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Automata Formal Languages & Logic

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Unit 1

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NFA -> DFA (Subset Construction)

- The initial state is the start state, plus all states reachable from the start state via λ-transitions (Called λ-closure).

- Transition from a state S on character a is found by following all possible transitions on a for each state in S, then taking the set of states reachable from there by λ-transitions.

- Accepting states are any set of states where some state in the set is an accepting state.

NFA -> DFA (Subset Construction)

- In converting an NFA to a DFA, the DFA's states correspond to set of NFA states.
- In the worst-case, the construction can result in a DFA that is exponentially larger than the original NFA .
- Minimization of a DFA ensures that the resulting DFA (after minimization) has the least possible states. The advantages of having a minimal DFA are: Faster Execution: The more the number of states the more time the DFA will take to process a string, hence minimization ensures faster execution.

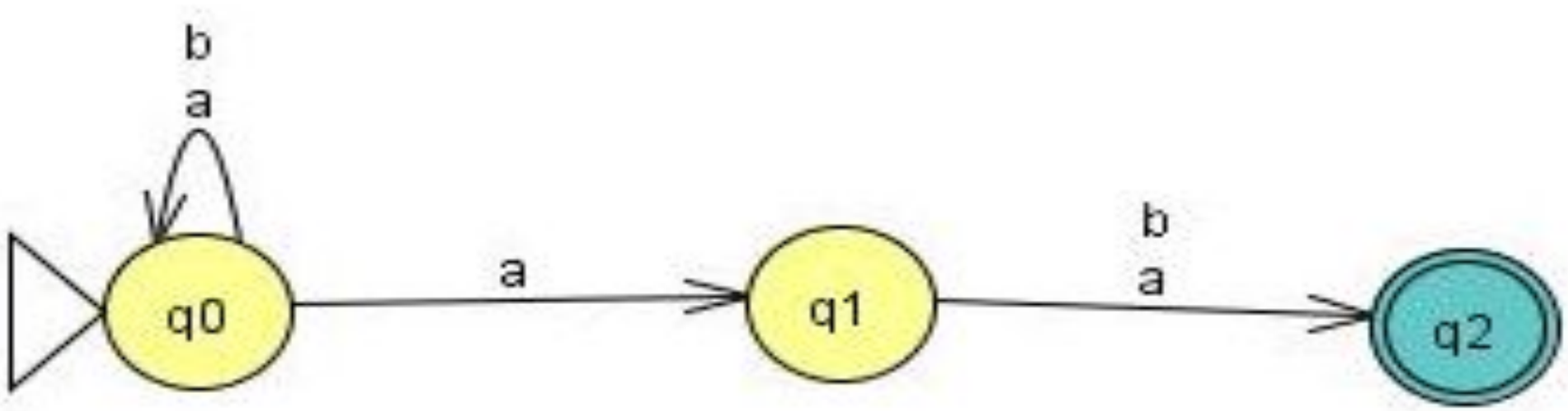
NFA -> DFA (Subset Construction)

Given an NFA with states Q, inputs Σ, transition function δ_N, state state q0, and final states F, construct equivalent DFA with:

*** States 2^Q (Set of subsets of Q).**
*** Inputs Σ.**
*** Start state {q0}.**
*** Final states = all those with a member of F.**

- **The DFA states have names that are sets of NFA states.**
- **But as a DFA state, an expression like {p,q} must be read as a single symbol, not as a set.**

Example 1: Convert the following NFA,Σ={a,b},L={Strings where the second symbol from RHS is a} to DFA.



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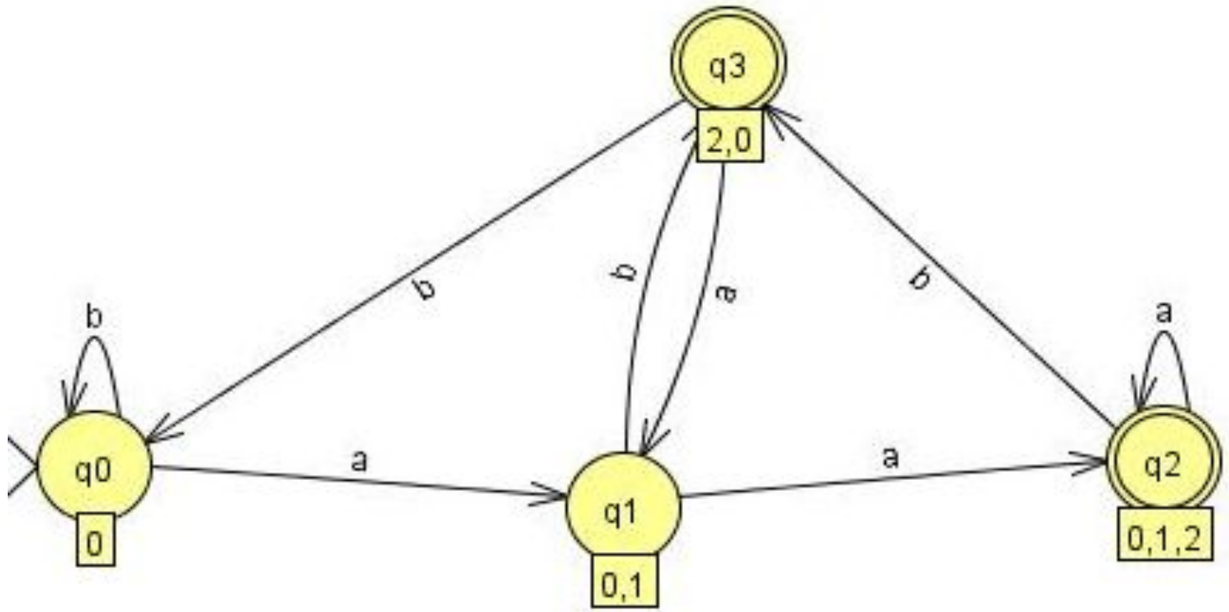
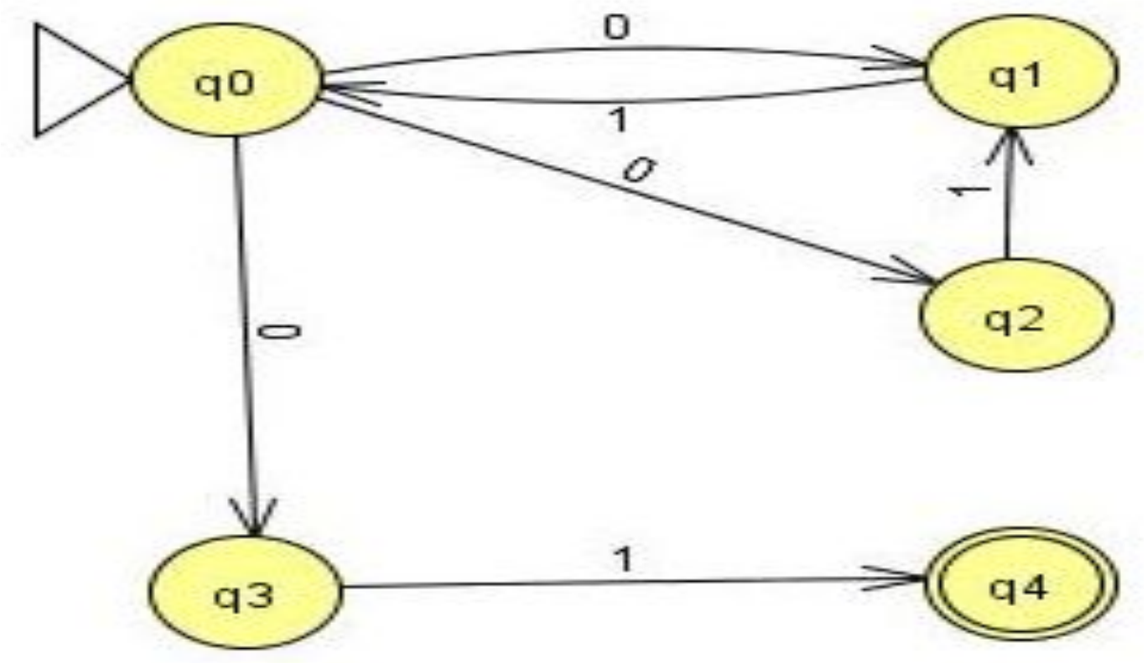
Solution:

	a	b
q0	{q0,q1}	q0
{q0q1}	{q0,q1,q2}	{q0,q2}
{q0,q1,q2}	{q0,q1,q2}	{q0,q2}
{q0,q2}	{q0q1}	q0



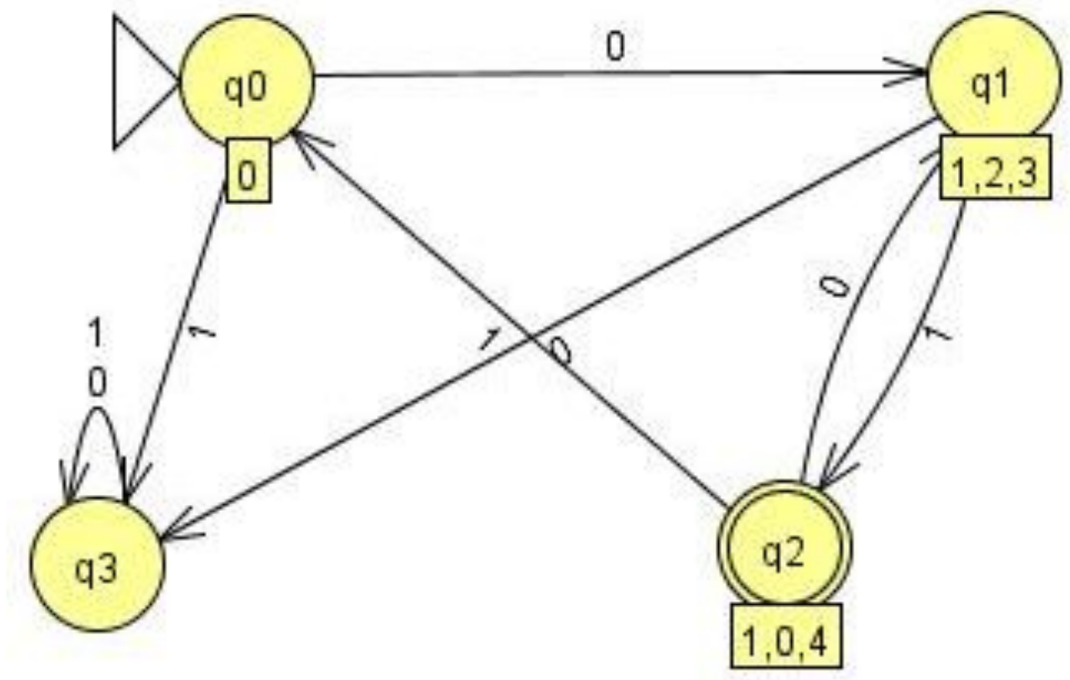
States= [{q0}, {q0q1},{q0q1q2},{q1q2}]
Can rename the states as q0=q0, {q0q1}=q1, {q0,q1,q2}=q2, {q0,q2}=q3

Example 2: Convert the following NFA to DFA.



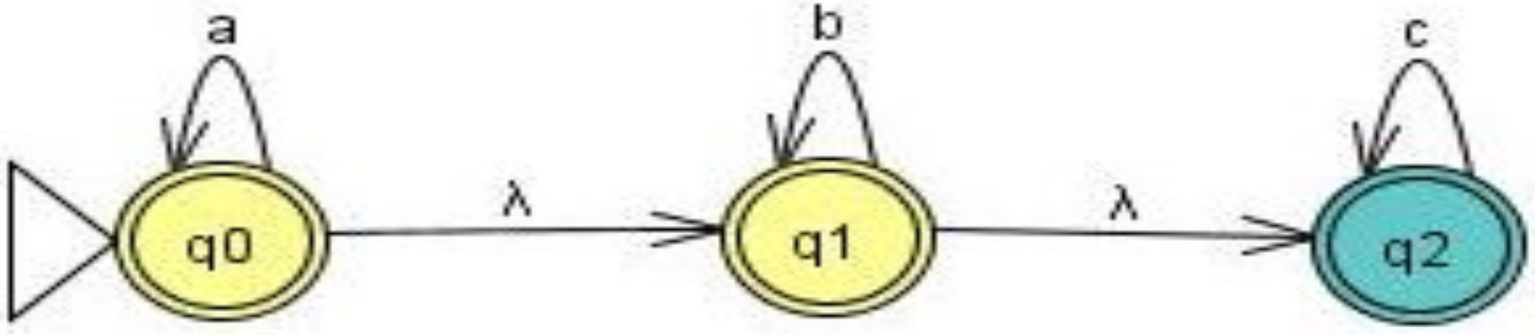
Solution:

	0	1
---> q0	{q1,q2,q3}	Φ
{q1,q2,q3}	Φ	{q0,q1,q4}
*{q0,q1,q4}	{q1,q2,q3}	q0
Φ	Φ	Φ



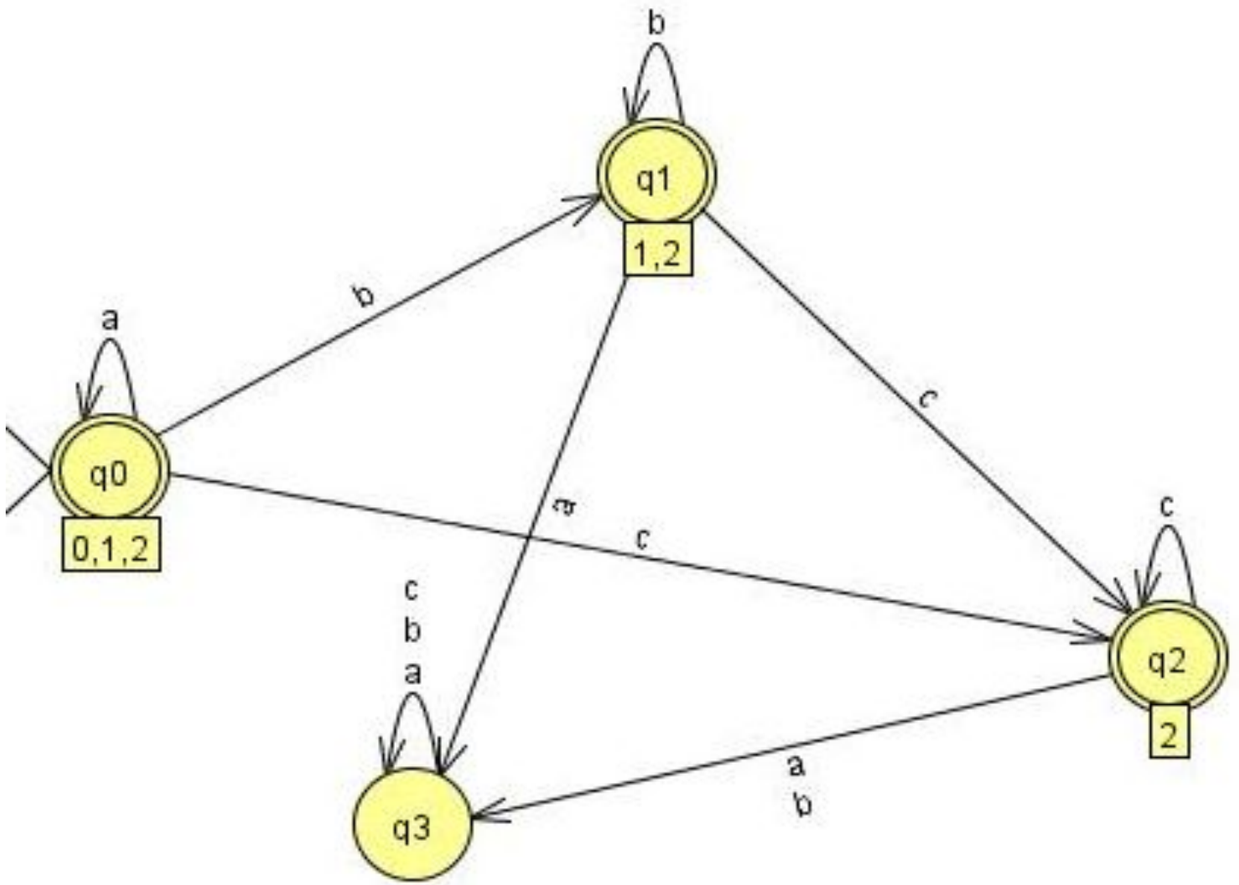
States: [{q0},{q0q1q2},{q0q1q4},Φ}
Rename the states as q0=q0,q0q1q2=q1, q0q1q4=q2, Φ= q3

Example 3: Convert the following λ-NFA $L=\{a^n b^m c^k , n,m,k>=0\}$ to DFA.



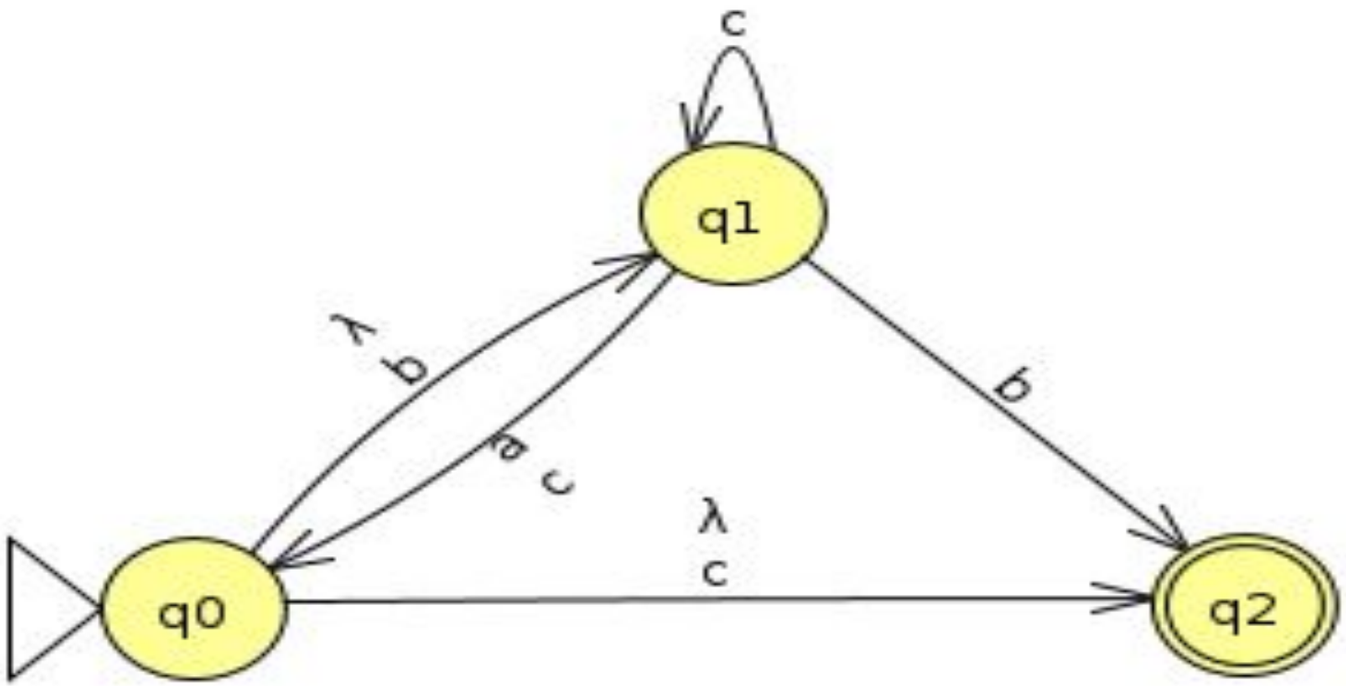
Solution:

	a	b	c
->*{q0q1q2}	{q0q1q2}	{q1q2}	q2
*{q1q2}	Φ	{q1q2}	q2
*q2	Φ	Φ	q2
Φ	Φ	Φ	Φ



Rename the states as:
{q0q1q2} as q0, {q1q2} as q1, q2 as

Example 4: Convert the following λ-NFA to DFA.

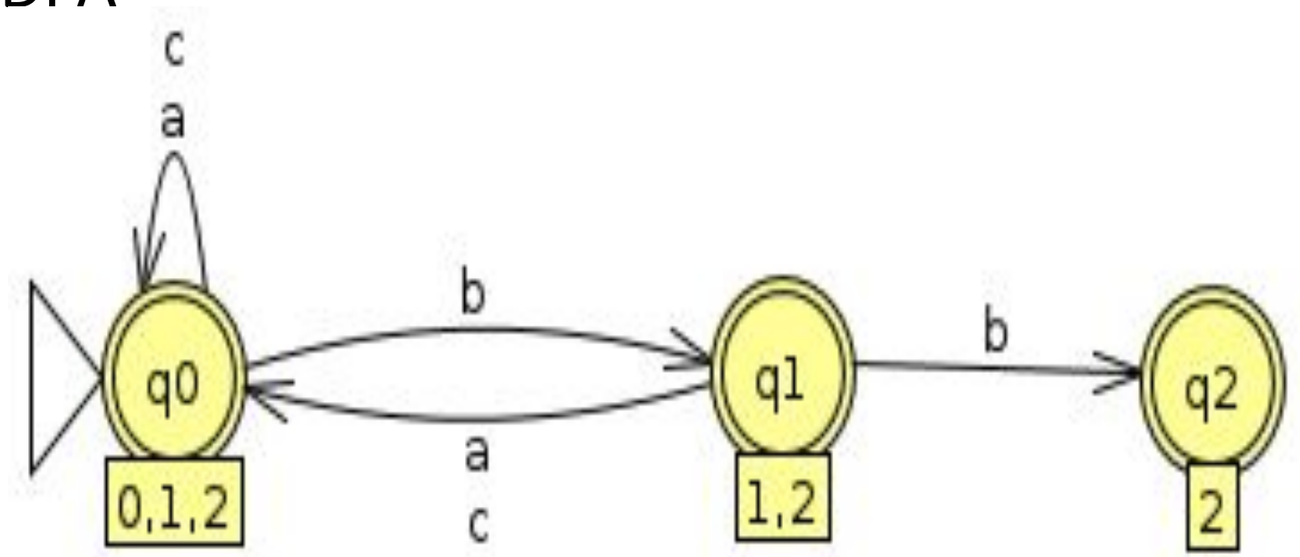


Solution:

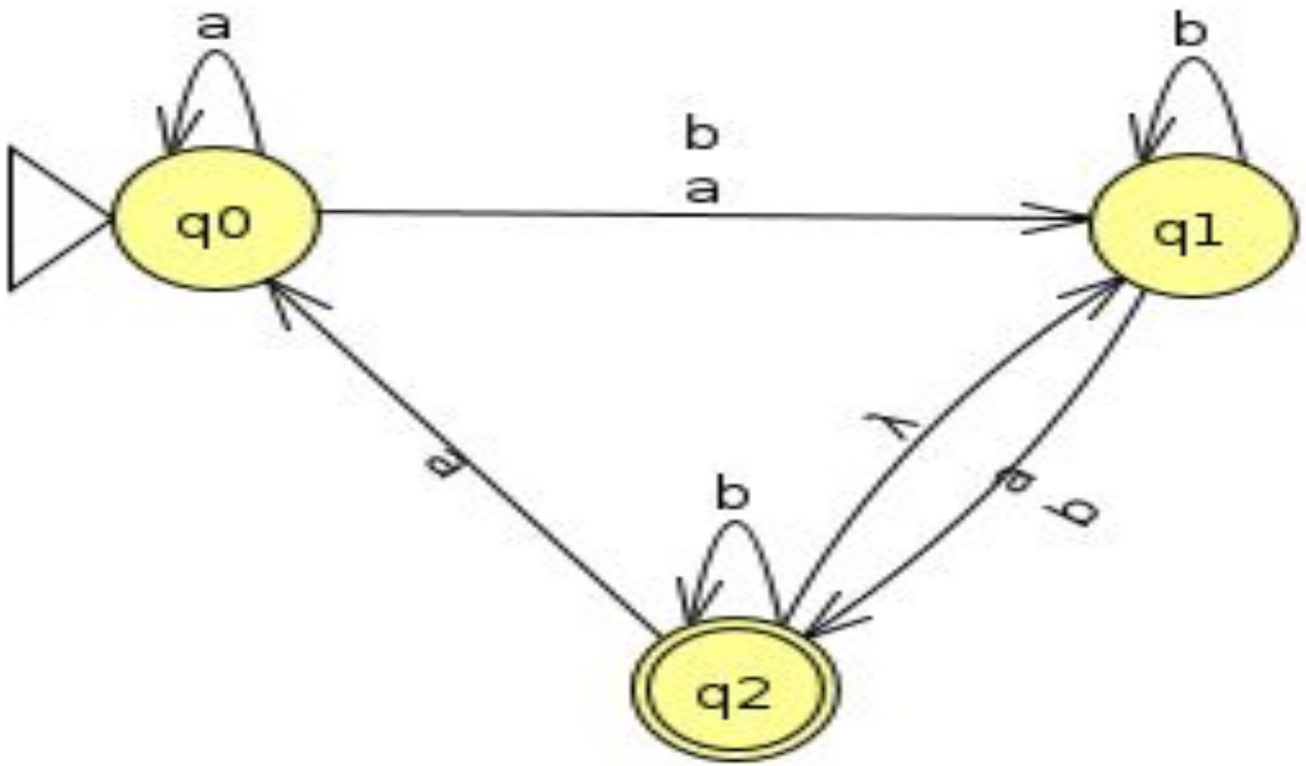
Transition Table

	a	b	c
-> *{q0q1q2}	{q0q1q2}	{q1q2}	{q0q1q2}
*{q1q2}	{q0q1q2}	q2	Φ
*q2	Φ	Φ	Φ
Φ	Φ	Φ	Φ

DFA



Example 5: Convert the following λ-NFA to DFA.

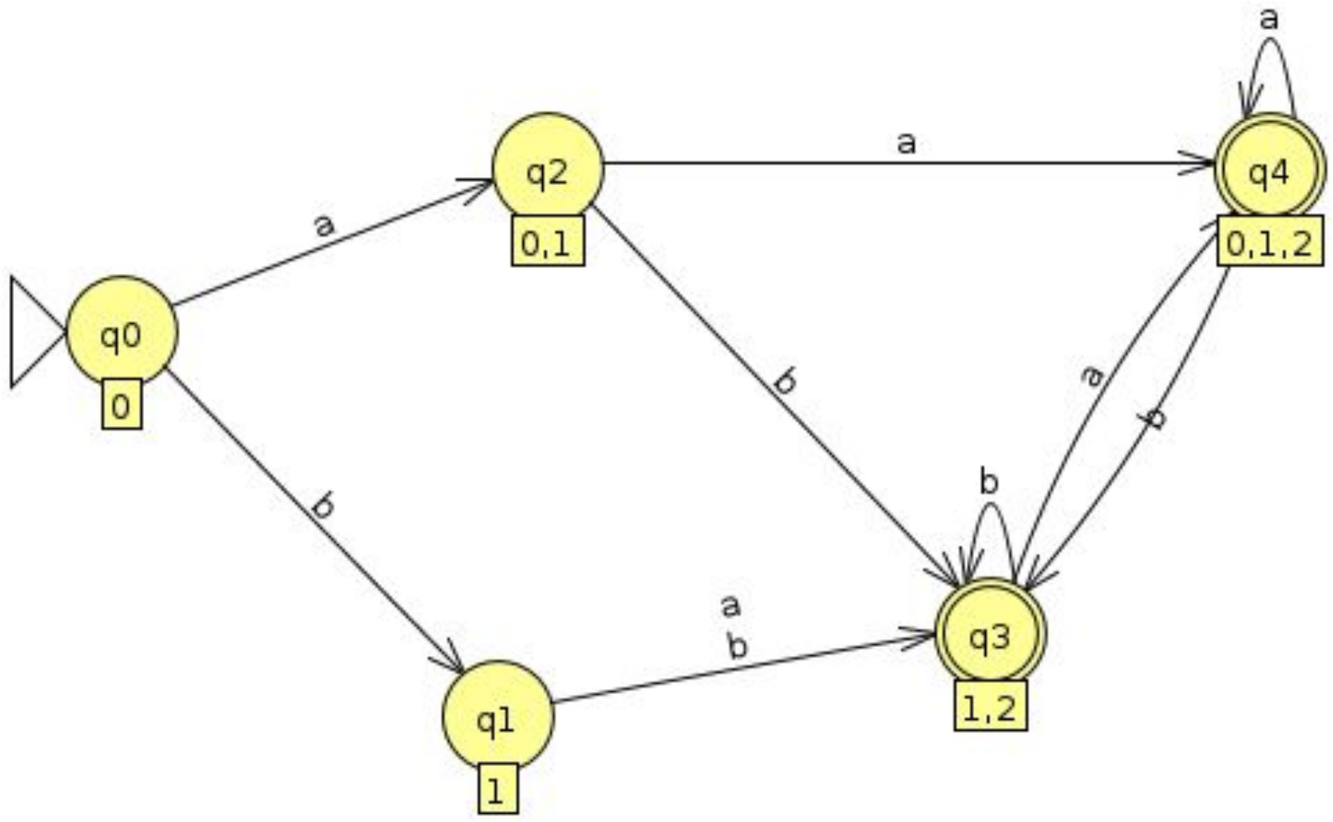


Solution:

Transition Table

	a	b
->q0	{q0q1}	q1
q1	{q1q2}	{q1q2}
{q0q1}	{q0q1q2}	{q0q2}
*{q1q2}	{q0q1q2}	{q1q2}
*{q0q1q2}	{q0q1q2}	{q1q2}

DFA



THANK YOU

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