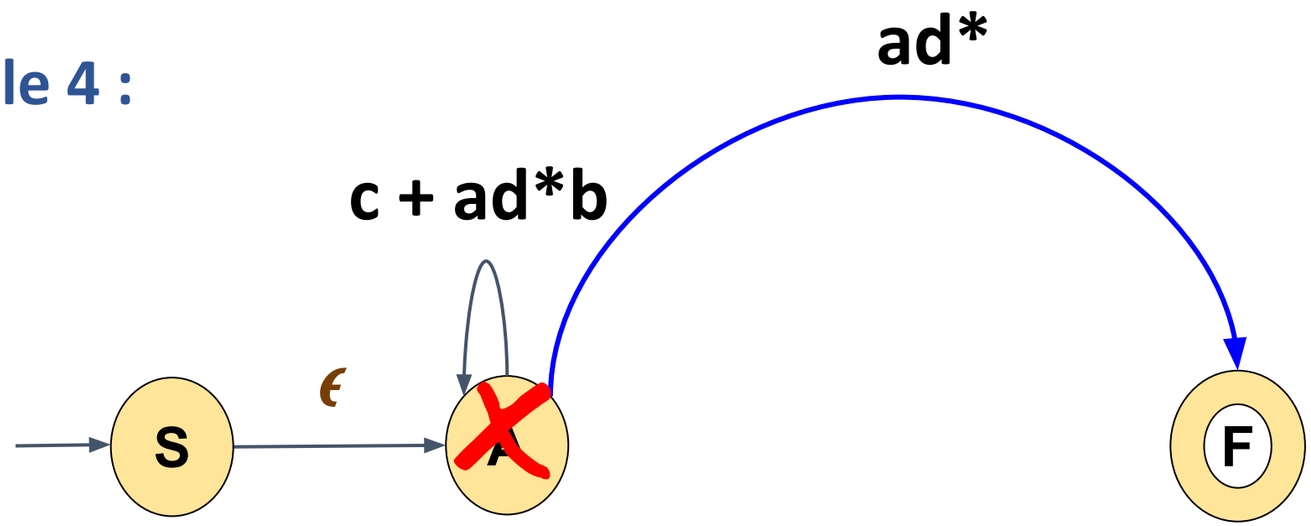
1. Eliminate B

Example 4 :



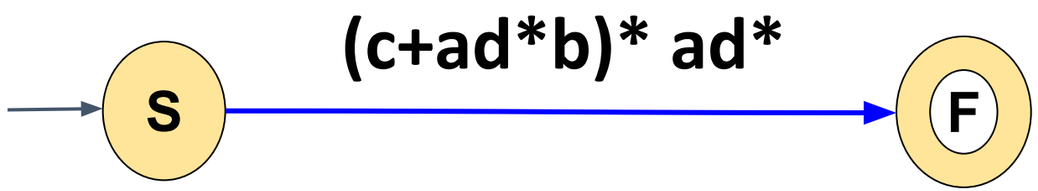
1. Eliminate B

Example 4 :



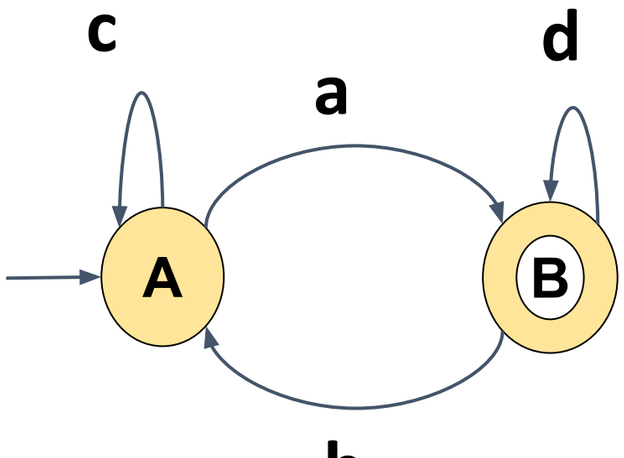
1. Eliminate B
2. Eliminate A

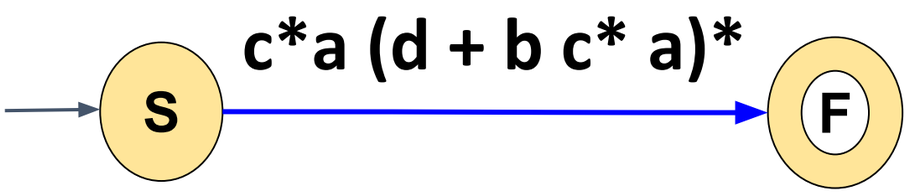
Example 4 :



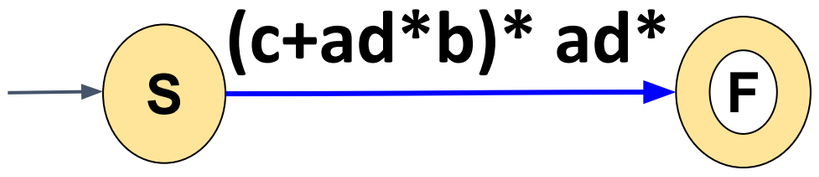
1. Eliminate B
2. Eliminate A

Example 4 :



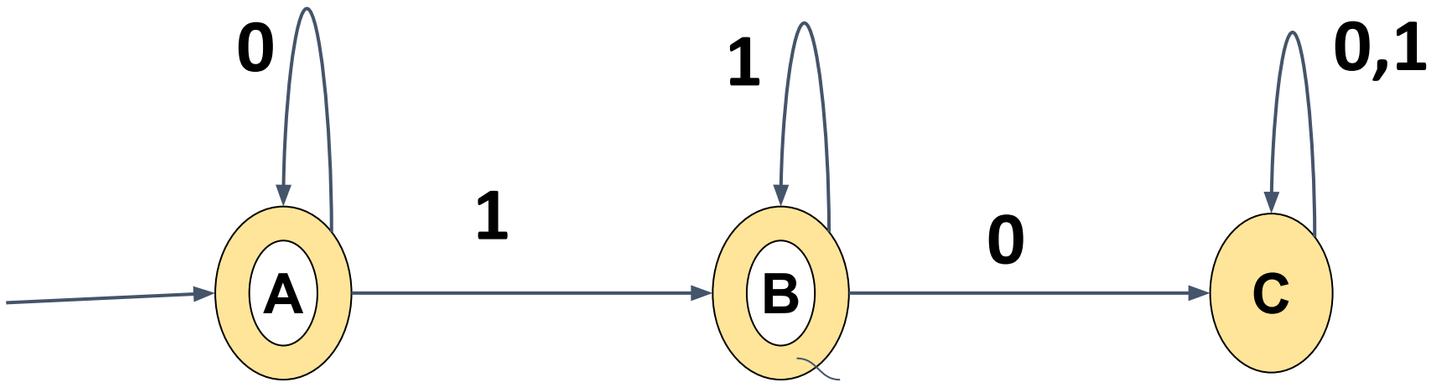


1. Eliminate A
2. Eliminate B

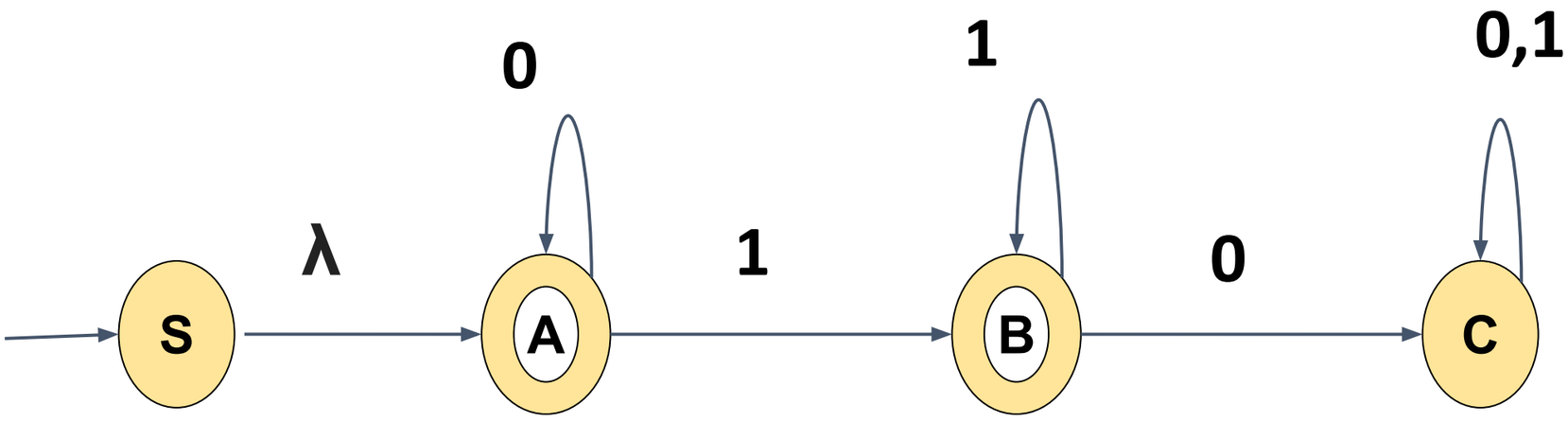


1. Eliminate B
2. Eliminate A

Example 5 :

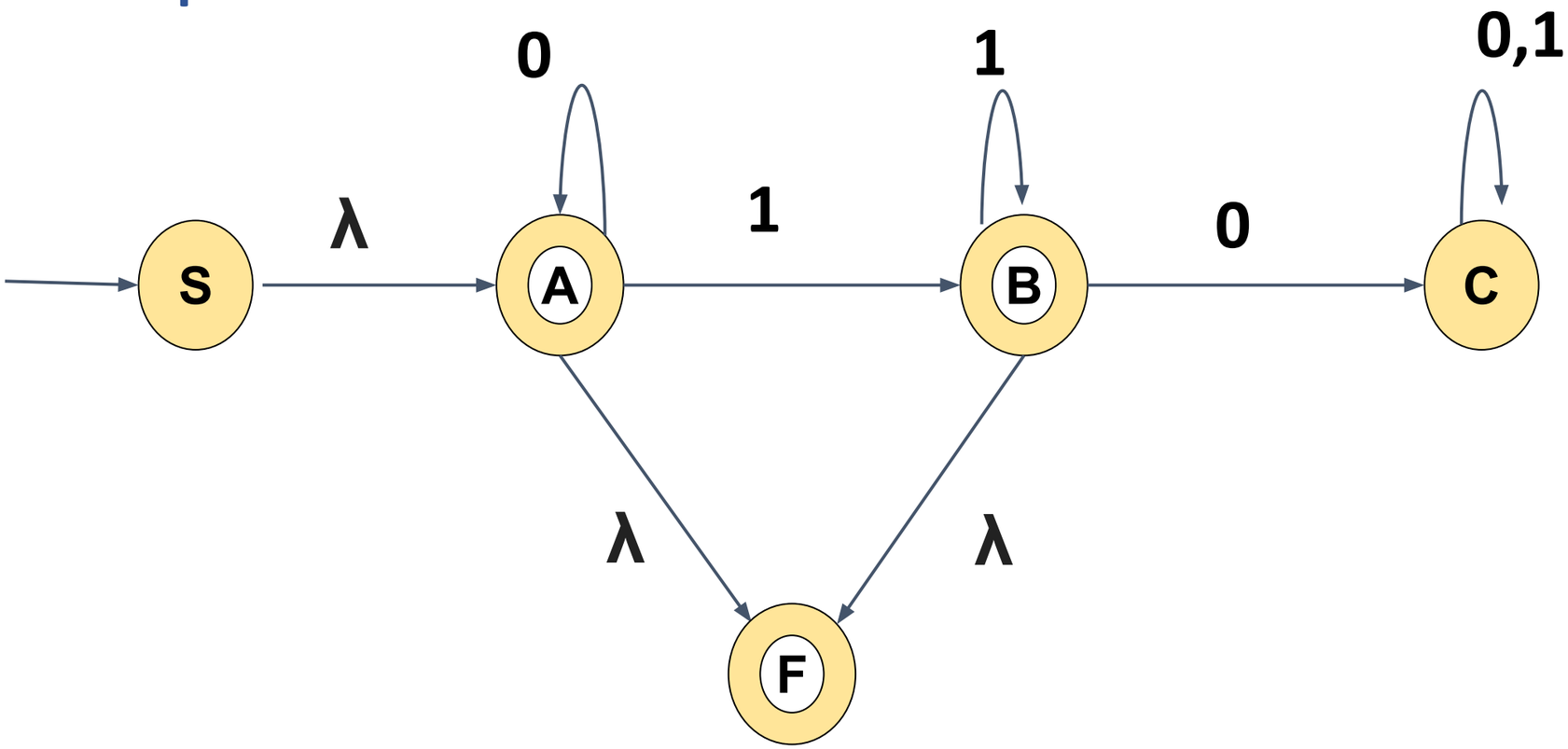


Example 5 :



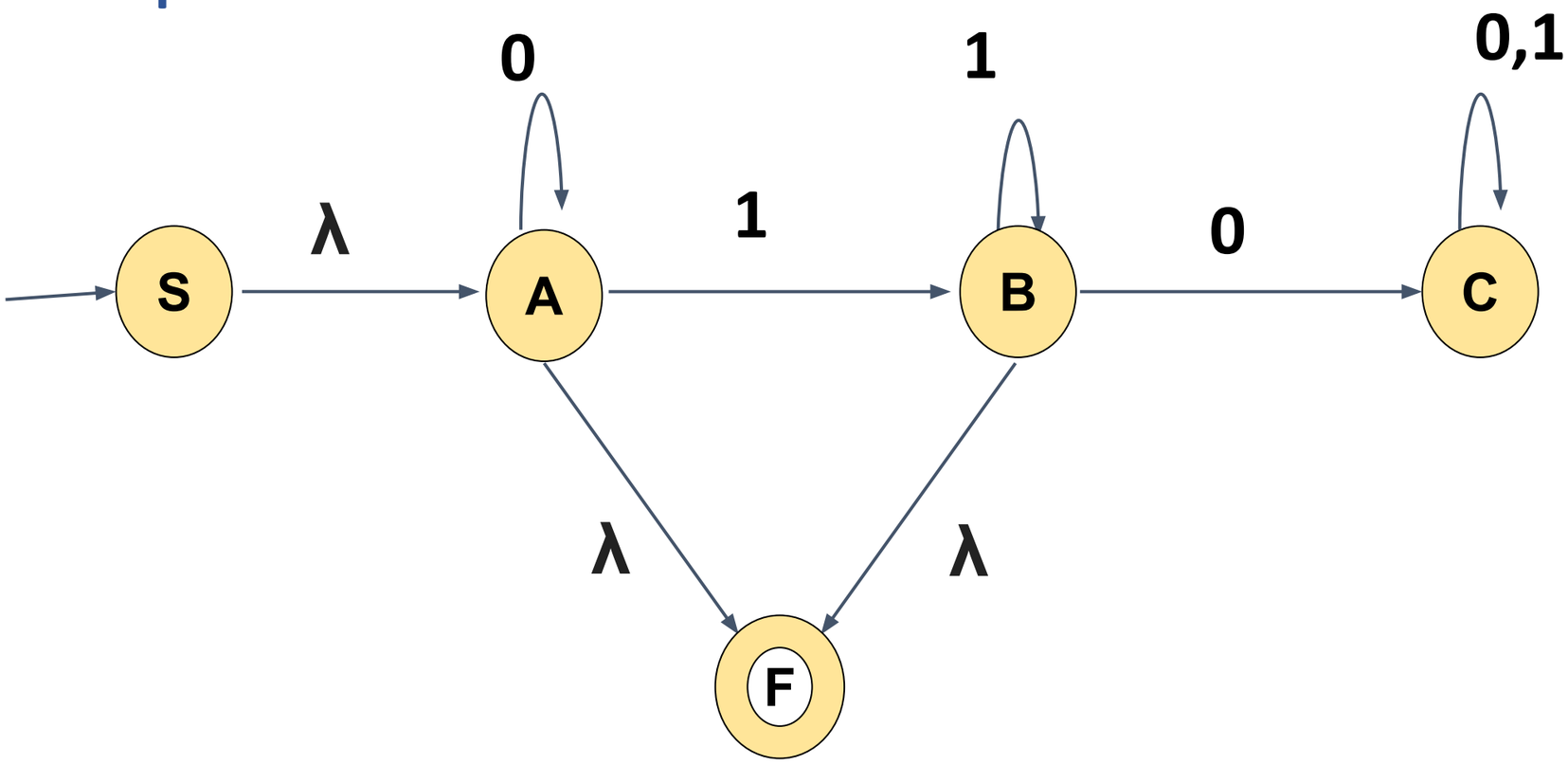
A new start state (S) is introduced as there is an incoming edge to the existing start state

Example 5 :



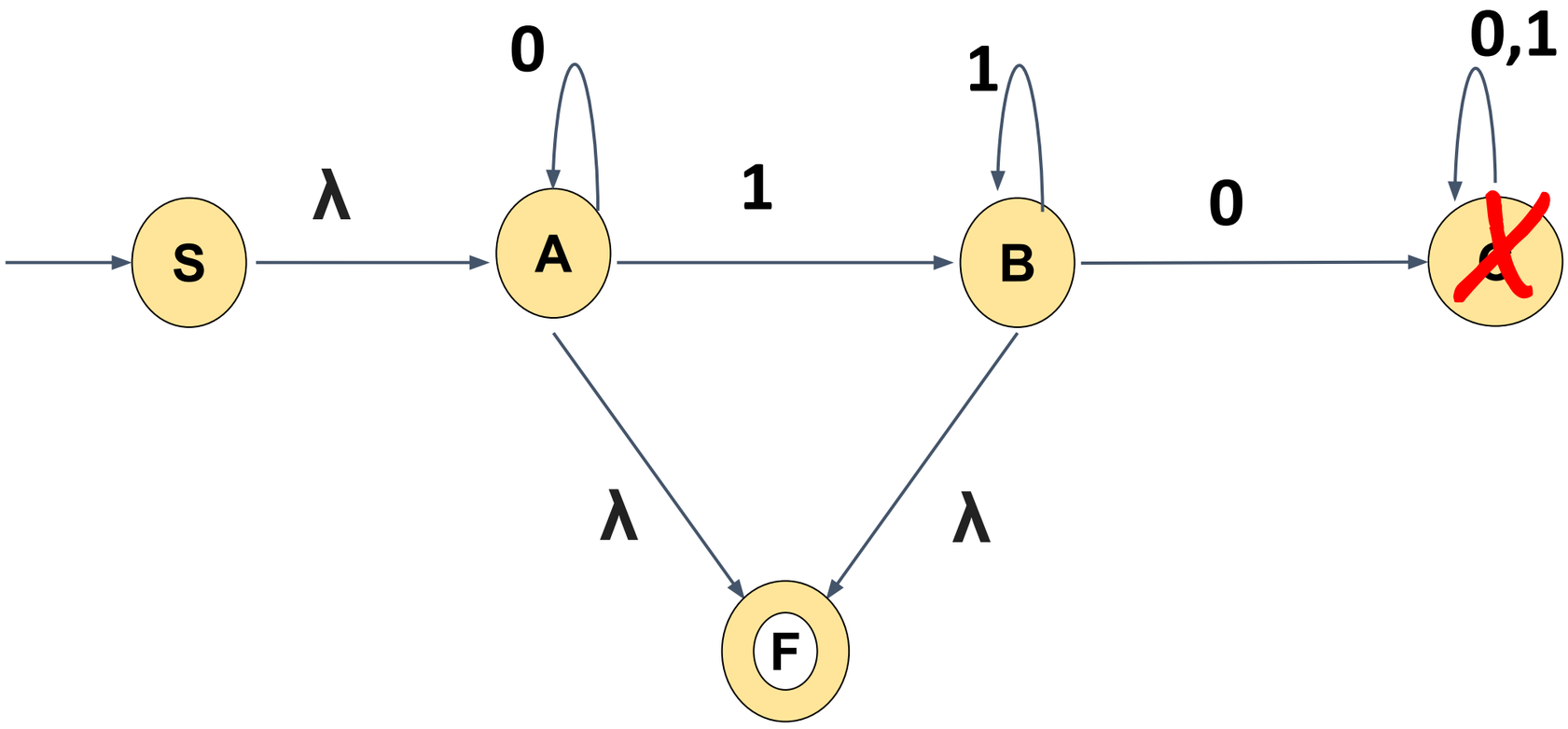
A new final state (F) is introduced as there is an outgoing edge from the existing final state and we must have a single accepting state

Example 5 :



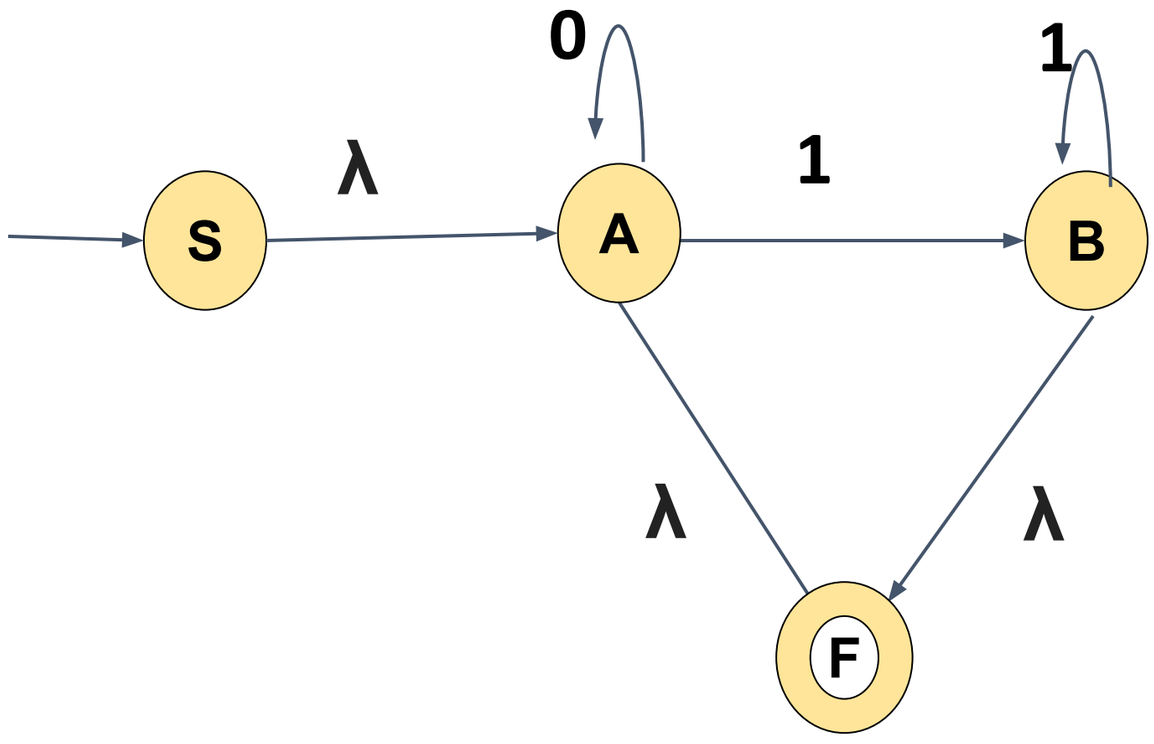
Previous final state is made as non final state

Example 5 :



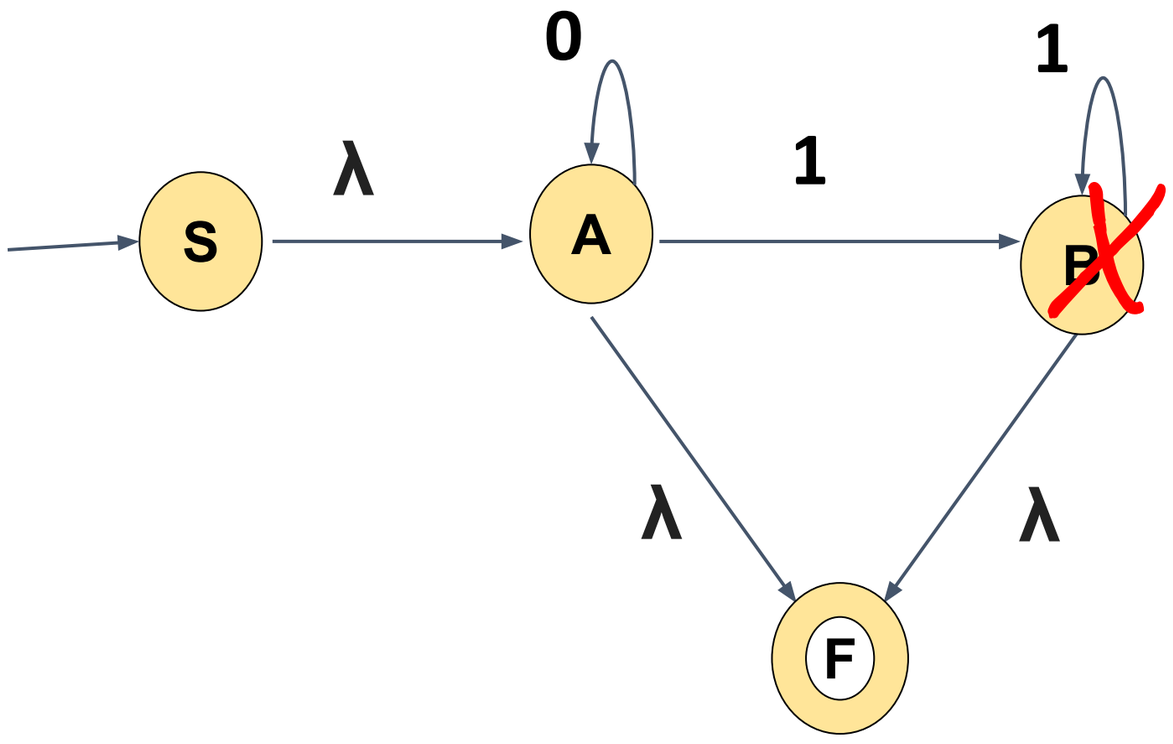
1. Eliminate C

Example 5 :



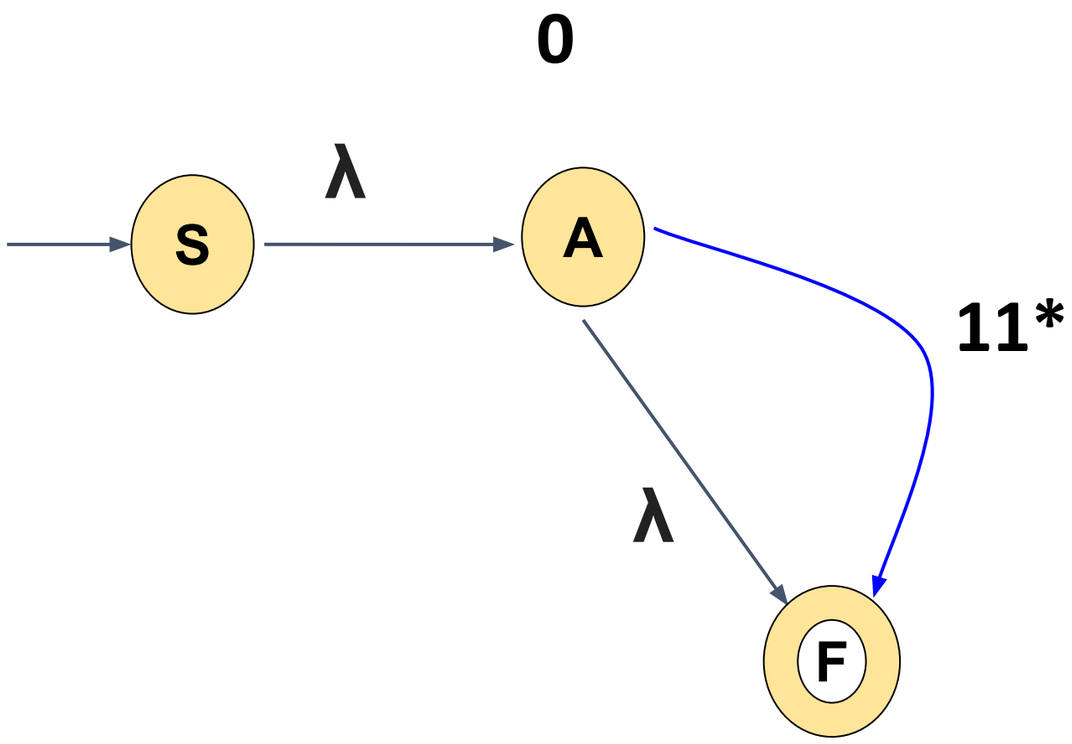
1. Eliminate C

Example 5 :



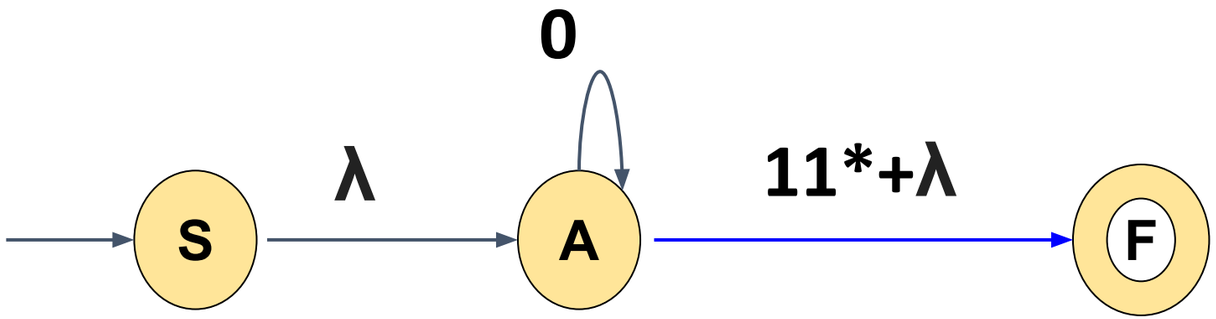
1. Eliminate C
2. Eliminate B

Example 5 :



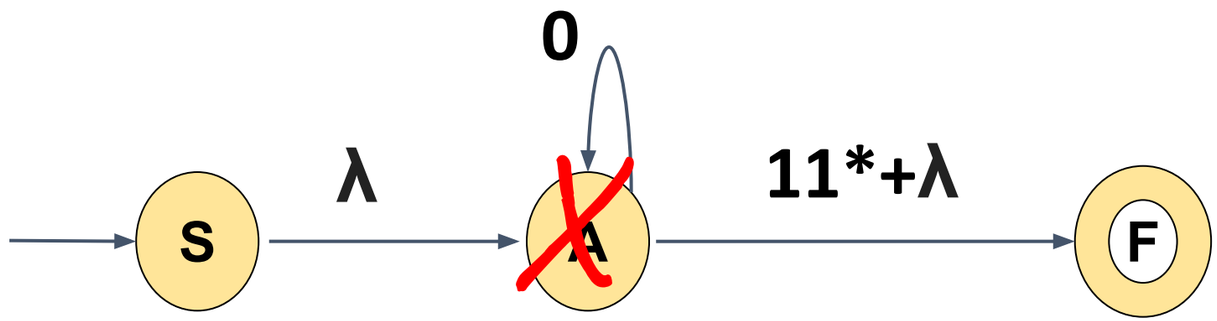
1. Eliminate C
2. Eliminate B

Example 5 :



1. Eliminate C
2. Eliminate B

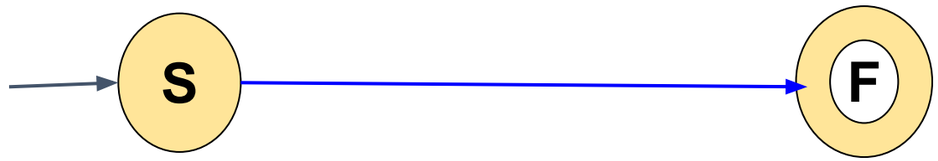
Example 5 :



1. Eliminate C
2. Eliminate B
3. Eliminate A

Example 5 :

$$0^*(11^*+\lambda)$$

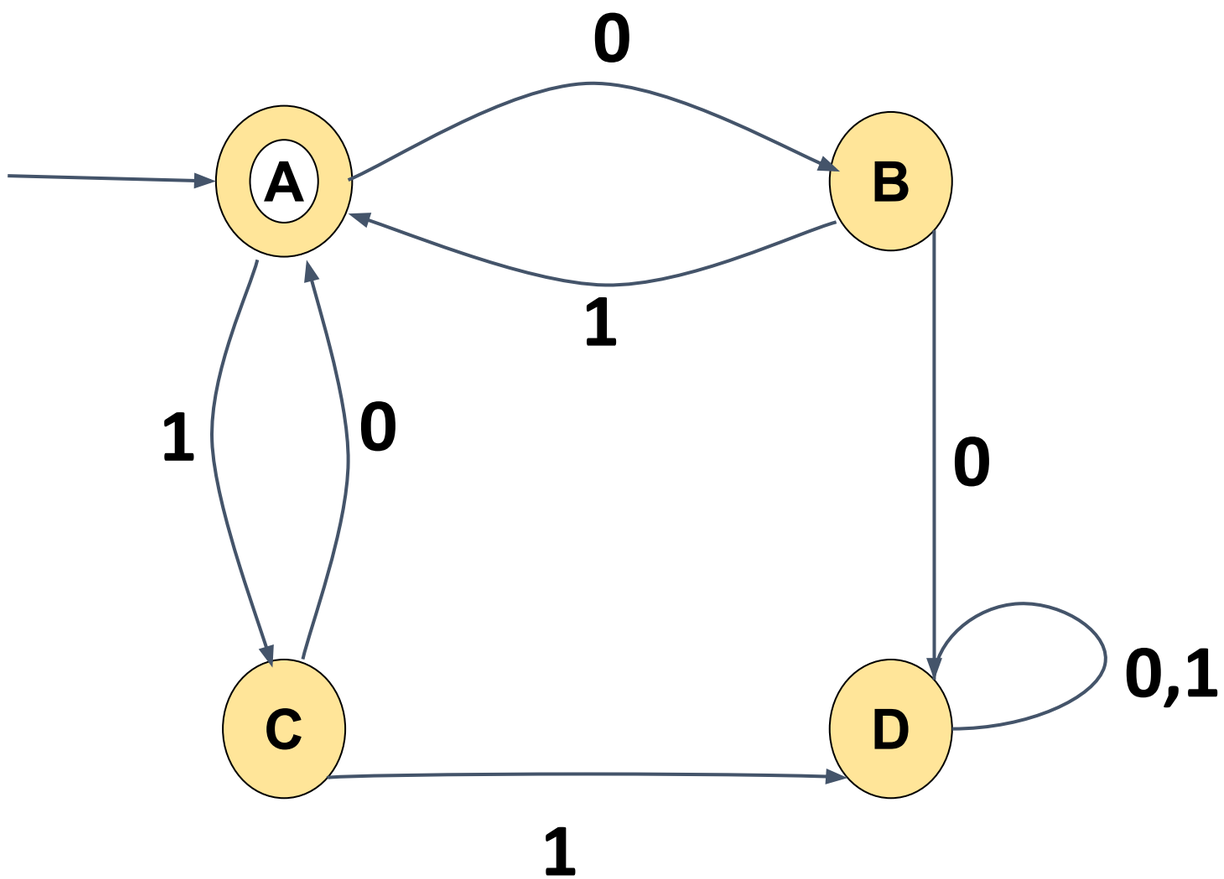


$= 0(11^*+\lambda)$

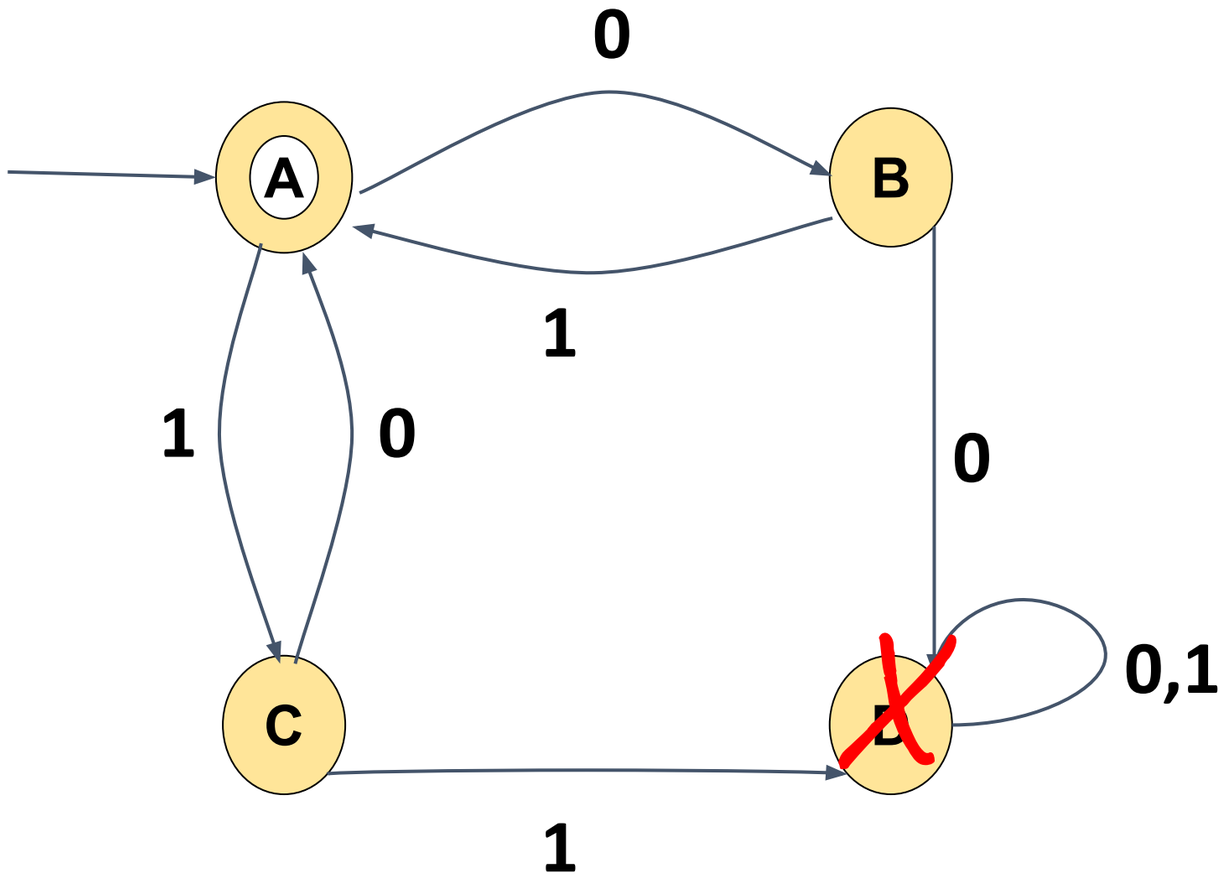
$=0^*(1^+ +\lambda)$

$RE = 0^*1^*$

Example 6 :

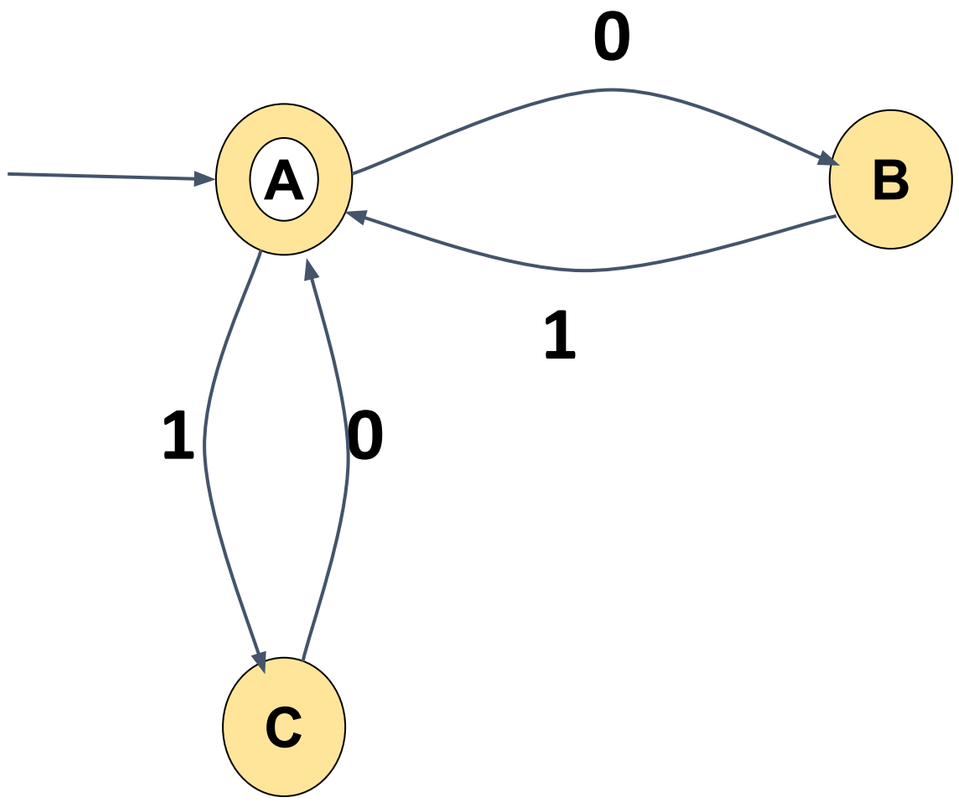


Example 6 :

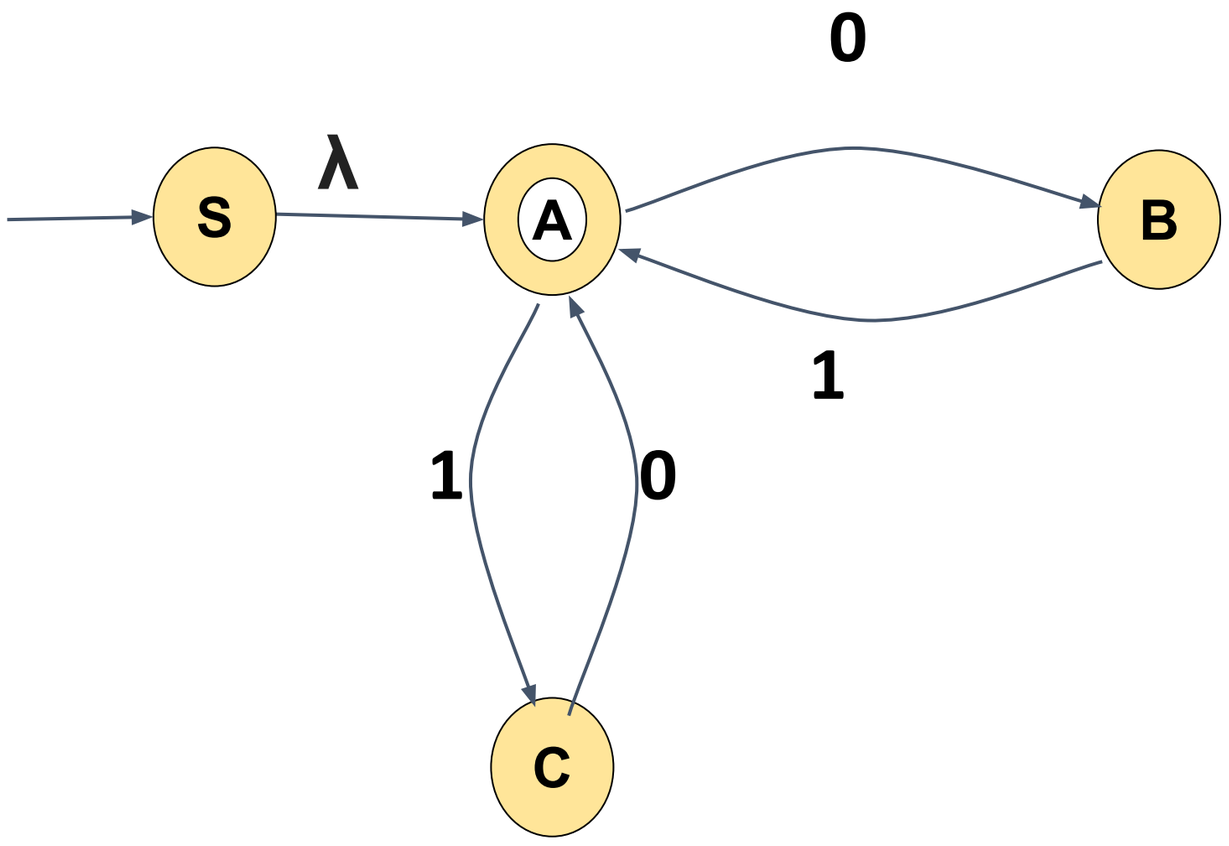


1. Eliminate D
   (Dead state)

Example 6 :

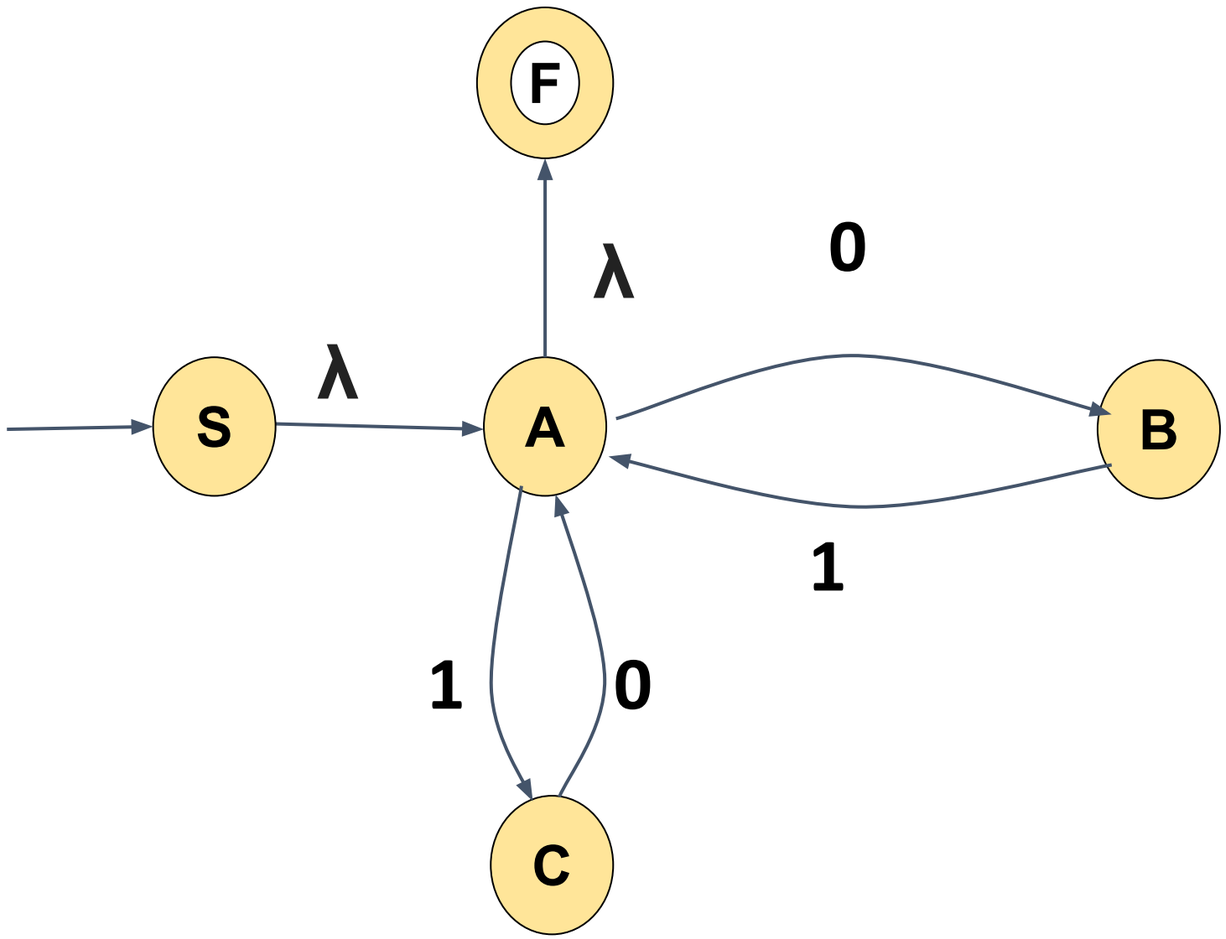


Example 6 :



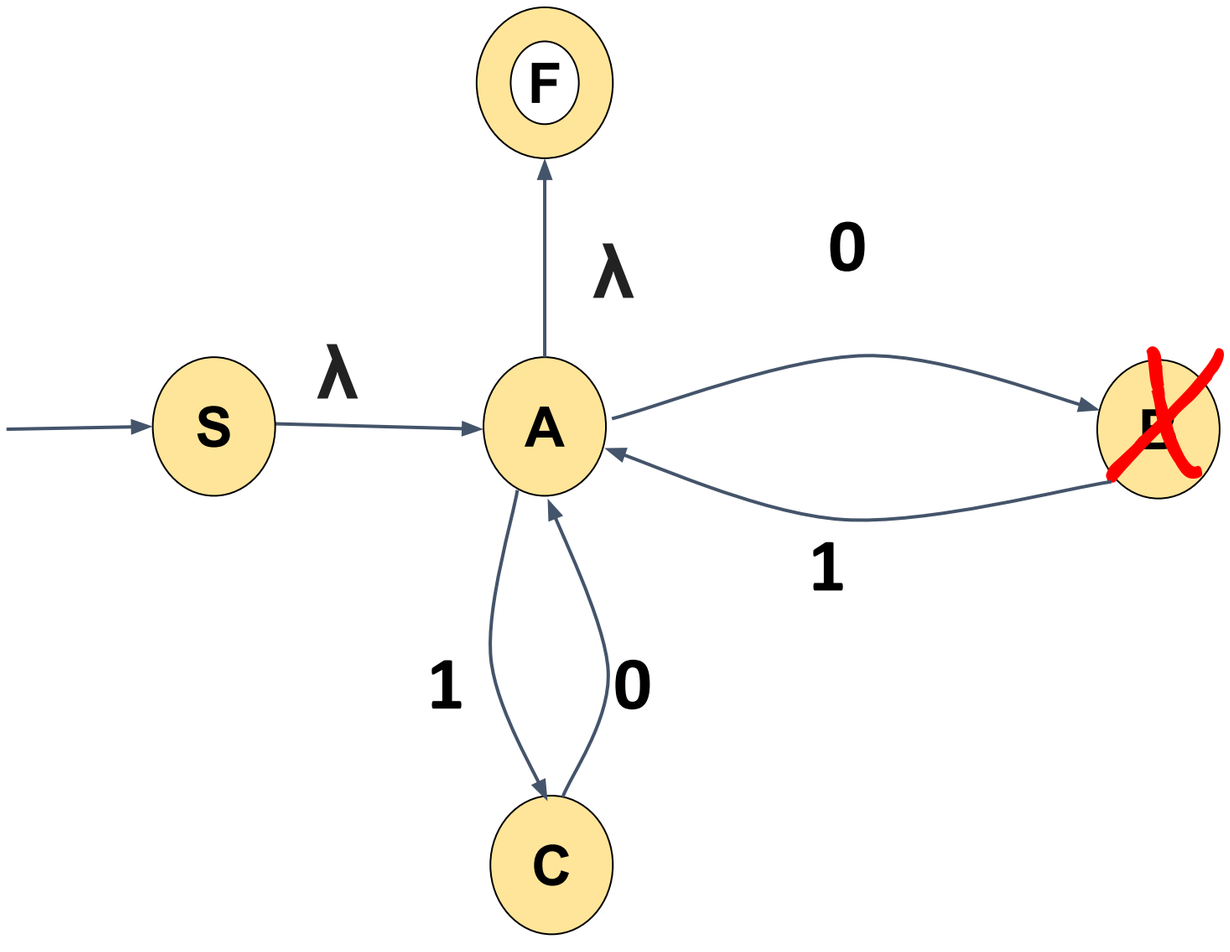
A new start state (S) is introduced as there is an incoming edge to the existing start state

Example 6 :



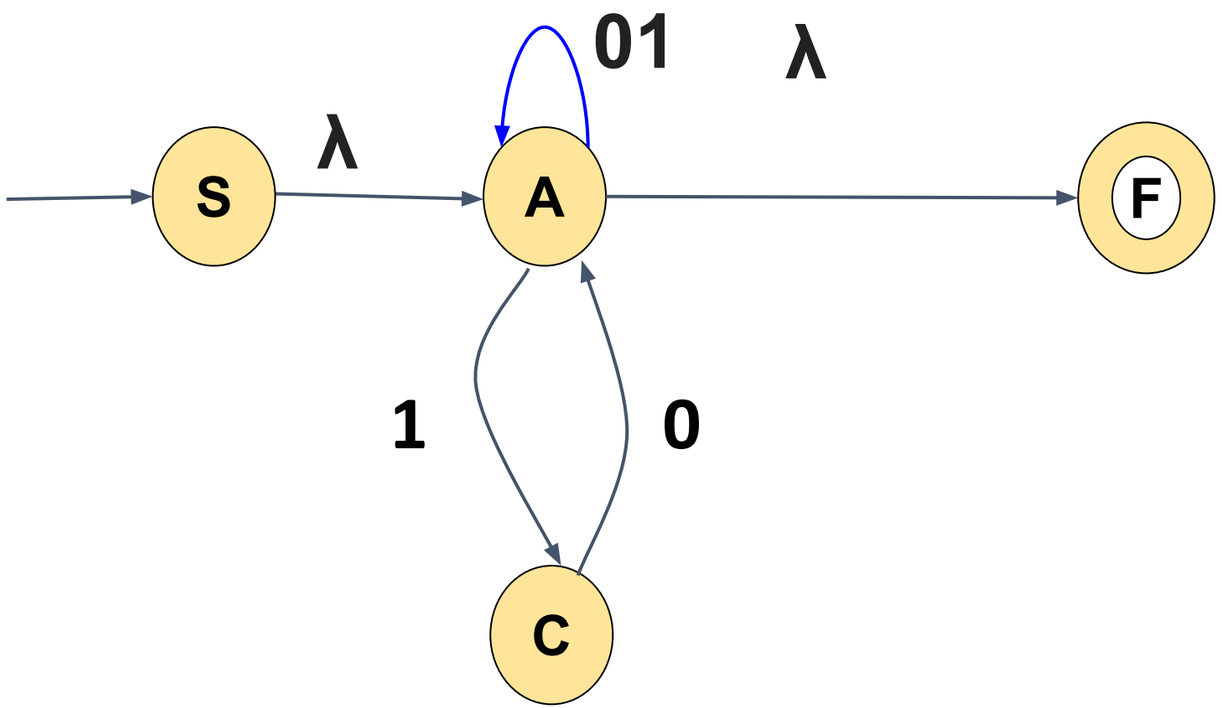
A new final state (F) is introduced as there is an outgoing edge from the existing final state

Example 6 :



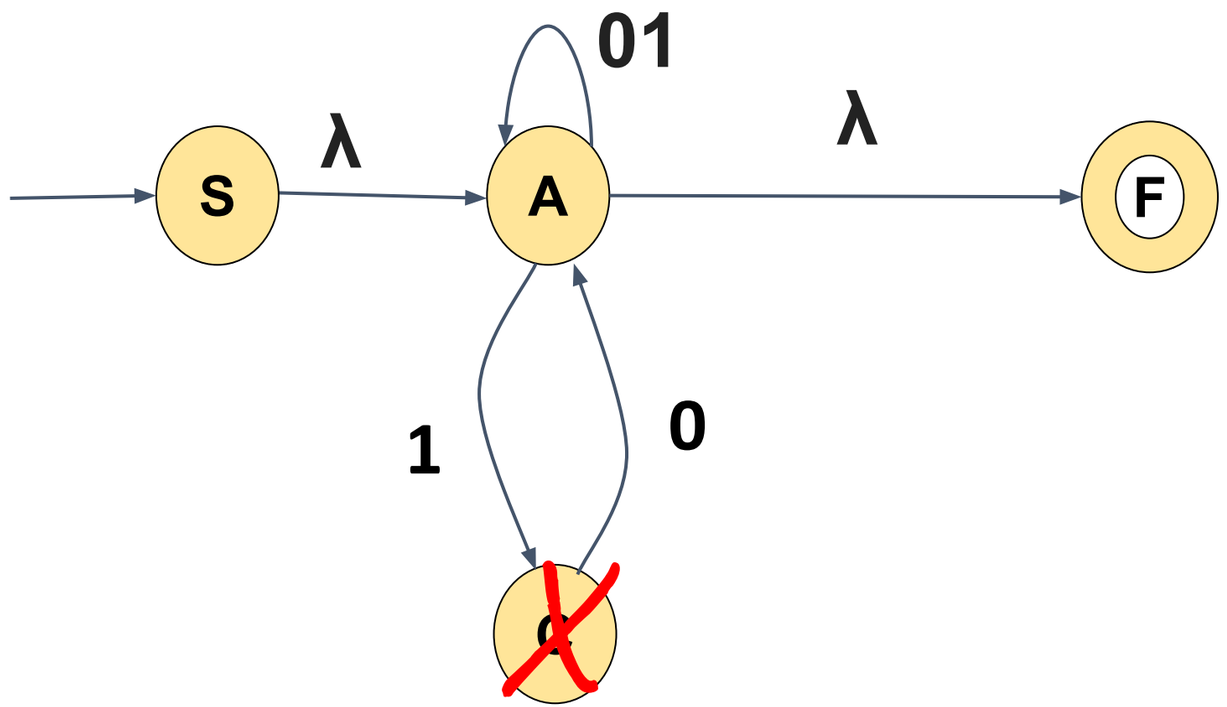
1. Eliminate D
2. Eliminate B

Example 6 :



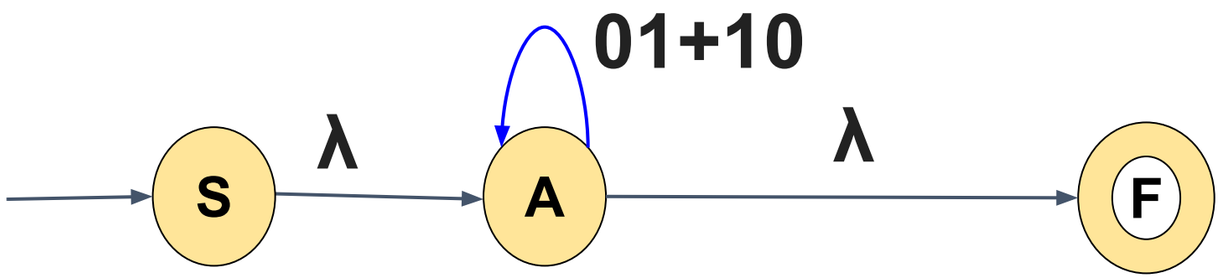
1. Eliminate D
2. Eliminate B

Example 6 :



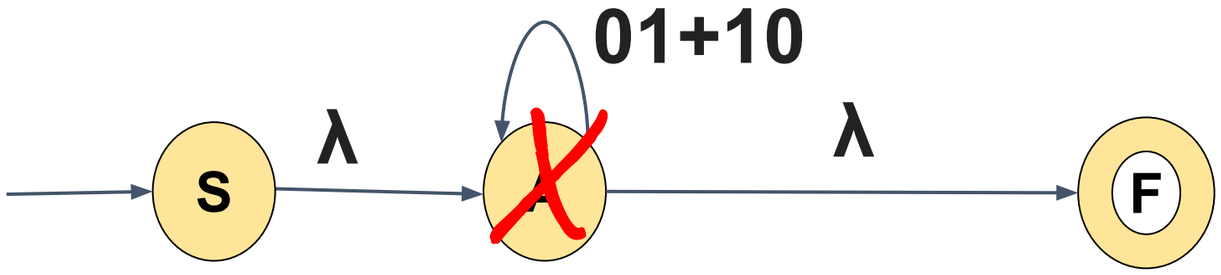
1. Eliminate D
2. Eliminate B
3. Eliminate C

Example 6 :



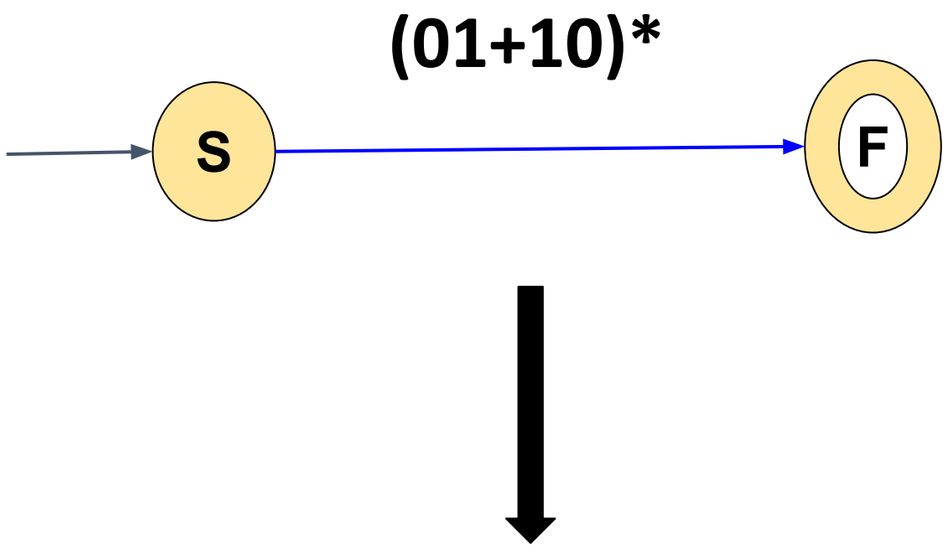
1. Eliminate D
2. Eliminate B
3. Eliminate C

Example 6 :



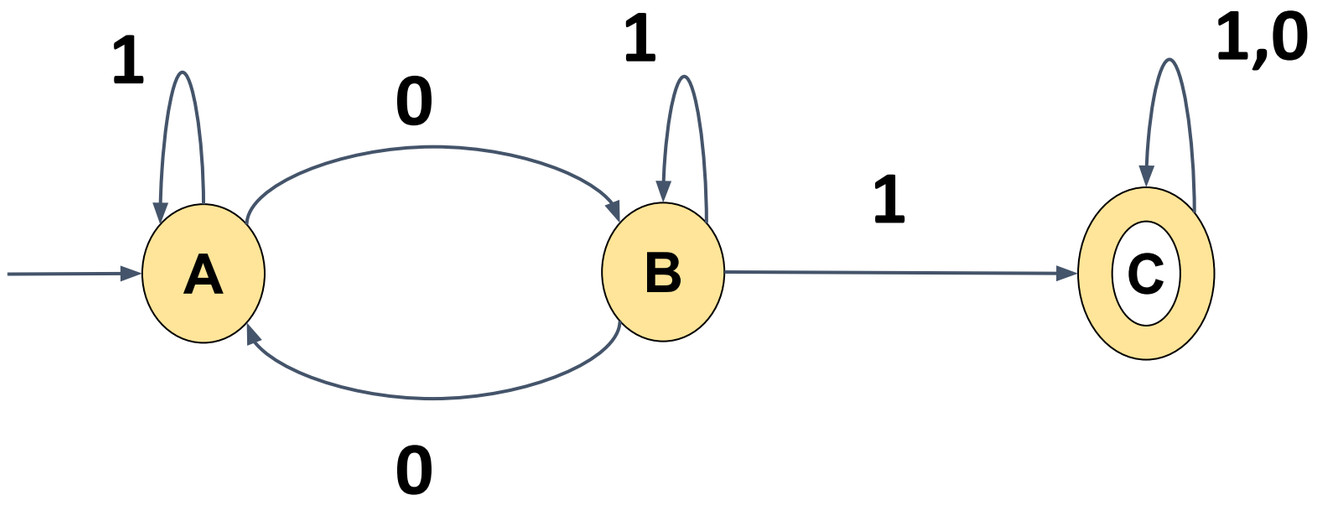
1. Eliminate D
2. Eliminate B
3. Eliminate C
4. Eliminate A

Example 6 :

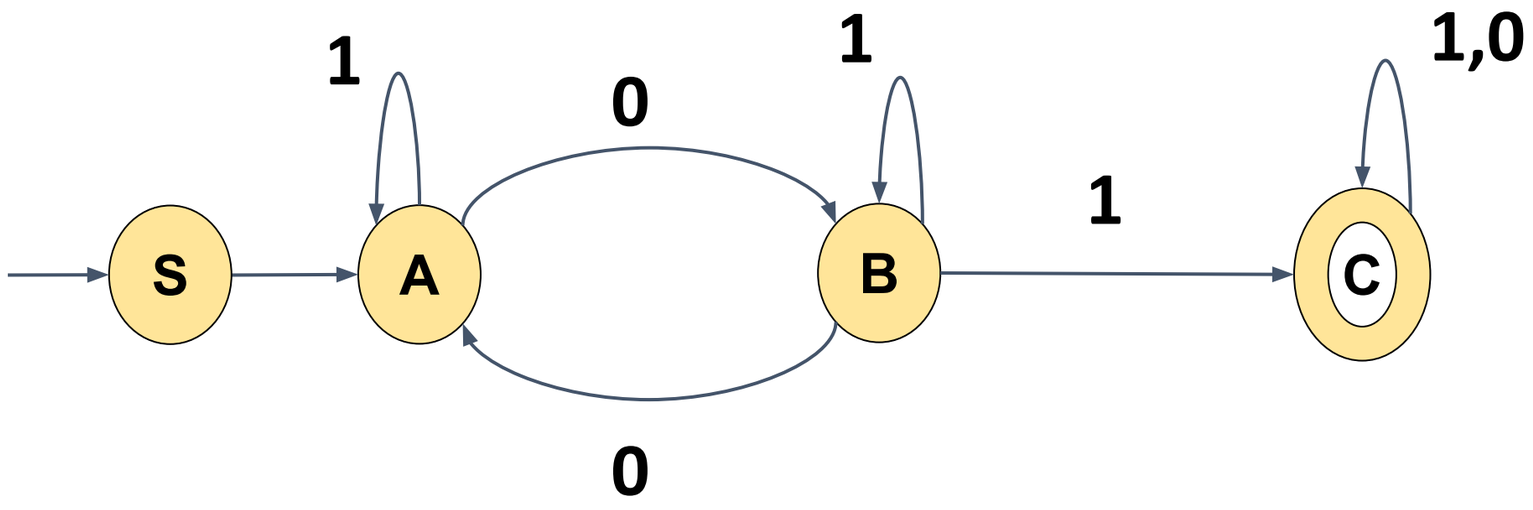


RE=(01+10)*

Example 7 :

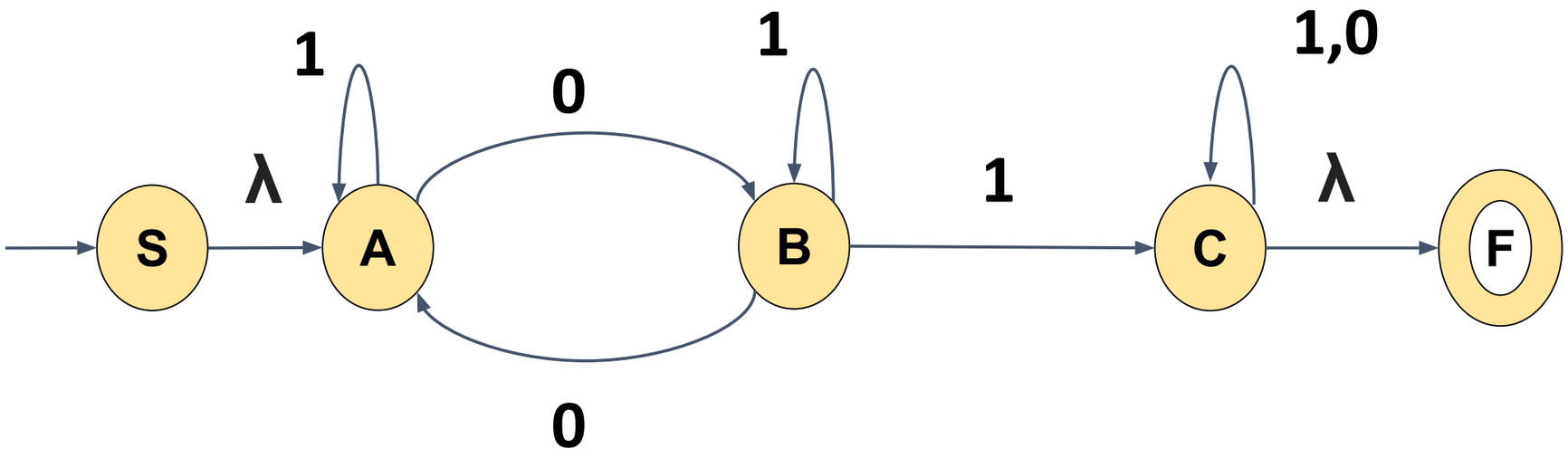


Example 7 :



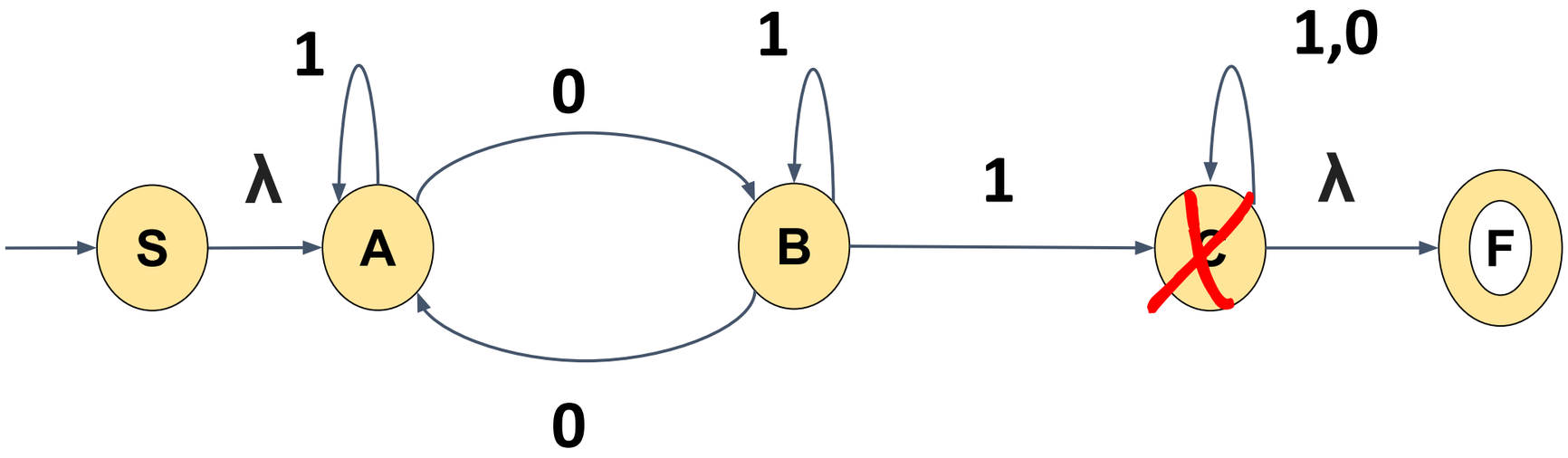
A new start state (S) is introduced as there is an incoming edge to the existing start state

Example 7 :



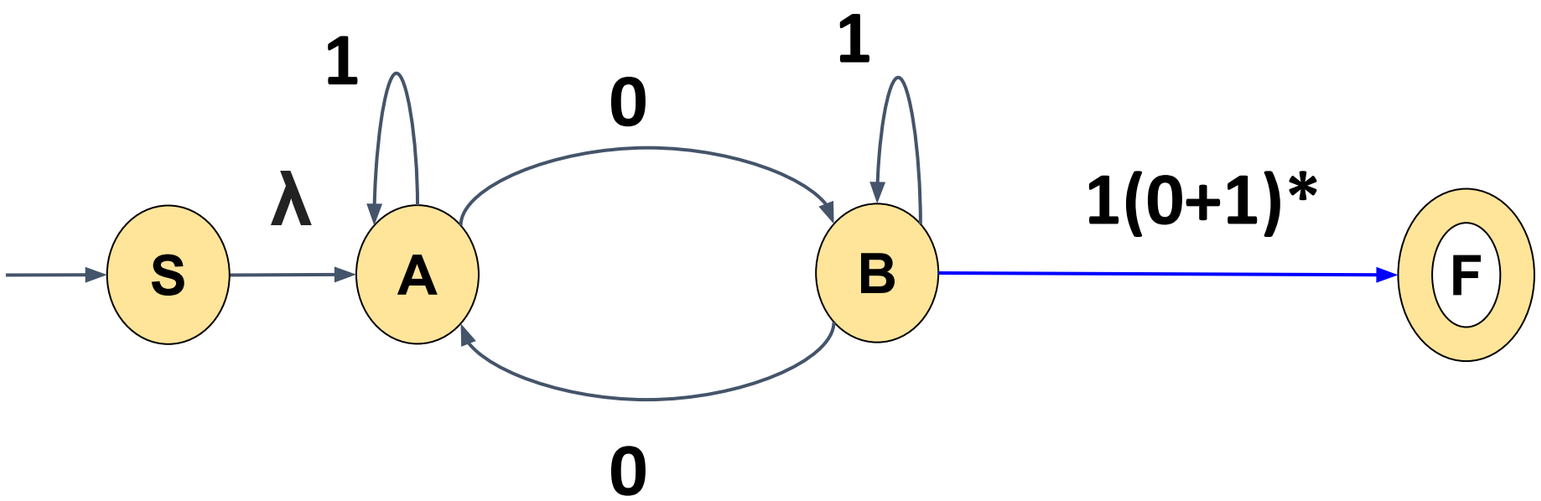
A new final state (F) is introduced as there is an outgoing edge from the existing
final state

Example 7 :



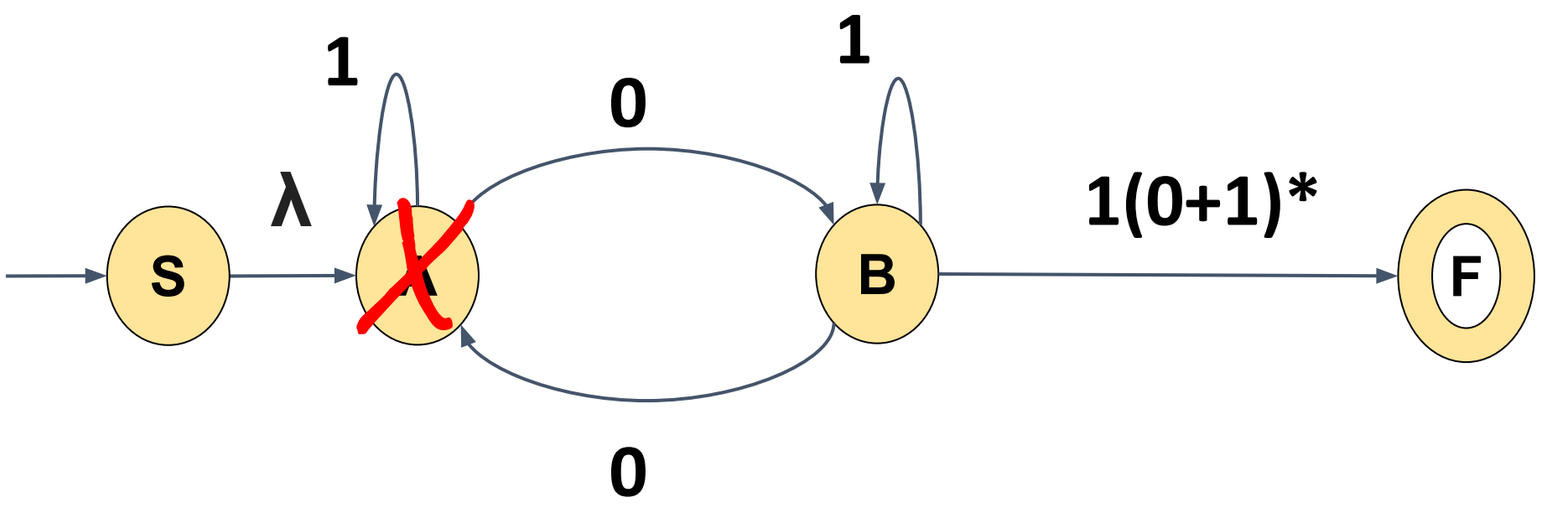
1. Eliminate C

Example 7 :



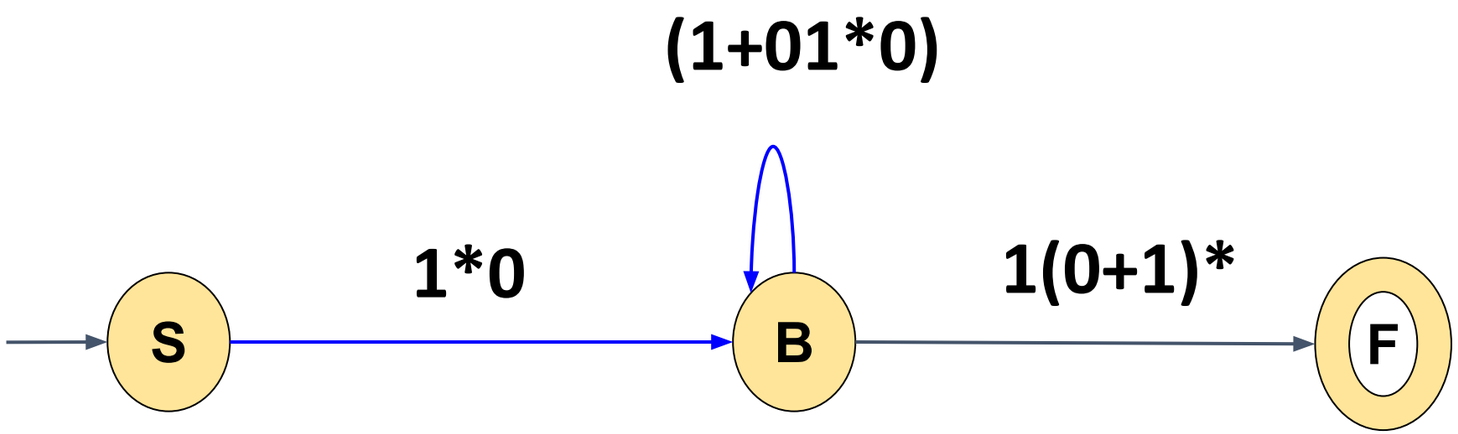
1. Eliminate C

Example 7 :



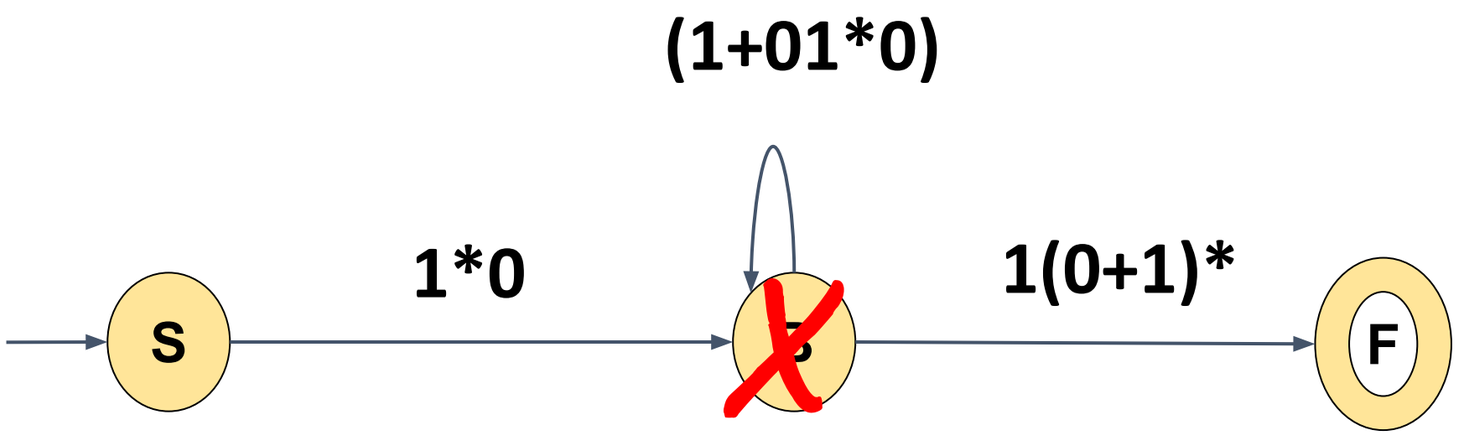
1. Eliminate C
2. Eliminate A

Example 7 :



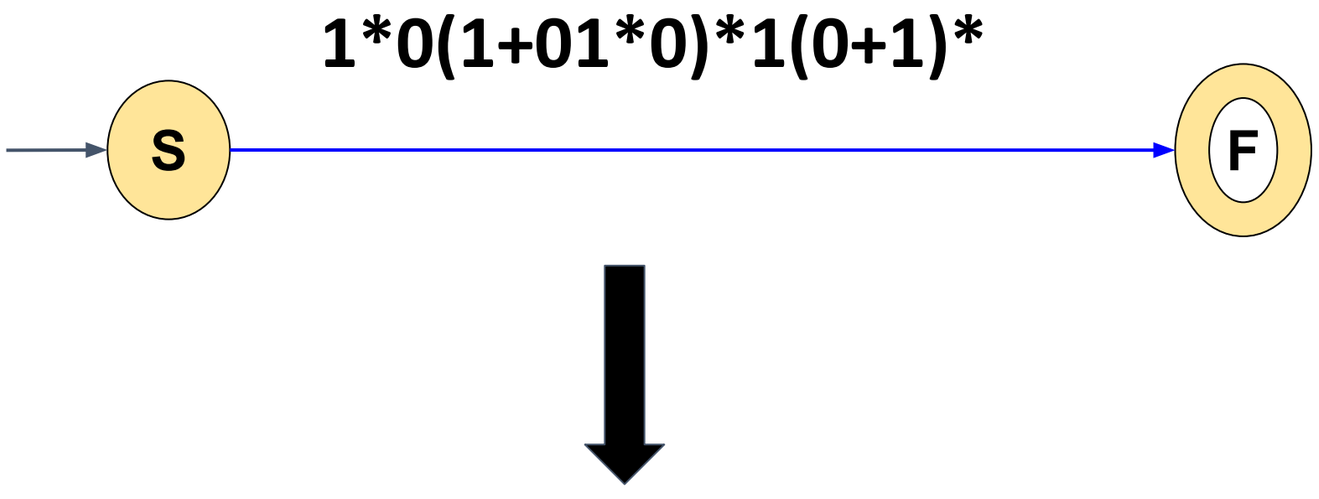
1. Eliminate C
2. Eliminate A

Example 7 :



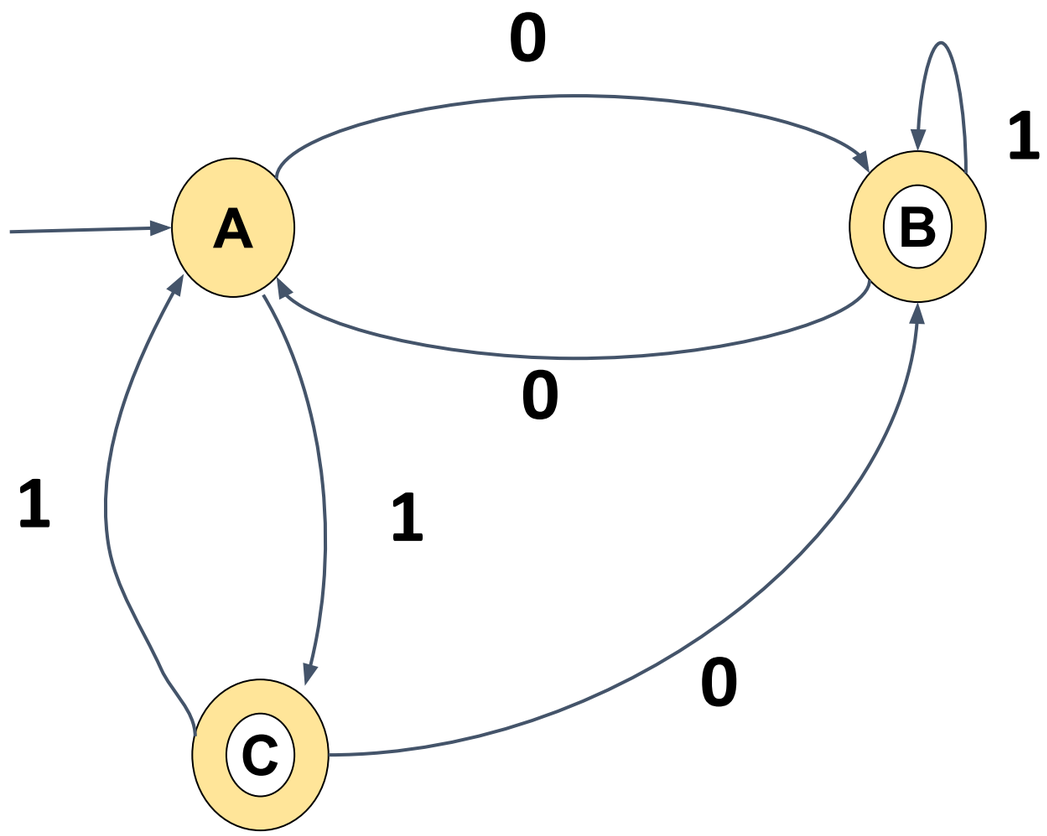
1. Eliminate C
2. Eliminate A
3. Eliminate B

Example 7 :

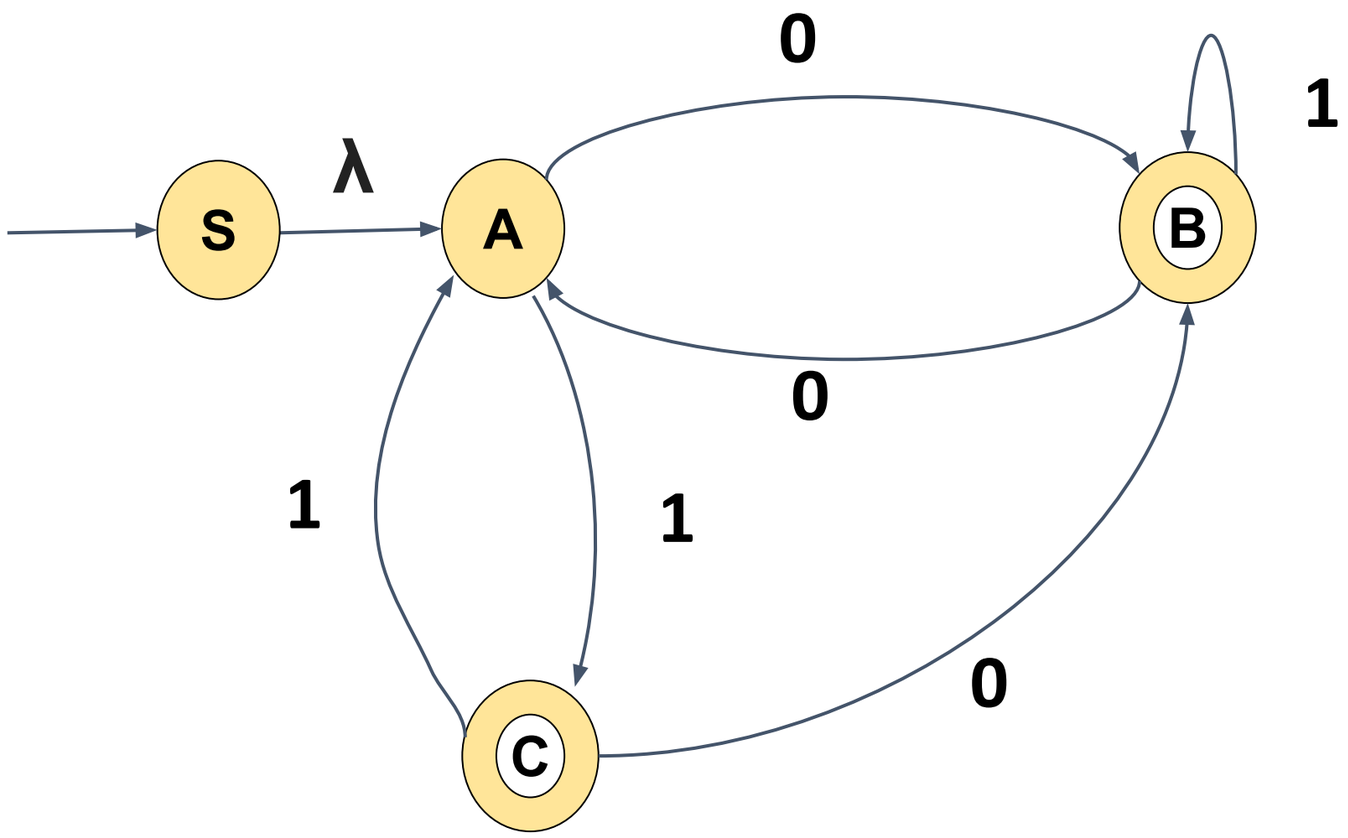


RE=1*0(1+01*0)*1(0+1)*

Example 8 :

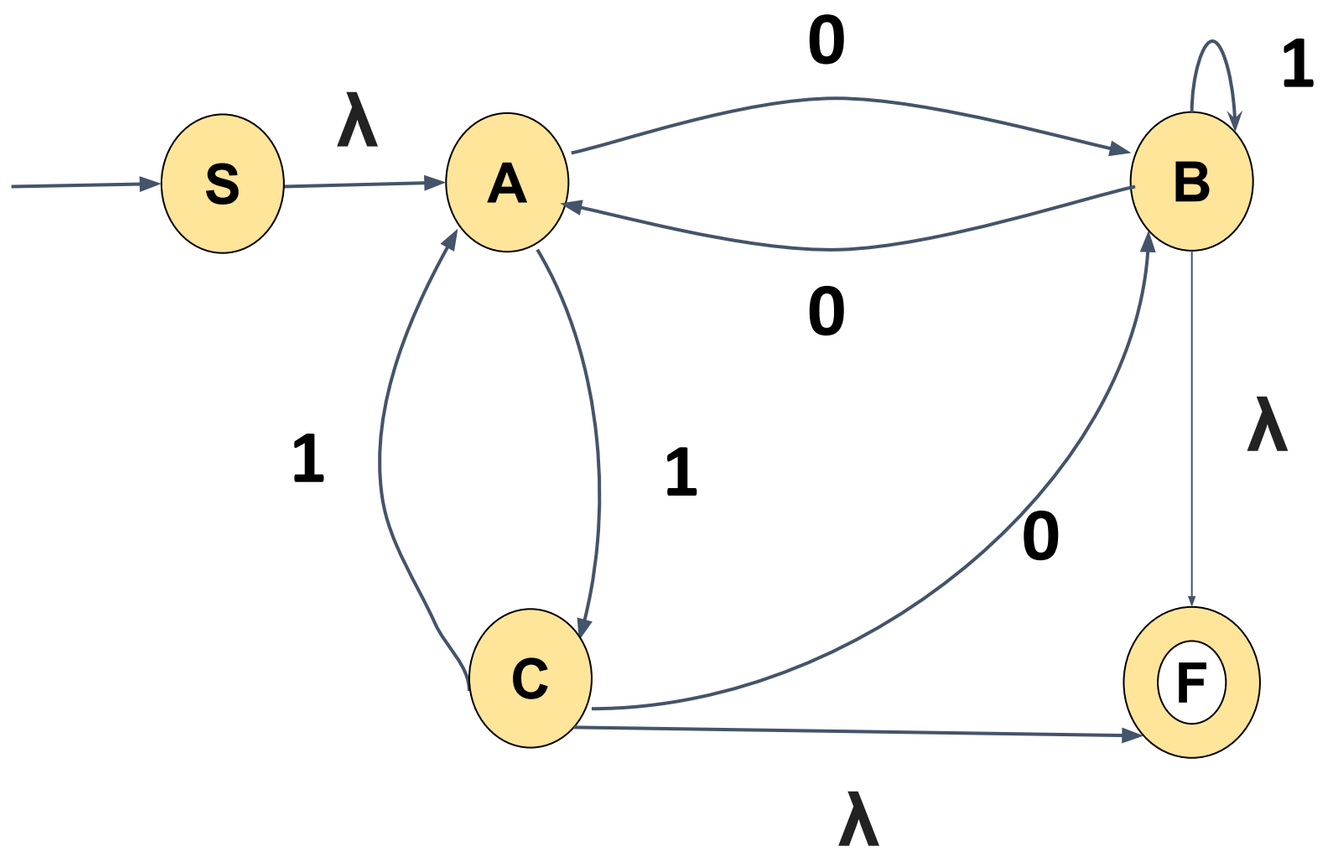


Example 8 :



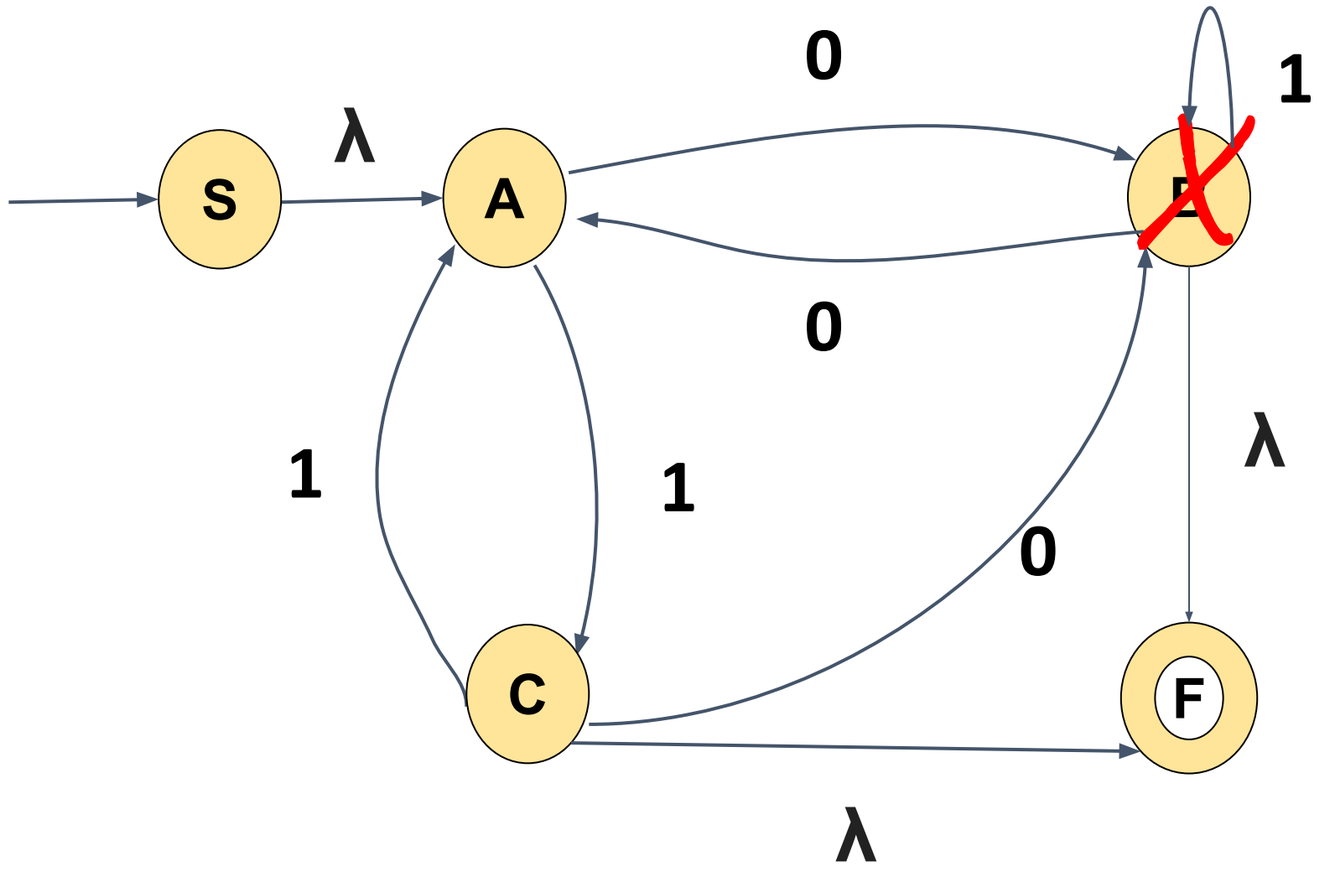
A new start state (S) is introduced as there is an incoming edge to the existing start state

Example 8 :



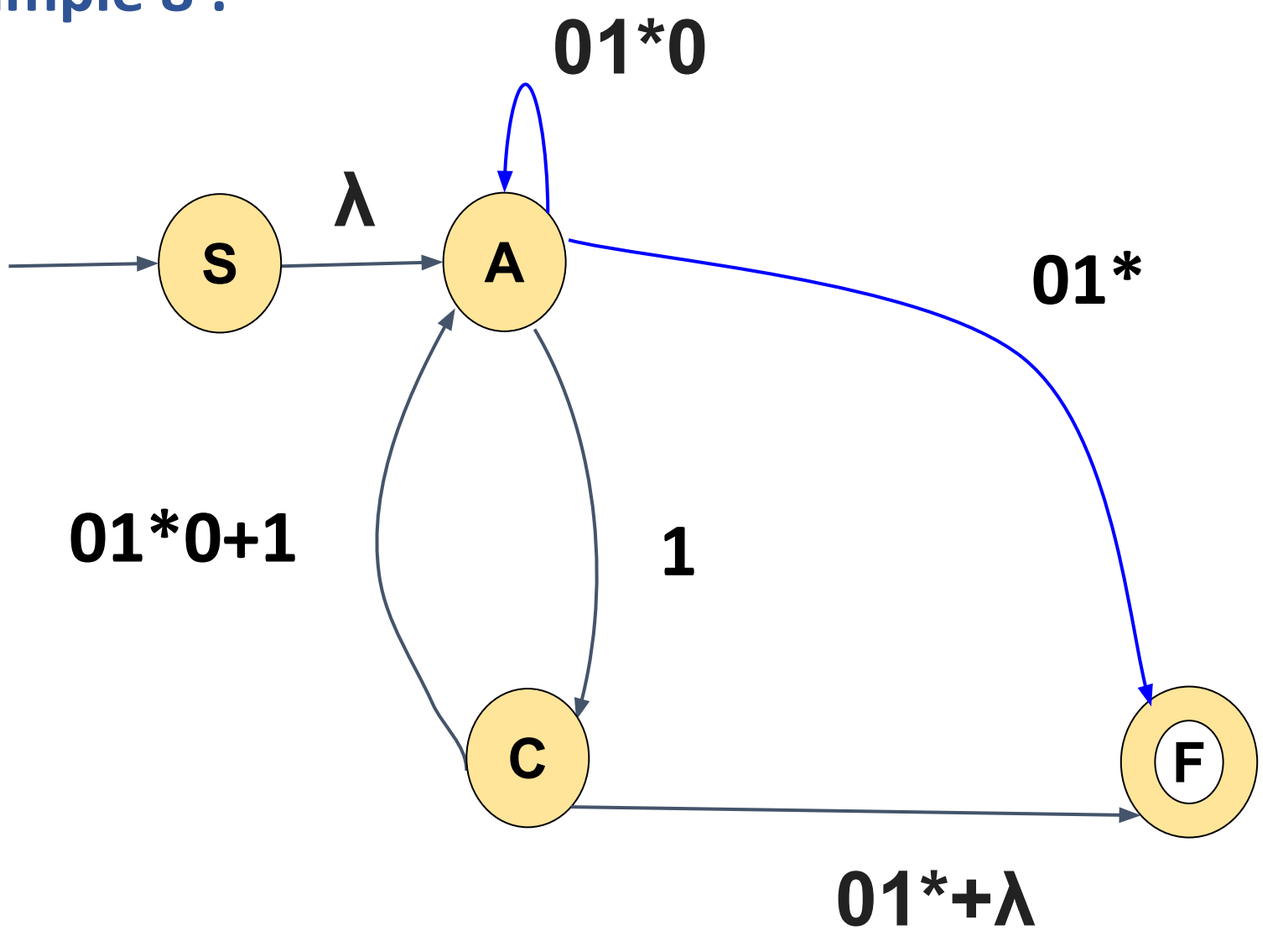
A new final state (F) is introduced as there is an outgoing edge from the existing final state

Example 8 :



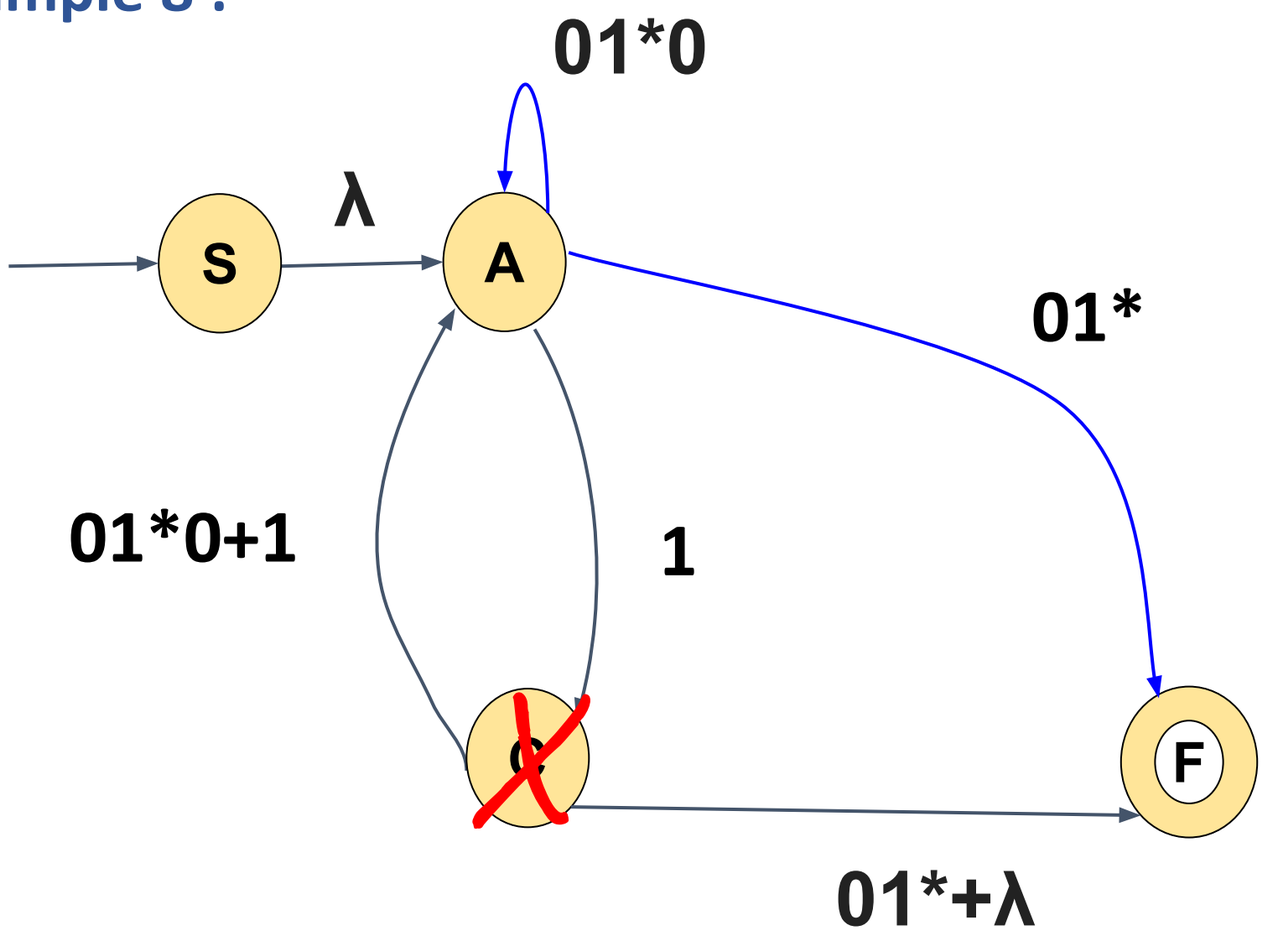
1. **Eliminate B**

Example 8 :



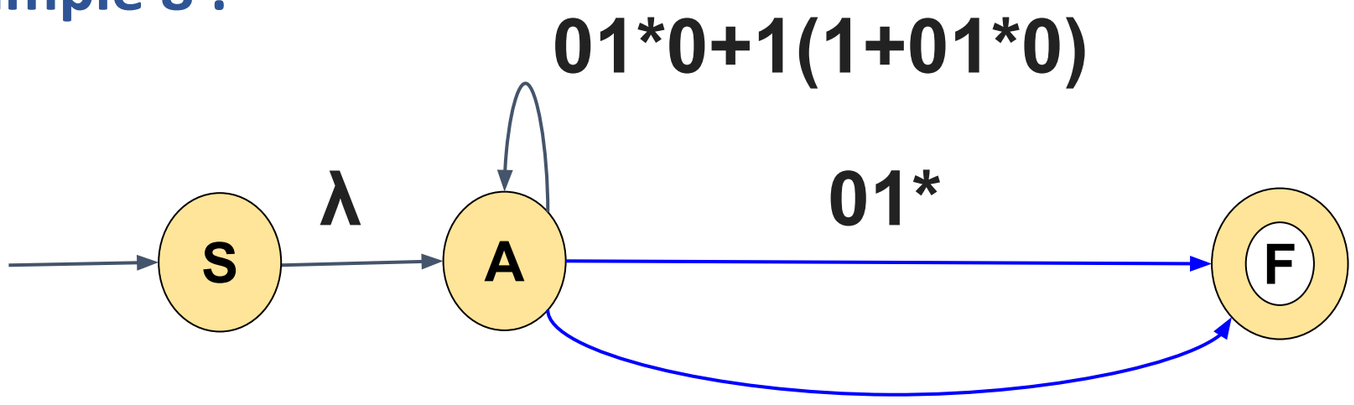
1. **Eliminate B**

Example 8 :



1. Eliminate B
2. Eliminate C

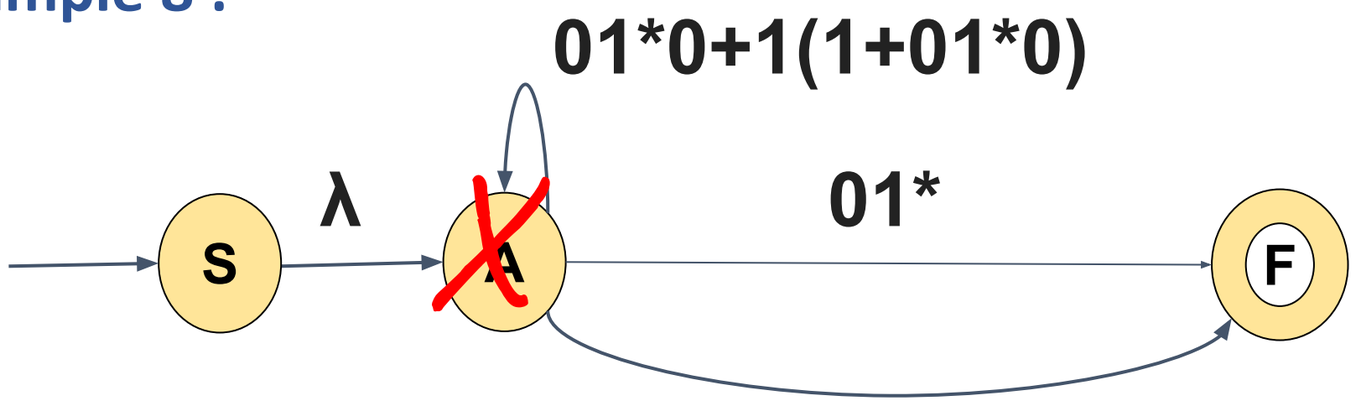
Example 8 :



1(01*+λ)

1. **Eliminate B**
2. **Eliminate C**

Example 8 :

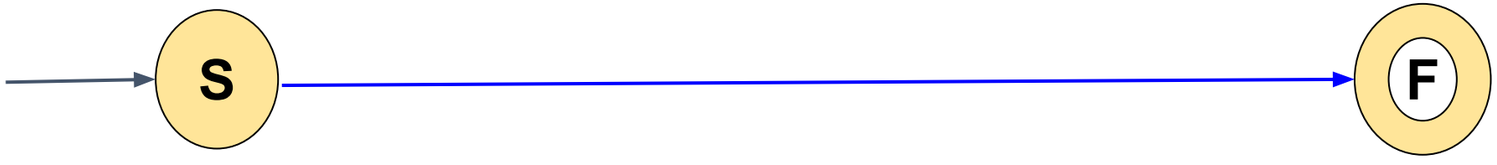


1(01*+λ)

1. Eliminate B
2. Eliminate C
3. Eliminate A

Example 8 :

$$(01^*0+1(1+01^*0))^*(01^*+1(01^*+\lambda))$$



$$RE=(01^*0+1(1+01^*0))^*(01^*+1(01^*+\lambda))$$

Example 8 :

$$RE=(01^*0+1(1+01^*0))^*(01^*+1(01^*+\lambda))$$

$$=(01^*0+11+101^*0)^*(01^*+(101^*+1))$$

Example 8 :

$$RE=(01^*0+1(1+01^*0))^*(01^*+1(01^*+\lambda))$$

$$=(01^*0+11+101^*0)^*\ (01^*+(101^*+1))$$

$$=(101^*0+01^*0+11)^*\ (01^*(\lambda+1)+1)$$

Example 8 :

$$RE=(01^*0+1(1+01^*0))^*(01^*+1(01^*+\lambda))$$

$$=(01^*0+11+101^*0)^*\ (01^*+(101^*+1))$$

$$=(101^*0+01^*0+11)^*\ (01^*(\lambda+1)+1)$$

$$=(01^*0(1+\lambda)+11)^*\ (01^*(\lambda+1)+1)$$

Example 8 :

$$RE=(01^*0+1(1+01^*0))^*(01^*+1(01^*+\lambda))$$

$$=(01^*0+11+101^*0)^*\ (01^*+(101^*+1))$$

$$=(101^*0+01^*0+11)^*\ (01^*(\lambda+1)+1)$$

$$=(01^*0(1+\lambda)+11)^*\ (01^*(\lambda+1)+1)$$

$$=(01^*0(1+\lambda))^*\ (11)^*\ (01^*(\lambda+1)+1)$$

Example 8 :

$$RE=(01^*0+1(1+01^*0))^*(01^*+1(01^*+\lambda))$$

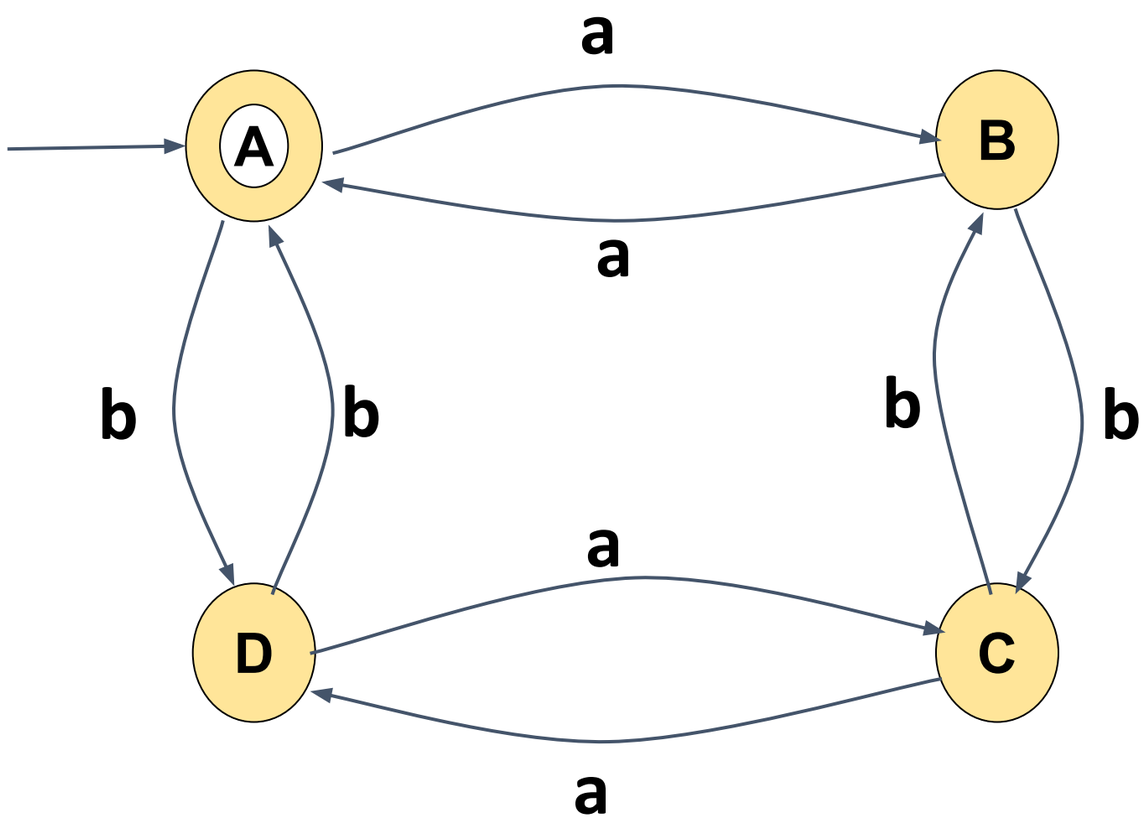
$$=(01^*0+11+101^*0)^*\ (01^*+(101^*+1))$$

$$=(101^*0+01^*0+11)^*\ (01^*(\lambda+1)+1)$$

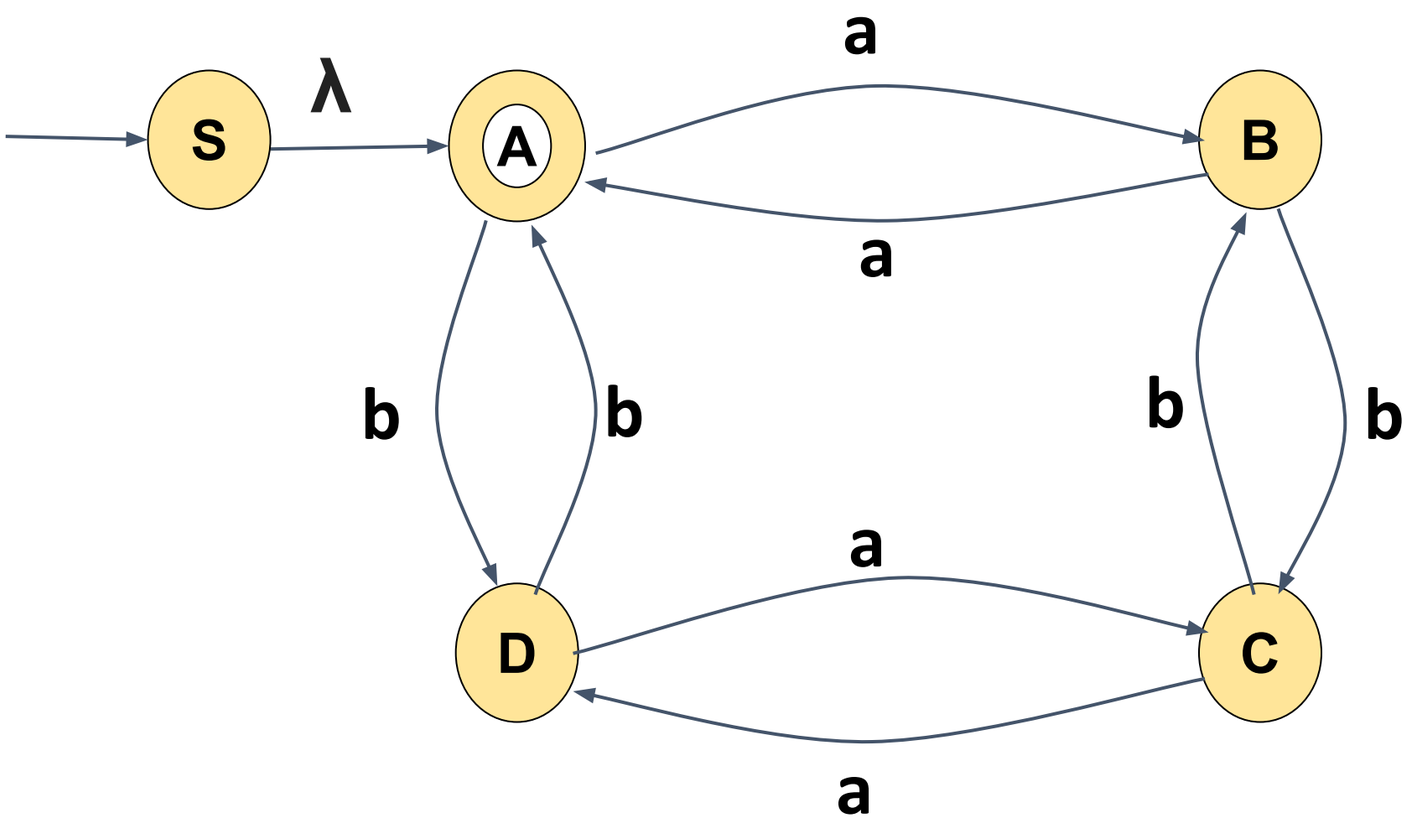
$$=(01^*0(1+\lambda)+11)^*\ (01^*(\lambda+1)+1)$$

$$RE = (01^*0(1+\lambda))^*\ (\ 11)^*\ (01^*(\lambda+1)+1)$$

Example 9 :order of elimination(B,D,C,A)

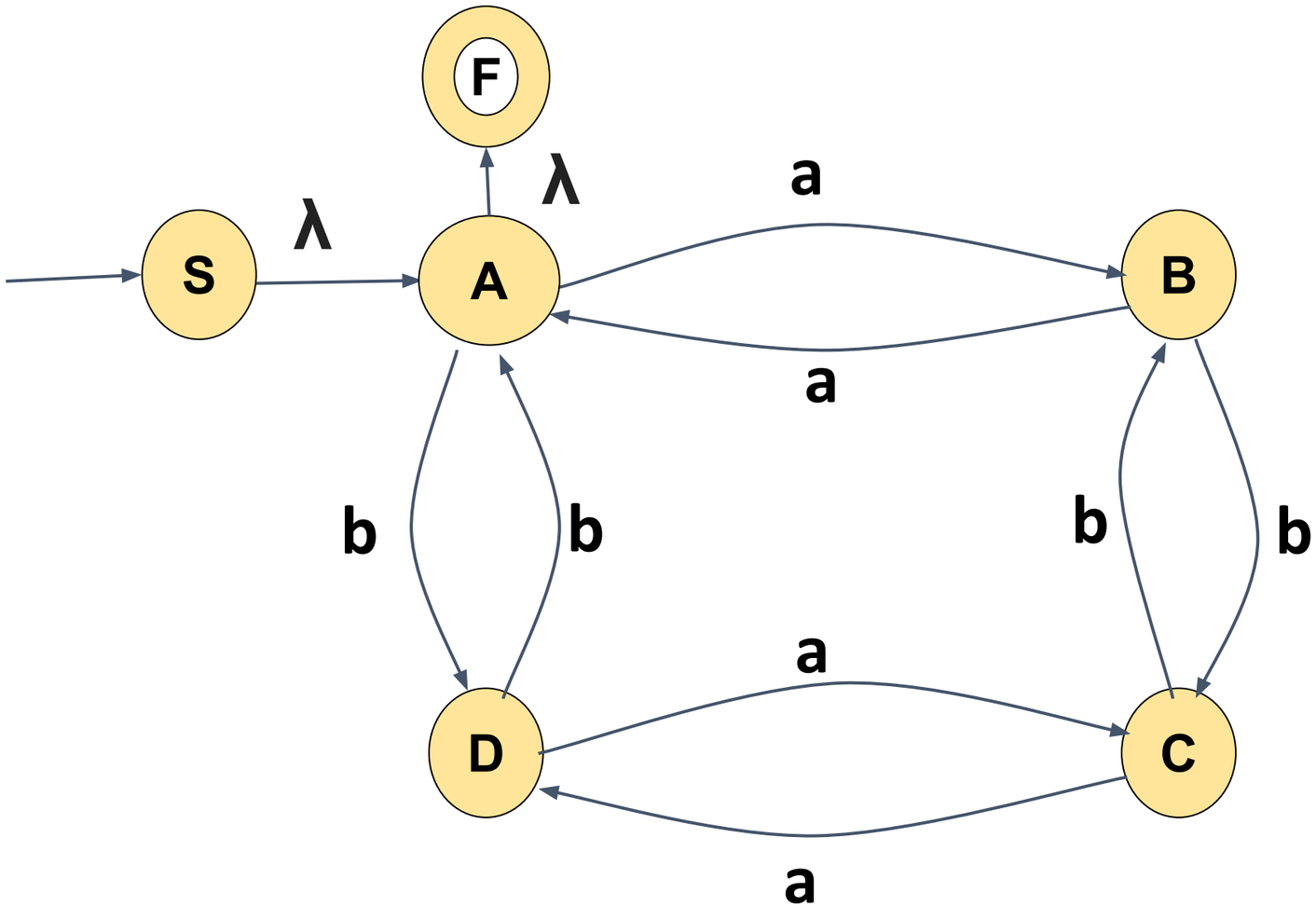


Example 9 :



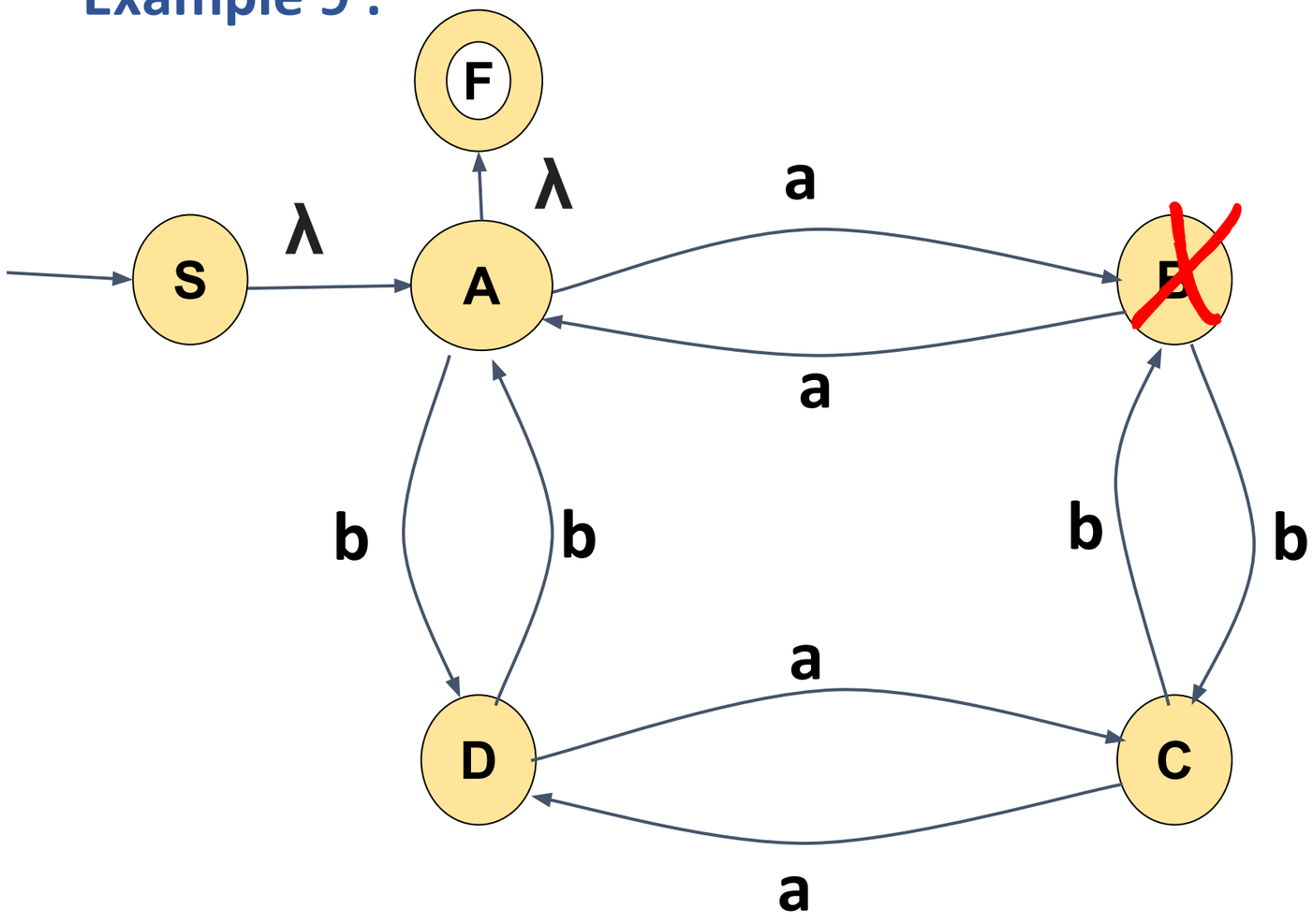
A new start state (S) is introduced as there is an incoming edge to the existing start state

Example 9 :



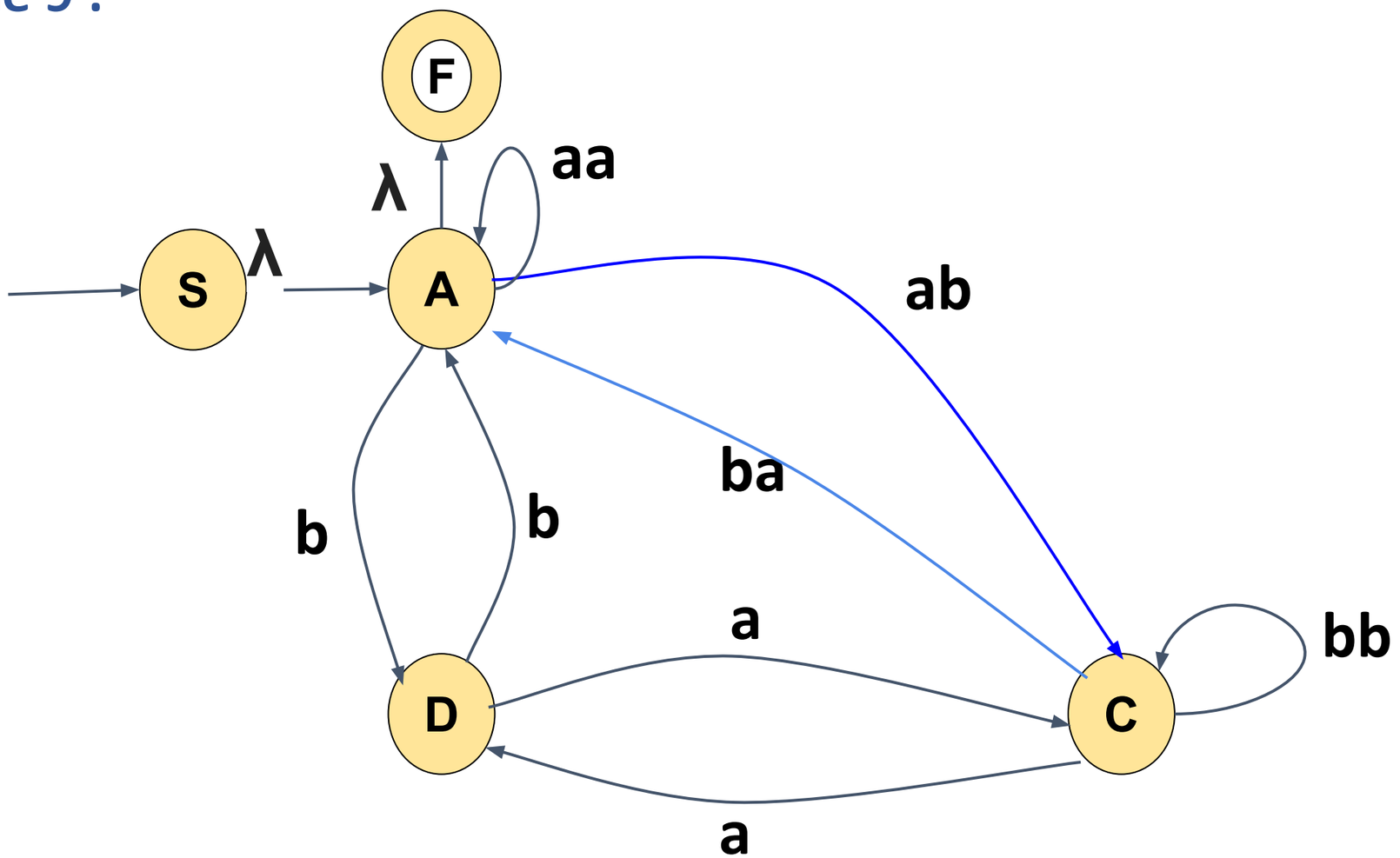
A new final state (F) is introduced as there is an outgoing edge from the existing final state

Example 9 :



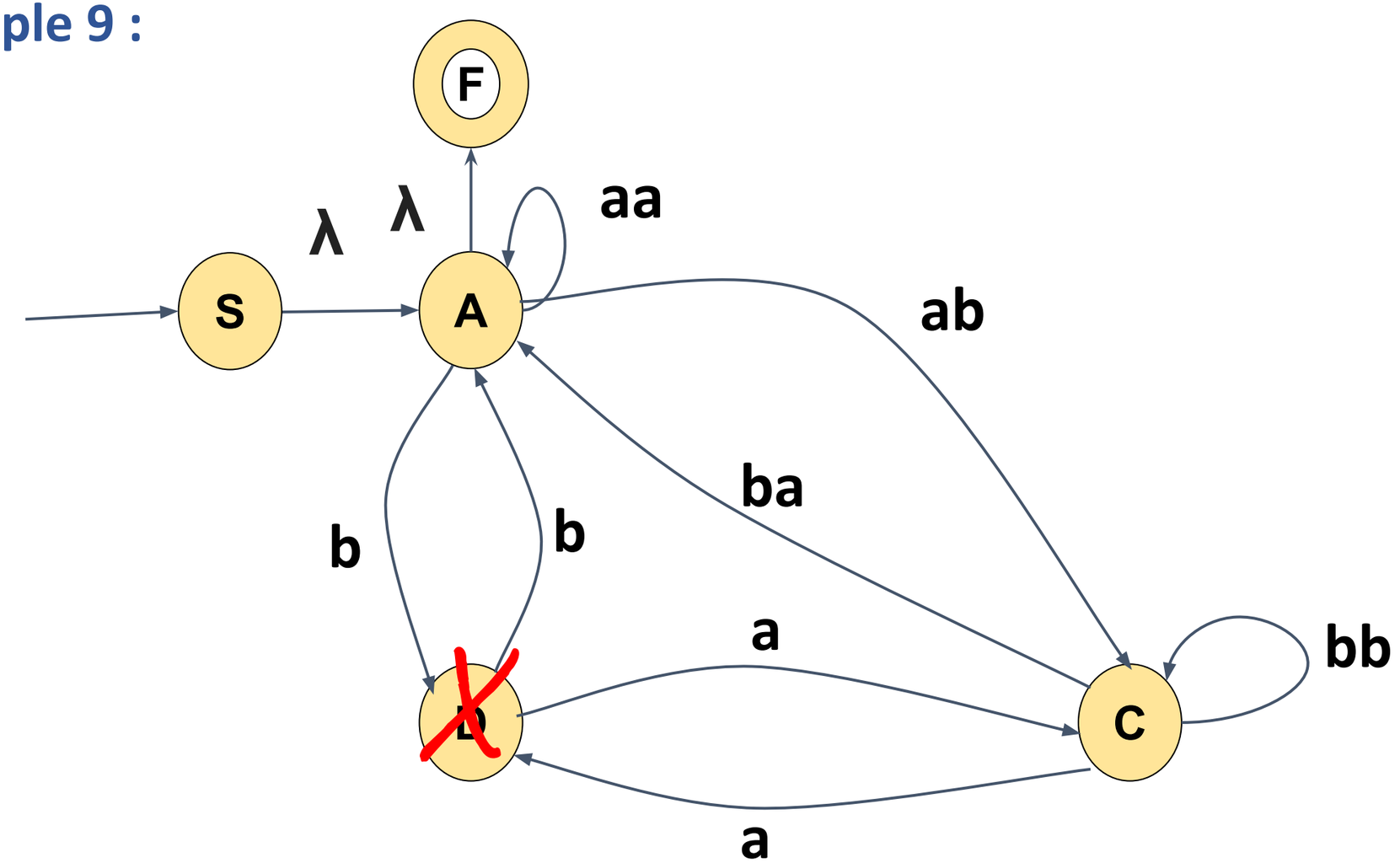
1. Eliminate B

Example 9 :



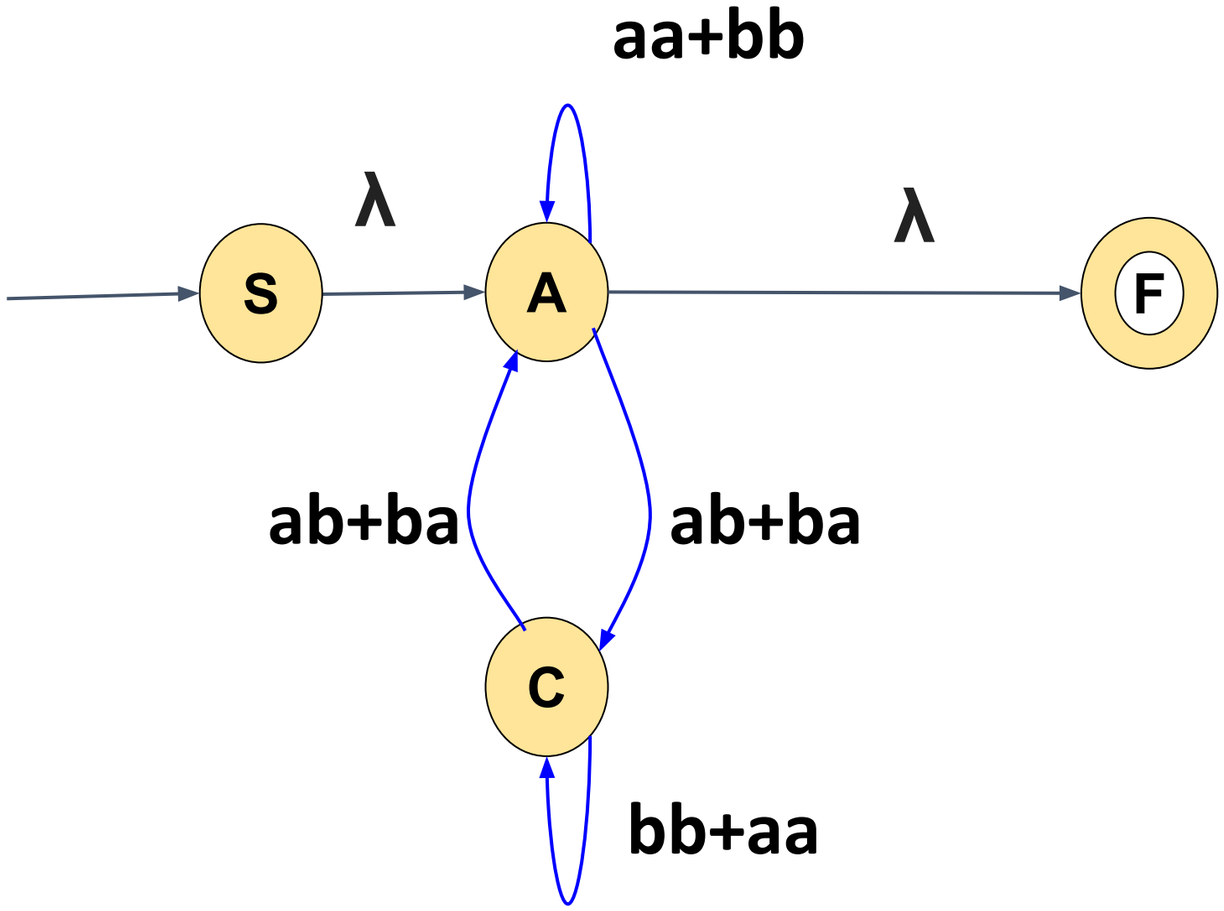
1. Eliminate B

Example 9 :



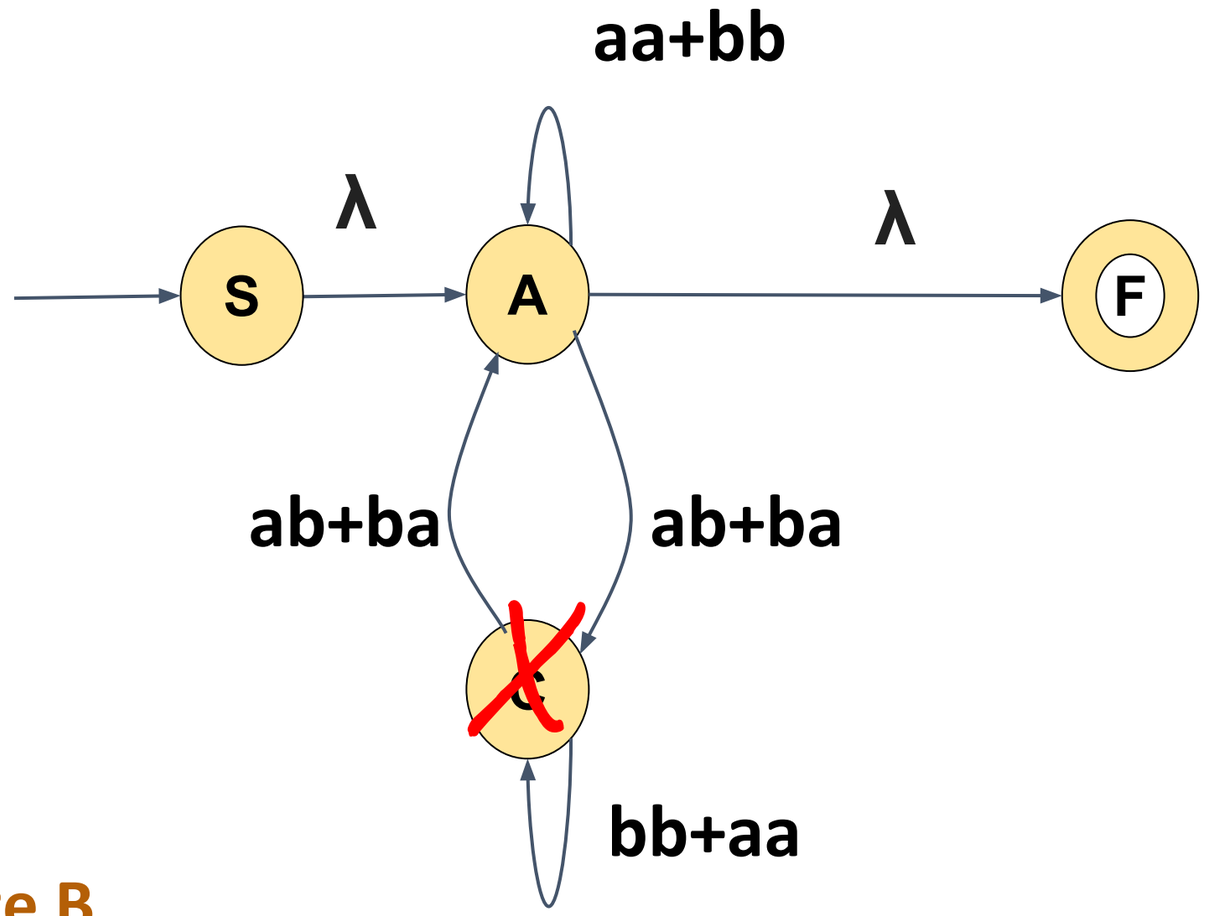
1. Eliminate B
2. Eliminate D

Example 9 :



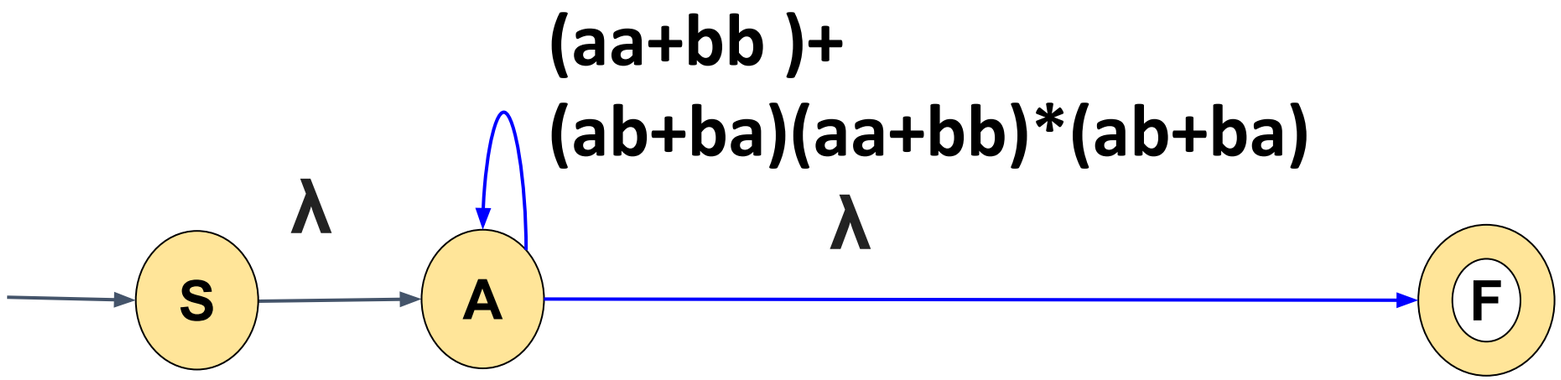
1. Eliminate B
2. Eliminate D

Example 9 :



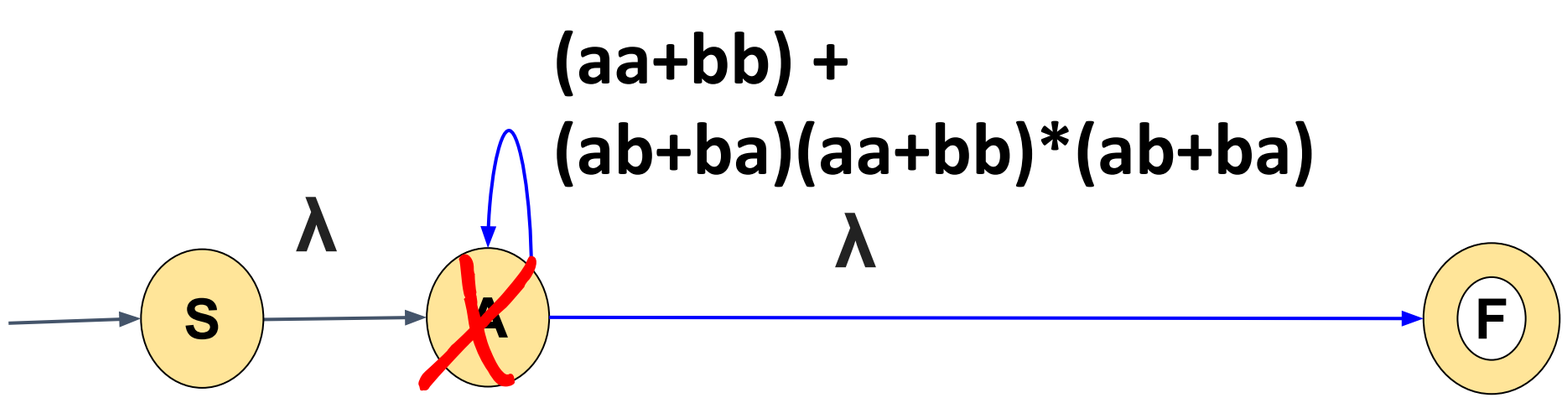
1. Eliminate B
2. Eliminate D
3. Eliminate C

Example 9 :



1. Eliminate B
2. Eliminate D
3. Eliminate C

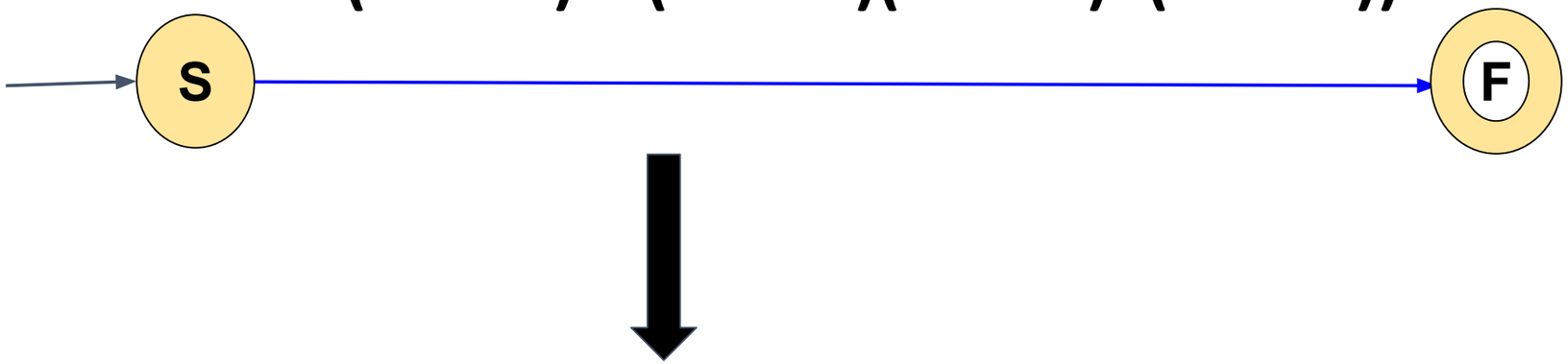
Example 9 :



1. Eliminate B
2. Eliminate D
3. Eliminate C
4. Eliminate A

Example 9 :

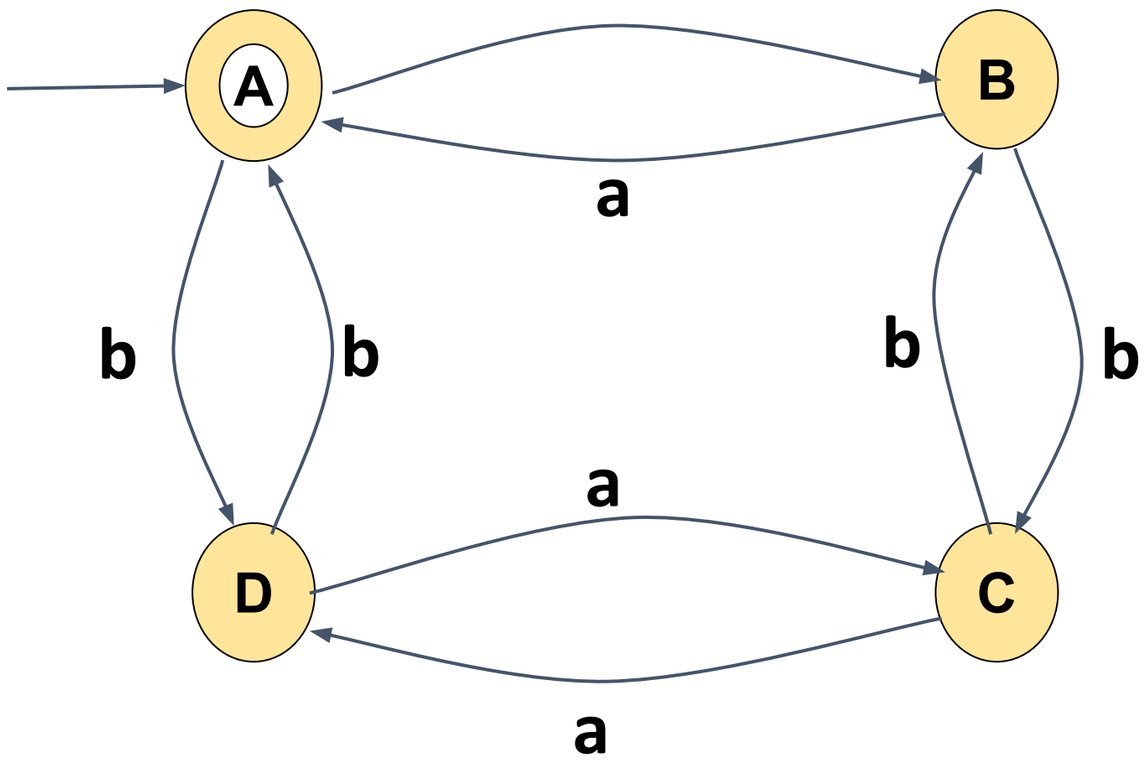
(aa+bb) + (ab+ba)(aa+bb)*(ab+ba))*



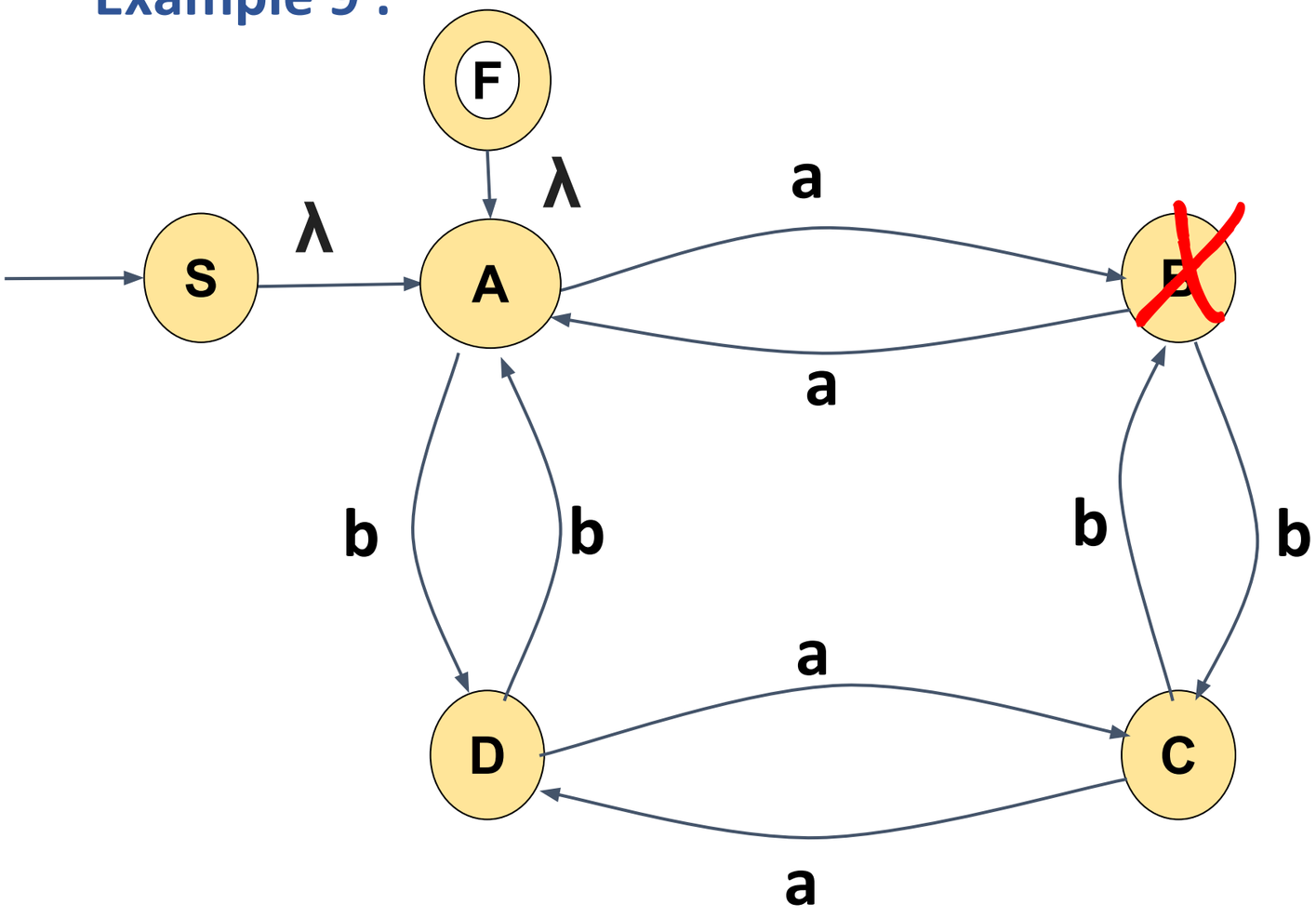
RE= ((aa+bb) + (ab+ba)(aa+bb)*(ab+ba))*

Example 9 :

Consider the same example: Order of elimination: B,C, D ,A (Adding new start state and new final state will remain same)

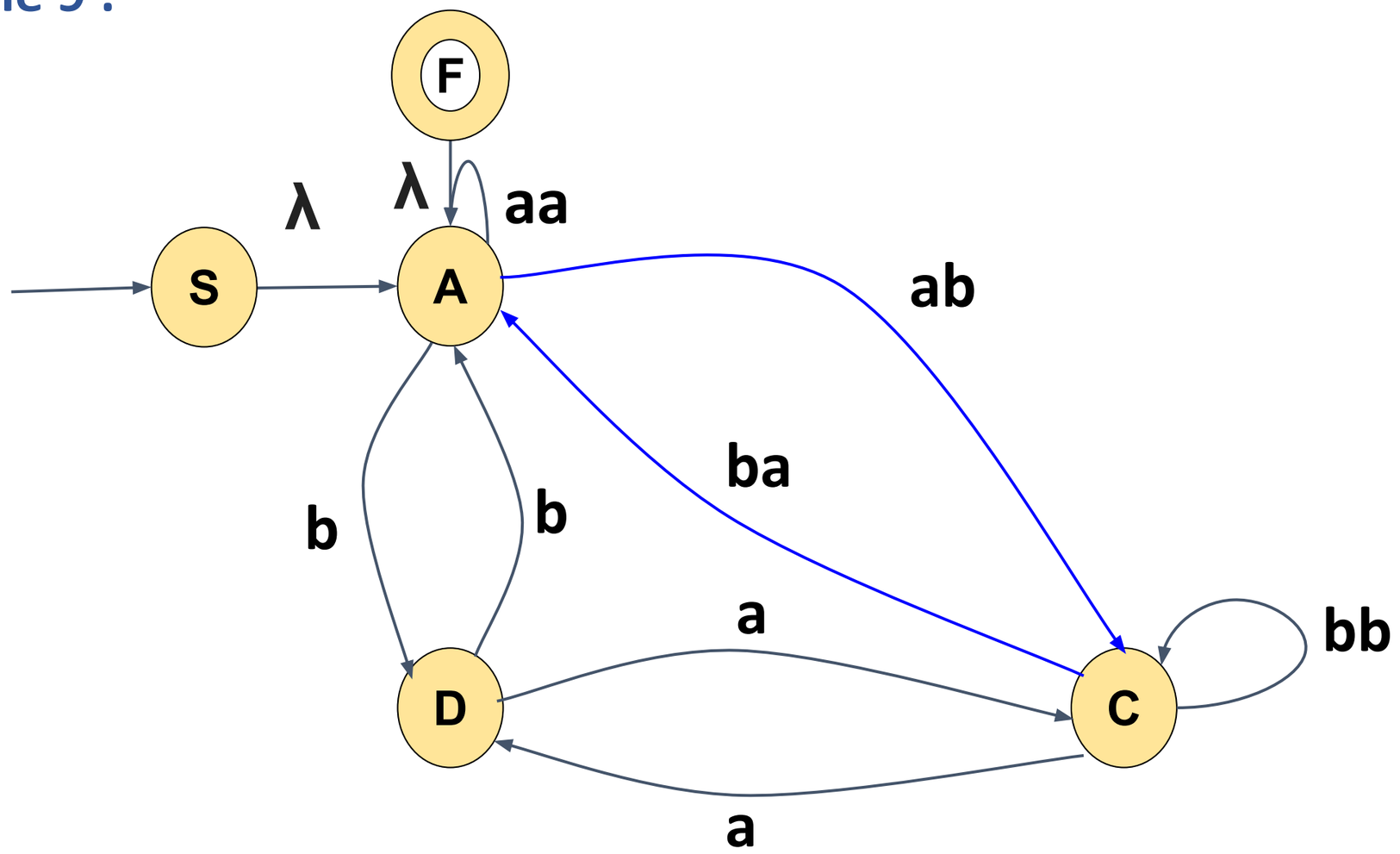


Example 9 :



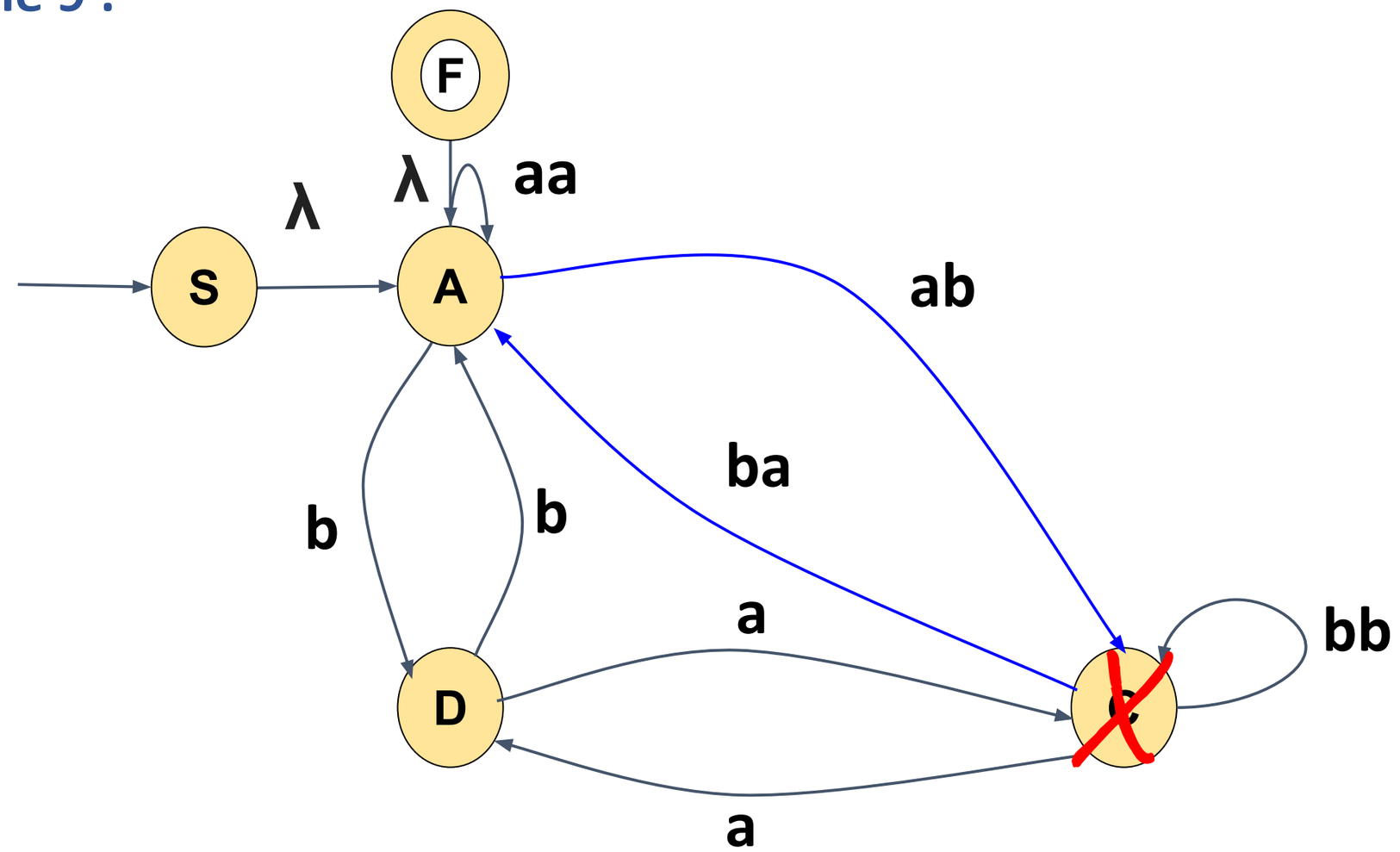
1. Eliminate B

Example 9 :



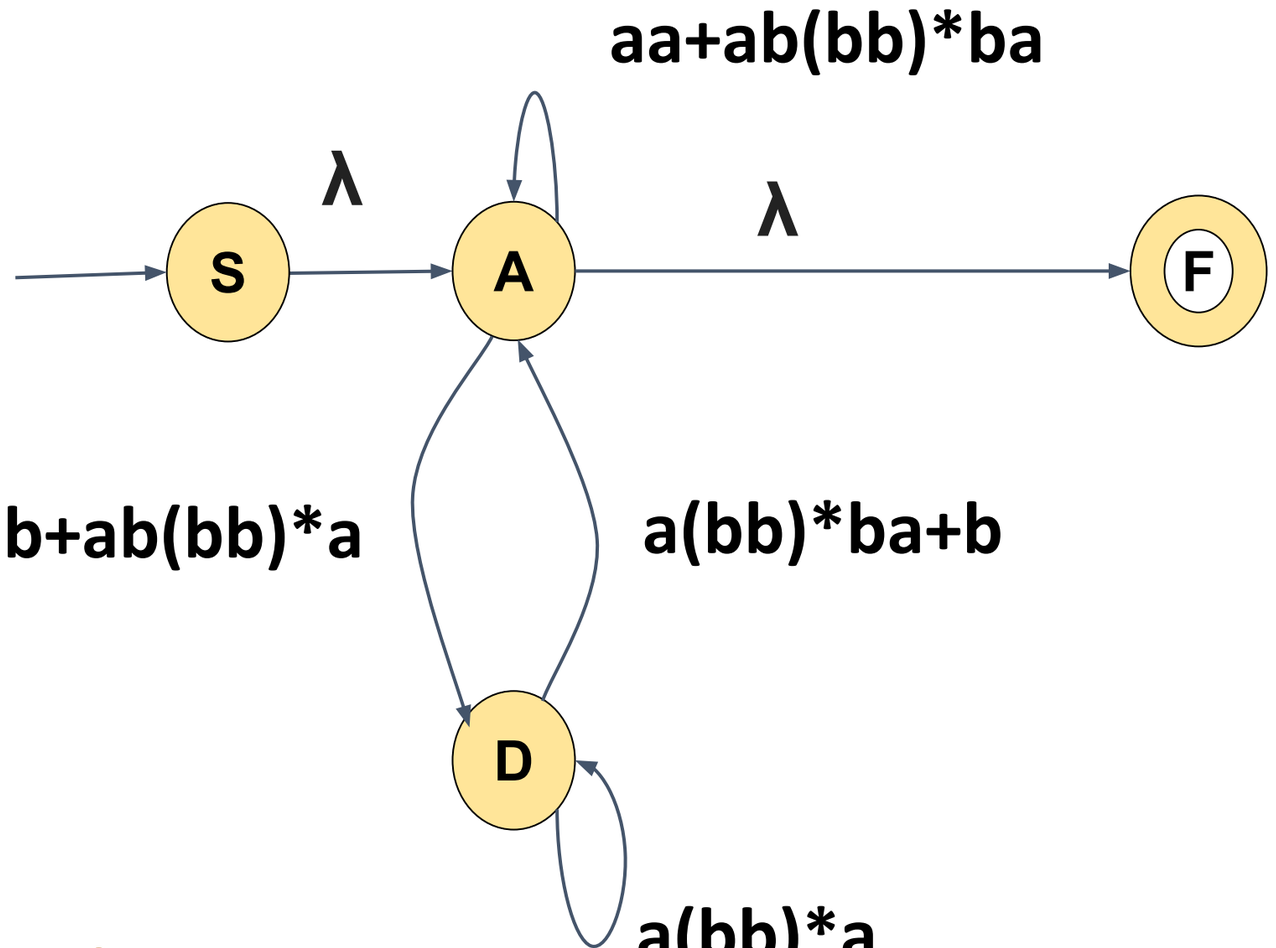
1. Eliminate B

Example 9 :



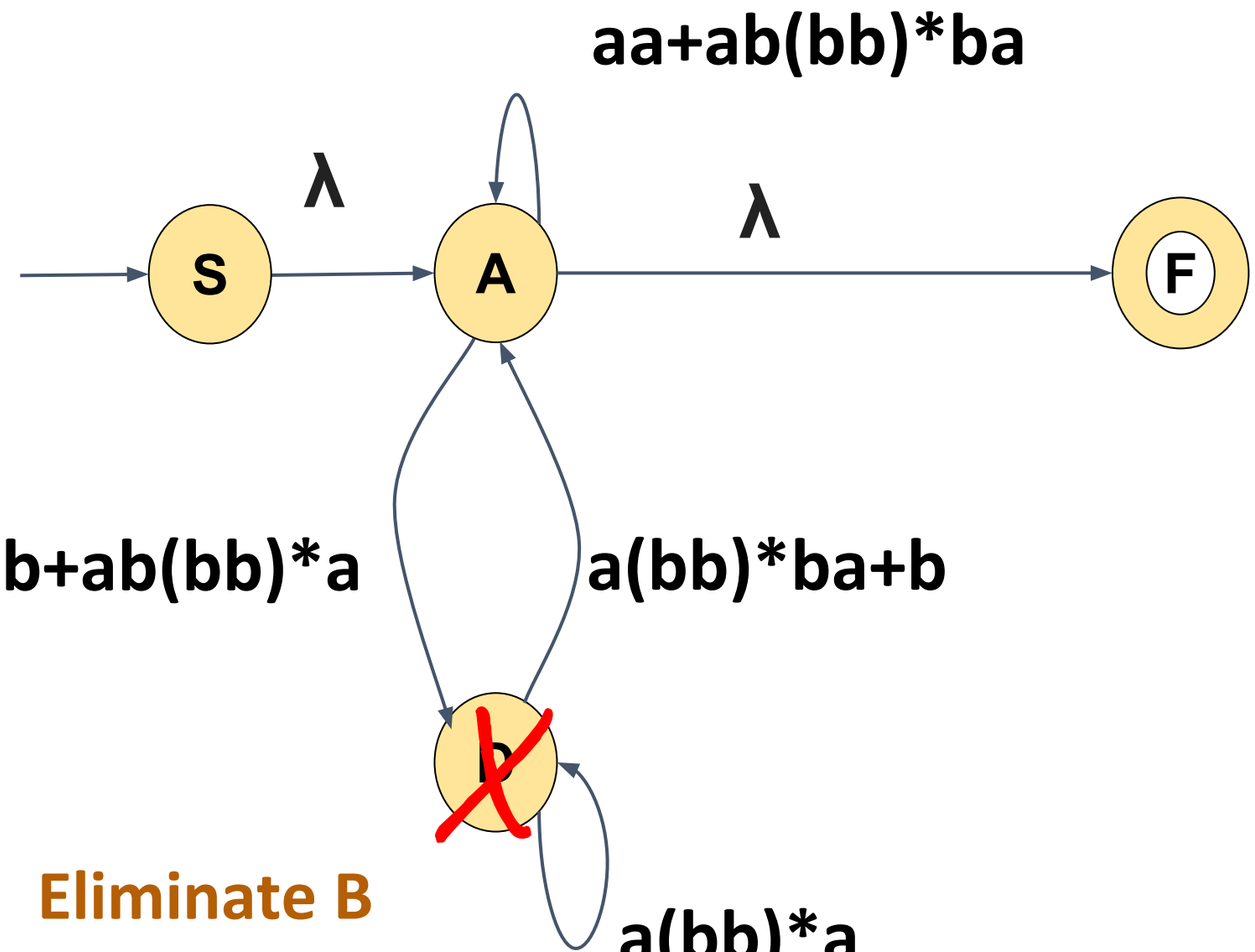
1. Eliminate B
2. Eliminate C

Example 9 :



1. Eliminate B
2. Eliminate C

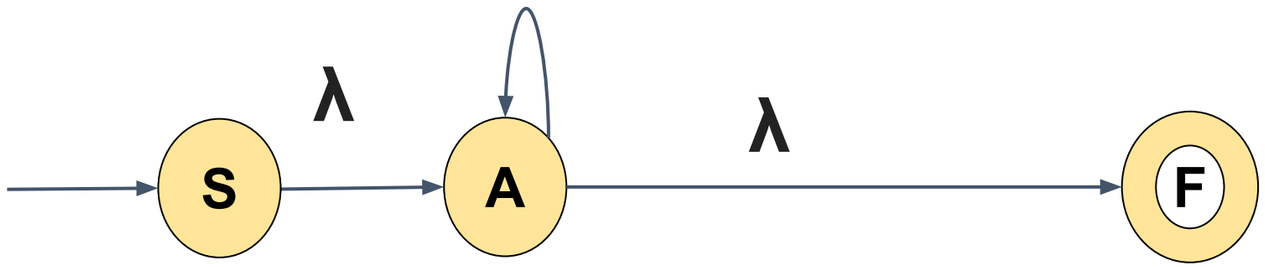
Example 9 :



1. Eliminate B
2. Eliminate C
3. Eliminate D

Example 9 :

aa+ab(bb)*ba + (b+ab(bb)*a)(a(bb)*a)*(a(bb)*ba+b



1. Eliminate B
2. Eliminate C
3. Eliminate D

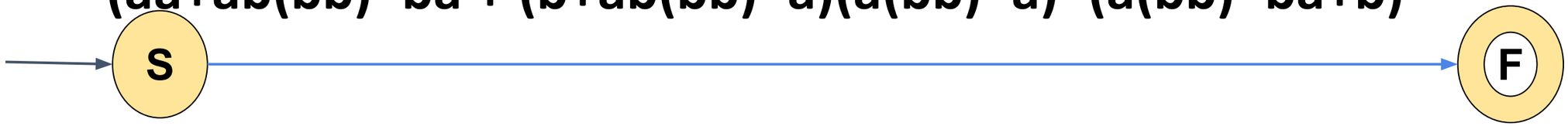
Example 9 :

(aa+ab(bb)*ba + (b+ab(bb)*a)(a(bb)*a)*(a(bb)*ba+b)

1. Eliminate B
2. Eliminate C
3. Eliminate D
4. Eliminate A

Example 9 :

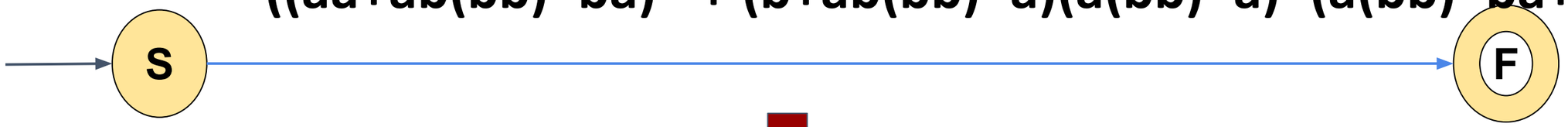
(aa+ab(bb)*ba + (b+ab(bb)*a)(a(bb)*a)*(a(bb)*ba+b)*



1. Eliminate B
2. Eliminate C
3. Eliminate D
4. Eliminate A

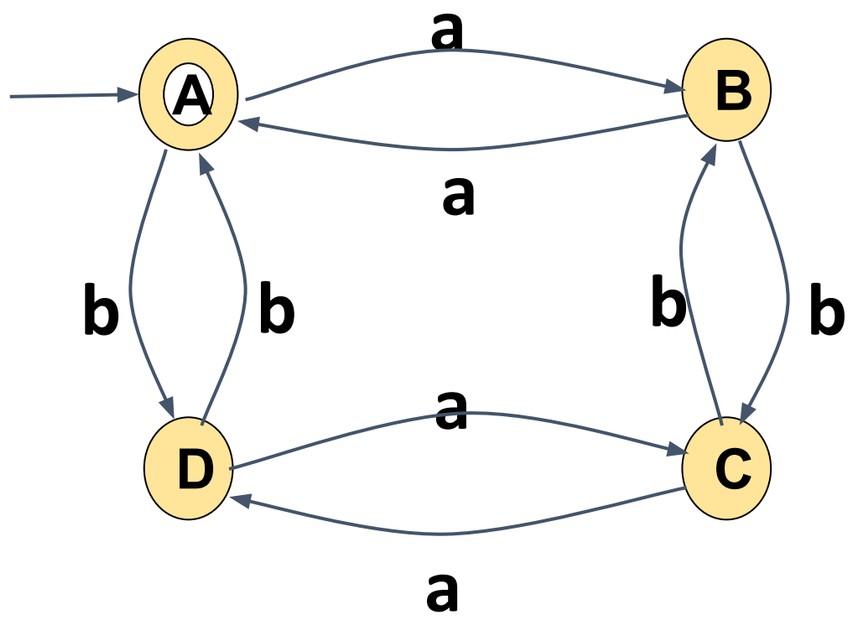
Example 9 :

((aa+ab(bb)*ba)* + (b+ab(bb)*a)(a(bb)*a)*(a(bb)*ba+b)*



RE = ((aa+ab(bb)*ba) + (b+ab(bb)*a)(a(bb)*a)*(a(bb)*ba+b))*

Example 9 :



(aa+bb + (ab+ba+(aa+bb)*(ab+ba))*

Eliminate : B,D,C,A

((aa+ab(bb)*ba)* +
(b+ab(bb)*a)(a(bb)*a)*(a(bb)*ba+b))*

Eliminate B,C,D,A

THANK YOU

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