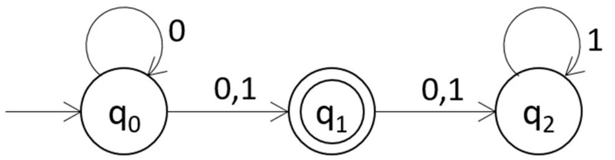
1. Convert the following NFA into its equivalent DFA.



Subset Construction Method:

Step 1: q_0 is the start/initial state of the required DFA.

Step 2: NFA has 3 states. Therefore, DFA has 8 (= 2^3) states, namely $[q_0]$, $[q_1]$, $[q_2]$, $[q_0q_1]$, $[q_1q_2]$, $[q_0q_2]$, $[q_0q_1q_2]$, ϕ.

Step 3: Evaluate δ_D using δ_N and determine the Transition function of the DFA as follows:

$\delta_D(q_0, 0) = \delta_N(q_0, 0) = [q_0q_1]$

$\delta_D(q_0, 1) = \delta_N(q_0, 1) = [q_1]$

$\delta_D(q_1, 0) = \delta_N(q_1, 0) = [q_2]$

$\delta_D(q_1, 1) = \delta_N(q_1, 1) = [q_2]$

$\delta_D(q_2, 0) = \delta_N(q_2, 0) = \phi$

$\delta_D(q_2, 1) = \delta_N(q_2, 1) = [q_2]$

$\delta_D([q_0q_1], 0) = \delta_N(q_0, 0) \cup \delta_N(q_1, 0) = \{q_0, q_1\} \cup \{q_2\} = [q_0q_1q_2]$

$\delta_D([q_0q_1], 1) = \delta_N(q_0, 1) \cup \delta_N(q_1, 1) = \{q_1\} \cup \{q_2\} = [q_1q_2]$

$\delta_D([q_0q_2], 0) = \delta_N(q_0, 0) \cup \delta_N(q_2, 0) = \{q_0, q_1\} \cup \phi = [q_0q_1]$

$\delta_D([q_0q_2], 1) = \delta_N(q_0, 1) \cup \delta_N(q_2, 1) = \{q_1\} \cup \{q_2\} = [q_1q_2]$

δ	0	1
→[q_0]	[q_0q_1]	[q_1]
***[q_1]**	[q_2]	[q_2]
[q_2]	ϕ	[q_2]
***[q_0q_1]**	[$q_0q_1q_2$]	[q_1q_2]
[q_0q_2]	[q_0q_1]	[q_1q_2]
***[q_1q_2]**	[q_2]	[q_2]
***[$q_0q_1q_2$]**	[$q_0q_1q_2$]	[q_1q_2]
ϕ	ϕ	ϕ

$\delta_D([q_1q_2], 0) = \delta_N(q_1, 0) \cup \delta_N(q_2, 0) = \{q_2\} = [q_2]$

$\delta_D([q_1q_2], 1) = \delta_N(q_1, 1) \cup \delta_N(q_2, 1) = \{q_2\} = [q_2]$

$\delta_D([q_0q_1q_2], 0) = \delta_N(q_0, 0) \cup \delta_N(q_1, 0) \cup \delta_N(q_2, 0) = \{q_0, q_1\} \cup \{q_2\} \cup \phi = [q_0q_1q_2]$

$\delta_D([q_0q_1q_2], 1) = \delta_N(q_0, 1) \cup \delta_N(q_1, 1) \cup \delta_N(q_2, 1) = \{q_1\} \cup \{q_2\} \cup \{q_2\} = [q_1q_2]$

$\delta_D(\phi, 0) = \delta_N(\phi, 0) = \phi$

$\delta_D(\phi, 1) = \delta_N(\phi, 1) = \phi$

Step 4: Now, change the names of the states $\{[q_0], [q_1], [q_2], [q_0q_1], [q_0q_2], [q_1q_2], [q_0q_1q_2], \phi\}$ as {A, B, C, D, E, F, G, H}.

Step 5: Draw the Transition Function for the newly named states.

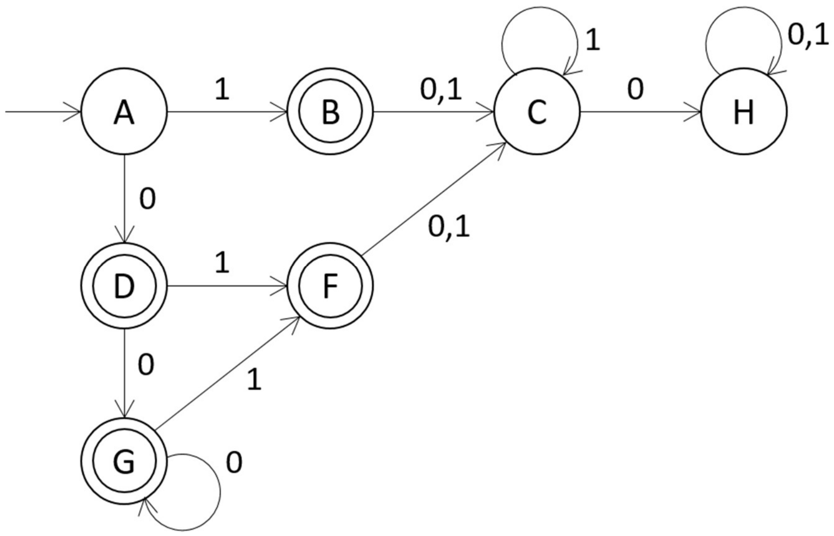
δ	0	1
→A	D	B
*B	C	C
C	H	C
*D	G	F
E	D	F
*F	C	C
*G	G	F
H	H	H

Step 6: Determine the states accessible from the start/initial state.
Here, the accessible states are: {A, D, B, G, F, C, H}.

Step 7: Draw the Transition Function for the accessible states only.

δ	0	1
→A	D	B
*D	G	F
*B	C	C
*G	G	F
*F	C	C
C	H	C
H	H	H

Step 8: Draw the DFA using the Transition Function.



Step 9: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

Q = {A, B, D, C, G, F, H}

Σ = {0, 1}

A is the initial/start state

F = {B, D, F, G}

Lazy Evaluation Method:

Step 1: q_0 is start/initial state of the required DFA.

$\delta_D (q_0, 0) = \delta_N (q_0, 0) = [q_0q_1]$

$\delta_D (q_0, 1) = \delta_N (q_0, 1) = [q_1]$

Step 2: Using the states obtained from each transition, proceed with the calculation as follows:

$\delta_D ([q_0q_1], 0) = \delta_N (q_0, 0) \cup \delta_N (q_1, 0) = \{q_0, q_1\} \cup \{q_2\} = [q_0q_1q_2]$

$\delta_D ([q_0q_1], 1) = \delta_N (q_0, 1) \cup \delta_N (q_1, 1) = \{q_1\} \cup \{q_2\} = [q_1q_2]$

$\delta_D (q_1, 0) = \delta_N (q_1, 0) = [q_2]$

$\delta_D (q_1, 1) = \delta_N (q_1, 1) = [q_2]$

$\delta_D ([q_0q_1q_2], 0) = \delta_N (q_0, 0) \cup \delta_N (q_1, 0) \cup \delta_N (q_2, 0) = \{q_0, q_1\} \cup \{q_2\} \cup \phi = [q_0q_1q_2]$

$\delta_D ([q_0q_1q_2], 1) = \delta_N (q_0, 1) \cup \delta_N (q_1, 1) \cup \delta_N (q_2, 1) = \{q_1\} \cup \{q_2\} = [q_0q_1q_2]$

$\delta_D ([q_1q_2], 0) = \delta_N (q_1, 0) \cup \delta_N (q_2, 0) = \{q_2\} = [q_2]$

$\delta_D ([q_1q_2], 1) = \delta_N (q_1, 1) \cup \delta_N (q_2, 1) = \{q_2\} = [q_2]$

$\delta_D (q_2, 0) = \delta_N (q_2, 0) = \phi$

$\delta_D (q_2, 1) = \delta_N (q_2, 1) = [q_2]$

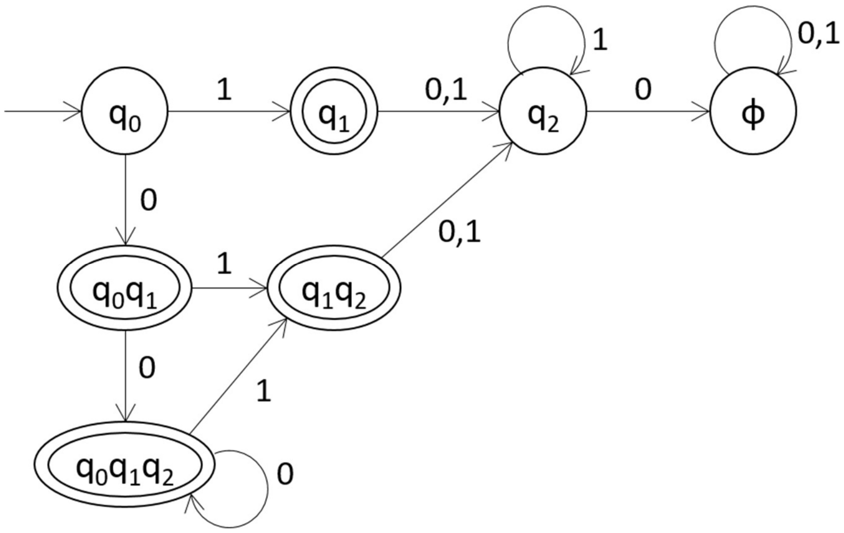
$\delta_D (\phi, 0) = \delta_N (\phi, 0) = \phi$

$\delta_D (\phi, 1) = \delta_N (\phi, 1) = \phi$

Step 3: Draw the Transition Function for the above determined states.

δ	**0**	**1**
→[q_0]	[q_0q_1]	[q_1]
***[q_0q_1]**	[$q_0q_1q_2$]	[q_1q_2]
***[q_1]**	[q_2]	[q_2]
***[$q_0q_1q_2$]**	[$q_0q_1q_2$]	[q_1q_2]
***[q_1q_2]**	[q_2]	[q_2]
[q_2]	φ	[q_2]
φ	φ	φ

Step 4: Draw the DFA using the Transition Function.



Step 5: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

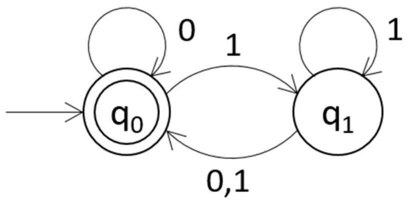
Q = {[q_0], [q_1], [q_2], [q_0q_1], [q_1q_2], [$q_0q_1q_2$], ϕ}

Σ = {0, 1}

q_0 is the initial/start state

F = {[q_1], [q_0q_1], [q_1q_2], [$q_0q_1q_2$]}

2. Convert the following NFA into its equivalent DFA.



Subset Construction Method:

Step 1: q_o is the start/initial state of the required DFA.

Step 2: NFA has 2 states. Therefore, DFA has 4 (= 2^2) states, namely [q_o], [q_1], [q_0q_1], ϕ.

Step 3: Evaluate δ_D using δ_N and determine the Transition function of the DFA as follows:

δ_D (q_0, 0) = δ_N (q_0, 0) = [q_0]

δ_D (q_0, 1) = δ_N (q_0, 1) = [q_1]

$\delta_D (q_1, 0) = \delta_N (q_1, 0) = [q_1]$
$\delta_D (q_1, 1) = \delta_N (q_1, 1) = [q_1]$
$\delta_D ([q_0q_1], 0) = \delta_N (q_0, 0) \cup \delta_N (q_1, 0) = \{q_0\} \cup \{q_1\} = [q_0q_1]$
$\delta_D ([q_0q_1], 1) = \delta_N (q_0, 1) \cup \delta_N (q_1, 1) = \{q_1\} \cup \{q_0, q_1\} = [q_0q_1]$
$\delta_D (\phi, 0) = \delta_N (\phi, 0) = \phi$
$\delta_D (\phi, 1) = \delta_N (\phi, 1) = \phi$

δ	**0**	**1**
→*[q_0]	[q_0]	[q_1]
[q_1]	[q_1]	[q_0q_1]
***[q_0q_1]**	[q_0q_1]	[q_0q_1]
ϕ	ϕ	ϕ

Step 4: Now, change the names of the states {[q_0], [q_1], [q_0q_1], ϕ} as {A, B, C, D}.

Step 5: Draw the Transition Function for the newly named states.

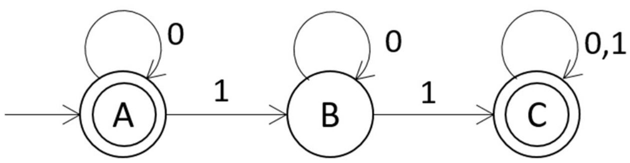
δ	**0**	**1**
→*A	A	B
B	B	C
***C**	C	C
D	D	D

Step 6: Determine the states accessible from the start/initial state.
Here, the accessible states are: {A, B, C}.

Step 7: Draw the Transition Function for the accessible states only.

δ	**0**	**1**
→*A	A	B
B	B	C
***C**	C	C

Step 8: Draw the DFA using the Transition Function.



Step 9: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}
Q = {A, B, C}
Σ = {0, 1}
A is the initial/start state
F = {A, C}

Lazy Evaluation Method:

Step 1: q_0 is start/initial state of the required DFA.

$\delta_D (q_0, 0) = \delta_N (q_0, 0) = [q_0]$

$\delta_D (q_0, 1) = \delta_N (q_0, 1) = [q_1]$

Step 2: Using the states obtained from each transition, proceed with the calculation as follows:

$\delta_D (q_1, 0) = \delta_N (q_1, 0) = [q_1]$

$\delta_D (q_1, 1) = \delta_N (q_1, 1) = [q_0q_1]$

$\delta_D ([q_0q_1], 0) = \delta_N (q_0, 0) \cup \delta_N (q_1, 0) = \{q_0\} \cup \{q_1\} = [q_0q_1]$

$\delta_D ([q_0q_1], 1) = \delta_N (q_0, 1) \cup \delta_N (q_1, 1) = \{q_1\} \cup \{q_0q_1\} = [q_0q_1]$

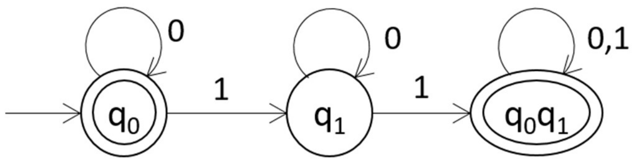
$\delta_D (\phi, 0) = \delta_N (\phi, 0) = \phi$

$\delta_D (\phi, 1) = \delta_N (\phi, 1) = \phi$

Step 3: Draw the Transition Function for the above determined states.

δ	**0**	**1**
→*[q_0]	[q_0]	[q_1]
[q_1]	[q_1]	[q_0q_1]
***[q_0q_1]**	[q_0q_1]	[q_0q_1]

Step 4: Draw the DFA using the Transition Function.



Step 5: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

Q = {[q_0], [q_1], [q_0q_1]}

Σ = {0, 1}

q_0 is the initial/start state

F = {[q_0], [q_0q_1]}

3. Convert the following NFA into its equivalent DFA.

δ	**0**	**1**
→ q_0	{q_0, q_1}	{q_2}
q_1	{q_0}	{q_1}
*** q_2**	ϕ	{q_0, q_1}

Subset Construction Method:

Step 1: q_o is the start/initial state of the required DFA.

Step 2: NFA has 3 states. Therefore, DFA has 8 (= 2^3) states, namely [q_o], [q_1], [q_2], [q_0q_1], [q_1q_2], [q_0q_2], [$q_0q_1q_2$], ϕ.

Step 3: Evaluate δ_D using δ_N and determine the Transition function of the DFA as follows:

δ_D (q_0, 0) = δ_N (q_0, 0) = [q_0q_1]

δ_D (q_0, 1) = δ_N (q_0, 1) = [q_2]

δ_D (q_1, 0) = δ_N (q_1, 0) = [q_0]

δ_D (q_1, 1) = δ_N (q_1, 1) = [q_1]

δ_D (q_2, 0) = δ_N (q_2, 0) = ϕ

δ_D (q_2, 1) = δ_N (q_2, 1) = [q_0q_1]

δ_D ([q_0q_1], 0) = δ_N (q_0, 0) U δ_N (q_1, 0) = {q_1} U {q_0} = [q_0q_1]

δ_D ([q_0q_1], 1) = δ_N (q_0, 1) U δ_N (q_1, 1) = {q_2} U {q_1} = [q_1q_2]

δ_D ([q_0q_2], 0) = δ_N (q_0, 0) U δ_N (q_2, 0) = {q_0q_1} U ϕ = [q_0q_1]

δ	0	1
→[q_0]	[q_0q_1]	[q_2]
[q_1]	[q_0]	[q_1]
***[q_2]**	ϕ	[q_0q_1]
[q_0q_1]	[q_0q_1]	[q_1q_2]
***[q_0q_2]**	[q_0q_1]	[$q_0q_1q_2$]
***[q_1q_2]**	[q_0]	[q_0q_1]
***[$q_0q_1q_2$]**	[q_0q_1]	[$q_0q_1q_2$]
ϕ	ϕ	ϕ

δ_D ([q_0q_2], 1) = δ_N (q_0, 1) U δ_N (q_2, 1) = {q_2} U {q_0q_1} = [$q_0q_1q_2$]

δ_D ([q_1q_2], 0) = δ_N (q_1, 0) U δ_N (q_2, 0) = {q_0} U ϕ = [q_0]

δ_D ([q_1q_2], 1) = δ_N (q_1, 1) U δ_N (q_2, 1) = {q_1} U {q_0q_1} = [q_0q_1]

δ_D ([$q_0q_1q_2$], 0) = δ_N (q_0, 0) U δ_N (q_1, 0) U δ_N (q_2, 0) = {q_0, q_1} U {q_0} U ϕ = [q_0q_1]

δ_D ([$q_0q_1q_2$], 1) = δ_N (q_0, 1) U δ_N (q_1, 1) U δ_N (q_2, 1) = {q_2} U {q_1} U {q_1q_0} = [$q_0q_1q_2$]

δ_D (ϕ, 0) = δ_N (ϕ, 0) = ϕ

δ_D (ϕ, 1) = δ_N (ϕ, 1) = ϕ

Step 4: Now, change the names of the states {[q_0], [q_1], [q_2], [q_0q_1], [q_0q_2], [q_1q_2], [$q_0q_1q_2$], ϕ} as {A, B, C, D, E, F, G, H}.

Step 5: Draw the Transition Function for the newly named states.

δ	0	1
→A	D	C
B	A	B
***C**	H	D
D	D	F
***E**	D	G
***F**	A	D
***G**	D	G
H	H	H

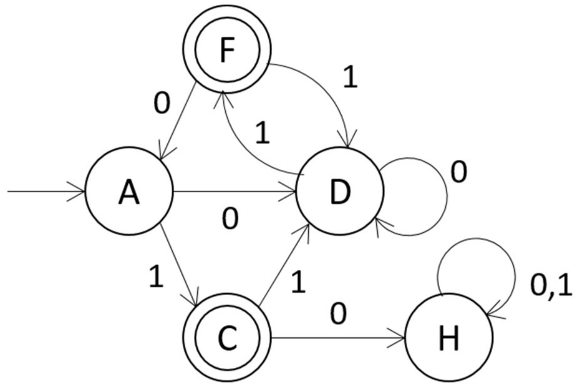
Step 6: Determine the states accessible from the start/initial state.

Here, the accessible states are: {A, D, C, H, F}.

Step 7: Draw the Transition Function for the accessible states only.

δ	0	1
→A	D	C
D	D	F
*C	H	D
*F	A	D
H	H	H

Step 8: Draw the DFA using the Transition Function.



Step 9: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

Q = {A, C, D, F, H}

Σ = {0, 1}

A is the initial/start state

F = {C, F}

Lazy Evaluation Method:

Step 1: q_0 is start/initial state of the required DFA.

$\delta_D (q_0, 0) = \delta_N (q_0, 0) = [q_0q_1]$

$\delta_D (q_0, 1) = \delta_N (q_0, 1) = [q_2]$

Step 2: Using the states obtained from each transition, proceed with the calculation as follows:

$\delta_D ([q_0q_1], 0) = \delta_N (q_0, 0) \cup \delta_N (q_1, 0) = \{q_1\} \cup \{q_0\} = [q_0q_1]$

$\delta_D ([q_0q_1], 1) = \delta_N (q_0, 1) \cup \delta_N (q_1, 1) = \{q_2\} \cup \{q_1\} = [q_1q_2]$

$\delta_D (q_2, 0) = \delta_N (q_2, 0) = \phi$

$\delta_D (q_2, 1) = \delta_N (q_2, 1) = [q_0q_1]$

$\delta_D ([q_1q_2], 0) = \delta_N (q_1, 0) \cup \delta_N (q_2, 0) = \{q_0\} \cup \phi = [q_0]$

δ_D ([q_1q_2], 1) = δ_N (q_1, 1) U δ_N (q_2, 1) = {q_1} U {q_0q_1} = [q_0q_1]

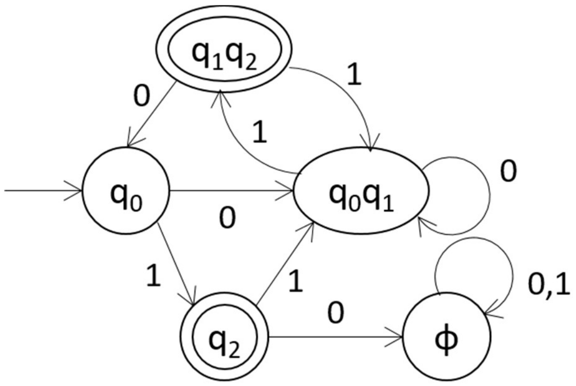
δ_D (ϕ, 0) = δ_N (ϕ, 0) = ϕ

δ_D (ϕ, 1) = δ_N (ϕ, 1) = ϕ

Step 3: Draw the Transition Function for the above determined states.

δ	0	1
→[q_0]	[q_0q_1]	[q_2]
[q_0q_1]	[q_0q_1]	[q_1q_2]
*[q_2]	ϕ	[q_0q_1]
*[q_1q_2]	[q_0]	[q_0q_1]
ϕ	ϕ	ϕ

Step 4: Draw the DFA using the Transition Function.



Step 5: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

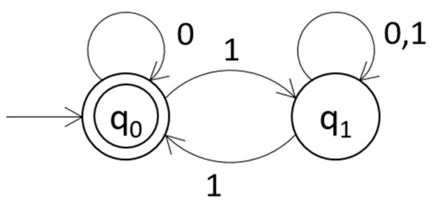
Q = {[q_0], [q_2], [q_0q_1], [q_1q_2], ϕ}

Σ = {0, 1}

q_0 is the initial/start state

F = {[q_2], [q_1q_2]}

4. Convert the following NFA into its equivalent DFA.



Subset Construction Method:

Step 1: q_o is the start/initial state of the required DFA.

Step 2: NFA has 2 states. Therefore, DFA has 4 (= 2^2) states, namely $[q_o]$, $[q_1]$, $[q_0q_1]$, ϕ.

Step 3: Evaluate δ_D using δ_N and determine the Transition function of the DFA as follows:

$\delta_D(q_0, 0) = \delta_N(q_0, 0) = [q_0]$

$\delta_D(q_0, 1) = \delta_N(q_0, 1) = [q_1]$

$\delta_D(q_1, 0) = \delta_N(q_1, 0) = [q_1]$

$\delta_D(q_1, 1) = \delta_N(q_1, 1) = [q_0q_1]$

$\delta_D([q_0q_1], 0) = \delta_N(q_0, 0) \cup \delta_N(q_1, 0) =$
$\{q_0, q_1\} \cup \{q_2\} = [q_0q_1]$

$\delta_D([q_0q_1], 1) = \delta_N(q_0, 1) \cup \delta_N(q_1, 1) =$
$\{q_1\} \cup \{q_2\} = [q_0q_1]$

$\delta_D(\phi, 0) = \delta_N(\phi, 0) = \phi$

$\delta_D(\phi, 1) = \delta_N(\phi, 1) = \phi$

δ	**0**	**1**
→*$[q_0]$	$[q_0]$	$[q_1]$
$[q_1]$	$[q_1]$	$[q_0q_1]$
***$[q_0q_1]$**	$[q_0q_1]$	$[q_0q_1]$
ϕ	ϕ	ϕ

Step 4: Now, change the names of the states $\{[q_0], [q_1], [q_0q_1], \phi\}$ as {A, B, C, D}.

Step 5: Draw the Transition Function for the newly named states.

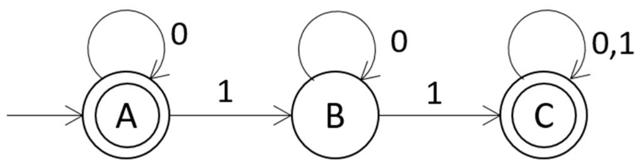
δ	**0**	**1**
→*A	A	B
B	B	C
***C**	C	C
D	D	D

Step 6: Determine the states accessible from the start/initial state.
Here, the accessible states are: {A, B, C}.

Step 7: Draw the Transition Function for the accessible states only.

δ	**0**	**1**
→*A	A	B
B	B	C
***C**	C	C

Step 8: Draw the DFA using the Transition Function.



Step 9: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

Q = {A, B, C}

Σ = {0, 1}

A is the initial/start state

F = {A, C}

Lazy Evaluation Method:

Step 1: q_0 is start/initial state of the required DFA.

δ_D (q_0, 0) = δ_N (q_0, 0) = [q_0]

δ_D (q_0, 1) = δ_N (q_0, 1) = [q_1]

Step 2: Using the states obtained from each transition, proceed with the calculation as follows:

δ_D (q_1, 0) = δ_N (q_1, 0) = [q_1]

δ_D (q_1, 1) = δ_N (q_1, 1) = [q_0q_1]

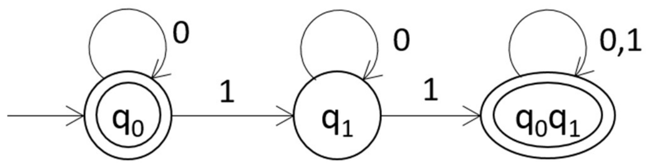
δ_D ([q_0q_1], 0) = δ_N (q_0, 0) U δ_N (q_1, 0) = {q_0, q_1} U {q_2} = [q_0q_1]

δ_D ([q_0q_1], 1) = δ_N (q_0, 1) U δ_N (q_1, 1) = {q_1} U {q_2} = [q_0q_1]

Step 3: Draw the Transition Function for the above determined states.

δ	**0**	**1**
→*[q_0]	[q_0]	[q_1]
[q_1]	[q_1]	[q_0q_1]
***[q_0q_1]**	[q_0q_1]	[q_0q_1]

Step 4: Draw the DFA using the Transition Function.



Step 5: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

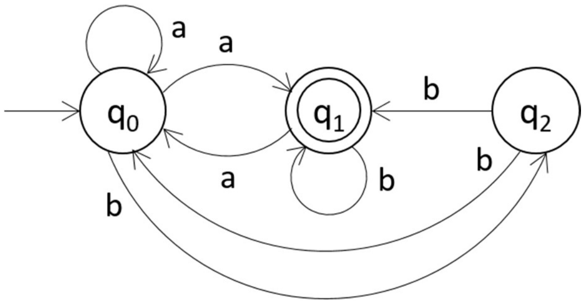
Q = {[q_0], [q_1], [q_0q_1]}

Σ = {0, 1}

q_0 is the initial/start state

F = {[q_0], [q_0q_1]}

5. Convert the following NFA into its equivalent DFA.



Subset Construction Method:

Step 1: q_o is the start/initial state of the required DFA.

Step 2: NFA has 3 states. Therefore, DFA has 8 (= 2^3) states, namely $[q_o]$, $[q_1]$, $[q_2]$, $[q_0q_1]$, $[q_1q_2]$, $[q_0q_2]$, $[q_0q_1q_2]$, ϕ.

Step 3: Evaluate δ_D using δ_N and determine the Transition function of the DFA as follows:

δ_D $(q_0, a) = \delta_N (q_0, a) = [q_0q_1]$

δ_D $(q_0, b) = \delta_N (q_0, b) = [q_2]$

δ_D $(q_1, a) = \delta_N (q_1, a) = [q_0]$

δ_D $(q_1, b) = \delta_N (q_1, b) = [q_1]$

δ_D $(q_2, a) = \delta_N (q_2, a) = \phi$

δ_D $(q_2, b) = \delta_N (q_2, b) = [q_0q_1]$

$\delta_D ([q_0q_1], a) = \delta_N (q_0, a) \cup \delta_N (q_1, a) = \{q_0, q_1\} \cup \{q_0\} = [q_0q_1]$

$\delta_D ([q_0q_1], b) = \delta_N (q_0, b) \cup \delta_N (q_1, b) = \{q_2\} \cup \{q_1\} = [q_1q_2]$

$\delta_D ([q_0q_2], a) = \delta_N (q_0, a) \cup \delta_N (q_2, a) = \{q_0, q_1\} \cup \phi = [q_0q_1]$

$\delta_D ([q_0q_2], b) = \delta_N (q_0, b) \cup \delta_N (q_2, b) = \{q_2\} \cup \{q_0q_1\} = [q_0q_1q_2]$

$\delta_D ([q_1q_2], a) = \delta_N (q_1, a) \cup \delta_N (q_2, a) = \{q_0\} \cup \phi = [q_0]$

$\delta_D ([q_1q_2], b) = \delta_N (q_1, b) \cup \delta_N (q_2, b) = \{q_1\} \cup \{q_0q_1\} = [q_0q_1]$

$\delta_D ([q_0q_1q_2], a) = \delta_N (q_0, a) \cup \delta_N (q_1, a) \cup \delta_N (q_2, a) = \{q_0, q_1\} \cup \{q_0\} \cup \phi = [q_0q_1]$

$\delta_D ([q_0q_1q_2], 1) = \delta_N (q_0, 1) \cup \delta_N (q_1, 1) \cup \delta_N (q_2, 1) = \{q_2\} \cup \{q_1\} \cup \{q_0q_1\} = [q_0q_1q_2]$

$\delta_D (\phi, a) = \delta_N (\phi, a) = \phi$

$\delta_D (\phi, b) = \delta_N (\phi, b) = \phi$

δ	**a**	**b**
→$[q_0]$	$[q_0q_1]$	$[q_2]$
$[q_1]$	$[q_0]$	$[q_1]$
***$[q_2]$**	ϕ	$[q_0q_1]$
$[q_0q_1]$	$[q_0q_1]$	$[q_1q_2]$
***$[q_0q_2]$**	$[q_0q_1]$	$[q_0q_1q_2]$
***$[q_1q_2]$**	$[q_0]$	$[q_0q_1]$
***$[q_0q_1q_2]$**	$[q_0q_1]$	$[q_0q_1q_2]$
ϕ	ϕ	ϕ

Step 4: Now, change the names of the states $\{[q_0], [q_1], [q_2], [q_0q_1], [q_0q_2], [q_1q_2], [q_0q_1q_2], \phi\}$ as {A, B, C, D, E, F, G, H}.

Step 5: Draw the Transition Function for the newly named states.

δ	a	b
→A	D	C
B	A	B
*C	H	D
D	D	F
*E	D	G
*F	A	D
*G	D	G
H	H	H

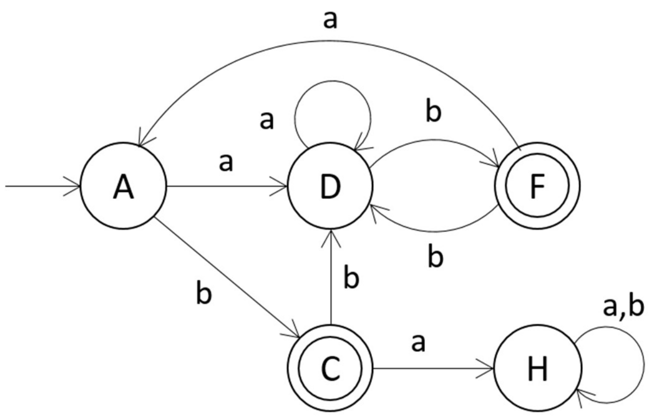
Step 6: Determine the states accessible from the start/initial state.

Here, the accessible states are: {A, C, D, F, H}.

Step 7: Draw the Transition Function for the accessible states only.

δ	a	b
→A	D	C
D	D	F
*C	H	D
*F	A	D
H	H	H

Step 8: Draw the DFA using the Transition Function.



Step 9: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

Q = {A, C, D, F, H}

Σ = {a, b}

A is the initial/start state

F = {C, F}

Lazy Evaluation Method:

Step 1: q_0 is start/initial state of the required DFA.

$\delta_D (q_0, a) = \delta_N (q_0, a) = [q_0q_1]$

$\delta_D (q_0, b) = \delta_N (q_0, b) = [q_2]$

Step 2: Using the states obtained from each transition, proceed with the calculation as follows:

$\delta_D (q_1, a) = \delta_N (q_1, a) = [q_0]$

$\delta_D (q_1, b) = \delta_N (q_1, b) = [q_1]$

$\delta_D (q_2, a) = \delta_N (q_2, a) = \phi$

$\delta_D (q_2, b) = \delta_N (q_2, b) = [q_0q_1]$

$\delta_D ([q_0q_1], a) = \delta_N (q_0, a) \cup \delta_N (q_1, a) = \{q_0, q_1\} \cup \{q_0\} = [q_0q_1]$

$\delta_D ([q_0q_1], b) = \delta_N (q_0, b) \cup \delta_N (q_1, b) = \{q_2\} \cup \{q_1\} = [q_1q_2]$

$\delta_D ([q_1q_2], a) = \delta_N (q_1, a) \cup \delta_N (q_2, a) = \{q_0\} \cup \phi = [q_0]$

$\delta_D ([q_1q_2], b) = \delta_N (q_1, b) \cup \delta_N (q_2, b) = \{q_1\} \cup \{q_0q_1\} = [q_0q_1]$

$\delta_D ([q_0q_2], a) = \delta_N (q_0, a) \cup \delta_N (q_2, a) = \{q_0, q_1\} \cup \phi = [q_0q_1]$

$\delta_D ([q_0q_2], b) = \delta_N (q_0, b) \cup \delta_N (q_2, b) = \{q_2\} \cup \{q_0q_1\} = [q_0q_1q_2]$

$\delta_D ([q_0q_1q_2], a) = \delta_N (q_0, a) \cup \delta_N (q_1, a) \cup \delta_N (q_2, a) = \{q_0, q_1\} \cup \{q_0\} \cup \phi = [q_0q_1]$

$\delta_D ([q_0q_1q_2], 1) = \delta_N (q_0, 1) \cup \delta_N (q_1, 1) \cup \delta_N (q_2, 1) = \{q_2\} \cup \{q_1\} \cup \{q_0q_1\} = [q_0q_1q_2]$

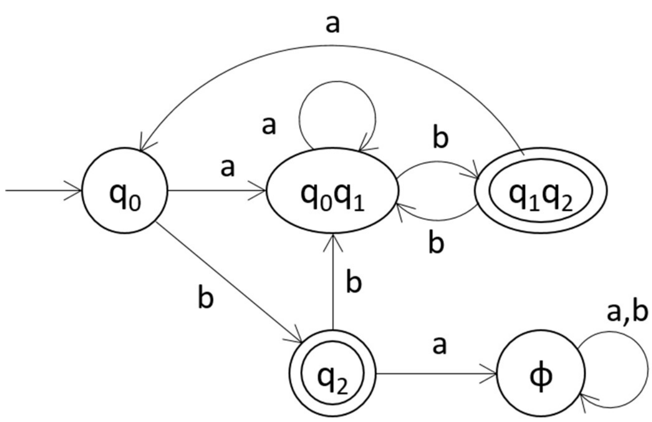
$\delta_D (\phi, a) = \delta_N (\phi, a) = \phi$

$\delta_D (\phi, b) = \delta_N (\phi, b) = \phi$

Step 3: Draw the Transition Function for the above determined states.

δ	**a**	**b**
→[q_0]	[q_0q_1]	[q_2]
[q_0q_1]	[q_0q_1]	[q_1q_2]
***[q_2]**	ϕ	[q_0q_1]
***[q_1q_2]**	[q_0]	[q_0q_1]
ϕ	ϕ	ϕ

Step 4: Draw the DFA using the Transition Function.



Step 5: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

Q = {[q_0], [q_2], [q_0q_1], [q_1q_2], ϕ}

Σ = {a, b}

q_0 is the initial/start state

F = {[q_2], [q_1q_2]}

6. Convert the following NFA into its equivalent DFA.

δ	a	b
→ q_0	{q_0, q_1}	{q_0}
q_1	{q_2}	{q_1}
q_2	{q_3}	{q_3}
*** q_3**	ϕ	{q_2}

Subset Construction Method:

Step 1: q_o is the start/initial state of the required DFA.

Step 2: NFA has 4 states. Therefore, DFA has 16 (= 2^4) states, namely [q_o], [q_1], [q_2], [q_3], [q_0q_1], [q_0q_2], [q_0q_3], [q_1q_2], [q_1q_3], [q_2q_3], [$q_0q_1q_2$], [$q_0q_1q_3$], [$q_0q_2q_3$], [$q_1q_2q_3$], [$q_0q_1q_2q_3$], ϕ.

Step 3: Evaluate δ_D using δ_N and determine the Transition function of the DFA as follows:

δ_D (q_0, a) = δ_N (q_0, a) = [q_0q_1]

δ_D (q_0, b) = δ_N (q_0, b) = [q_0]

δ_D (q_1, a) = δ_N (q_1, a) = [q_2]

δ_D (q_1, b) = δ_N (q_1, b) = [q_1]
δ_D (q_2, a) = δ_N (q_2, a) = [q_3]
δ_D (q_2, b) = δ_N (q_2, b) = [q_3]
δ_D (q_3, a) = δ_N (q_3, a) = ϕ
δ_D (q_3, b) = δ_N (q_3, b) = [q_2]
δ_D ([q_0q_1], a) = δ_N (q_0, a) U δ_N (q_1, a)
= {q_0, q_1} U {q_2} = [$q_0q_1q_2$]
δ_D ([q_0q_1], b) = δ_N (q_0, b) U δ_N (q_1, b)
= {q_0} U {q_1} = [q_0q_1]
δ_D ([q_0q_2], a) = δ_N (q_0, a) U δ_N (q_2, a)
= {q_0, q_1} U {q_3} = [$q_0q_1q_3$]
δ_D ([q_0q_2], b) = δ_N (q_0, b) U δ_N (q_2, b)
= {q_0} U {q_3} = [q_0q_3]
δ_D ([q_0q_3], a) = δ_N (q_0, a) U δ_N (q_3, a)
= {q_0, q_1} U ϕ = [q_0q_1]
δ_D ([q_0q_3], b) = δ_N (q_0, b) U δ_N (q_3, b)
= {q_1} U {q_2} = [q_1q_2]
δ_D ([q_1q_2], a) = δ_N (q_1, a) U δ_N (q_2, a)
= {q_2} U {q_3} = [q_2q_3]
δ_D ([q_1q_2], b) = δ_N (q_1, b) U δ_N (q_2, b)
= {q_1} U {q_3} = [q_1q_3]
δ_D ([q_1q_3], a) = δ_N (q_1, a) U δ_N (q_3, a)
= {q_2} U ϕ = [q_2]

δ	**0**	**1**
→[q_0]	[q_0q_1]	[q_0]
[q_1]	[q_2]	[q_1]
[q_2]	[q_3]	[q_3]
***[q_3]**	ϕ	[q_2]
[q_0q_1]	[$q_0q_1q_2$]	[q_0q_1]
[q_0q_2]	[$q_0q_1q_3$]	[q_0q_3]
***[q_0q_3]**	[q_0q_1]	[q_0q_2]
[q_1q_2]	[q_2q_3]	[q_1q_3]
***[q_1q_3]**	[q_2]	[q_1q_2]
***[q_2q_3]**	[q_3]	[q_2q_3]
[$q_0q_1q_2$]	[$q_0q_1q_2q_3$]	[$q_0q_1q_3$]
***[$q_0q_1q_3$]**	[$q_0q_1q_2$]	[$q_0q_1q_2$]
***[$q_0q_2q_3$]**	[$q_0q_1q_3$]	[$q_0q_2q_3$]
***[$q_1q_2q_3$]**	[q_2q_3]	[$q_1q_2q_3$]
***[$q_0q_1q_2q_3$]**	[$q_0q_1q_2q_3$]	[$q_0q_1q_2q_3$]
ϕ	ϕ	ϕ

δ_D ([q_1q_3], b) = δ_N (q_1, b) U δ_N (q_3, b) = {q_1} U {q_2} = [q_1q_2]
δ_D ([q_2q_3], a) = δ_N (q_2, a) U δ_N (q_3, a) = {q_3} U ϕ = [q_3]
δ_D ([q_2q_3], b) = δ_N (q_2, b) U δ_N (q_3, b) = {q_3} U {q_2} = [q_2q_3]
δ_D ([$q_0q_1q_2$], a) = δ_N (q_0, a) U δ_N (q_1, a) U δ_N (q_2, a) = {q_0, q_1} U {q_2} U {q_3} = [$q_0q_1q_2q_3$]
δ_D ([$q_0q_1q_2$], b) = δ_N (q_0, b) U δ_N (q_1, b) U δ_N (q_2, b) = {q_0} U {q_1} U {q_3} = [$q_0q_1q_3$]
δ_D ([$q_0q_1q_3$], a) = δ_N (q_0, a) U δ_N (q_1, a) U δ_N (q_3, a) = {q_0, q_1} U {q_2} U ϕ = [$q_0q_1q_2$]
δ_D ([$q_0q_1q_3$], b) = δ_N (q_0, b) U δ_N (q_1, b) U δ_N (q_3, b) = {q_0} U {q_1} U {q_2} = [$q_0q_1q_2$]
δ_D ([$q_0q_2q_3$], a) = δ_N (q_0, a) U δ_N (q_2, a) U δ_N (q_3, a) = {q_0, q_1} U {q_3} U ϕ = [$q_0q_1q_3$]
δ_D ([$q_0q_2q_3$], b) = δ_N (q_0, b) U δ_N (q_2, b) U δ_N (q_3, b) = {q_0} U {q_3} U {q_2} = [$q_0q_2q_3$]
δ_D ([$q_1q_2q_3$], a) = δ_N (q_1, a) U δ_N (q_2, a) U δ_N (q_3, a) = {q_2} U {q_3} U ϕ = [q_2q_3]
δ_D ([$q_1q_2q_3$], b) = δ_N (q_1, b) U δ_N (q_2, b) U δ_N (q_3, b) = {q_1} U {q_3} U {q_2} = [$q_1q_2q_3$]
δ_D ([$q_0q_1q_2q_3$], a) = δ_N (q_0, a) U δ_N (q_1, a) U δ_N (q_2, a) U δ_N (q_3, a) = {q_0, q_1} U {q_2} U {q_3} U ϕ = [$q_0q_1q_2q_3$]

δ_D ([$q_0q_1q_2q_3$], b) = δ_N (q_0, b) U δ_N (q_1, b) U δ_N (q_2, b) U δ_N (q_3, a) = {q_0} U {q_1} U {q_3} U {q_2} = [$q_0q_1q_2q_3$]

δ_D (ϕ, a) = δ_N (ϕ, a) = ϕ

δ_D (ϕ, b) = δ_N (ϕ, b) = ϕ

Step 4: Now, change the names of the states [q_o], [q_1], [q_2], [q_3], [q_0q_1], [q_0q_2], [q_0q_3], [q_1q_2], [q_1q_3], [q_2q_3], [$q_0q_1q_2$], [$q_0q_1q_3$], [$q_0q_2q_3$], [$q_1q_2q_3$], [$q_0q_1q_2q_3$], ϕ. as {A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P}.

Step 5: Draw the Transition Function for the newly named states.

δ	**0**	**1**
→A	E	A
B	C	B
C	D	D
***D**	P	C
E	K	E
F	L	G
***G**	E	F
H	J	I
***I**	C	H
***J**	D	J
K	O	L
***L**	K	K
***M**	L	M
***N**	J	N
***O**	O	O
P	P	P

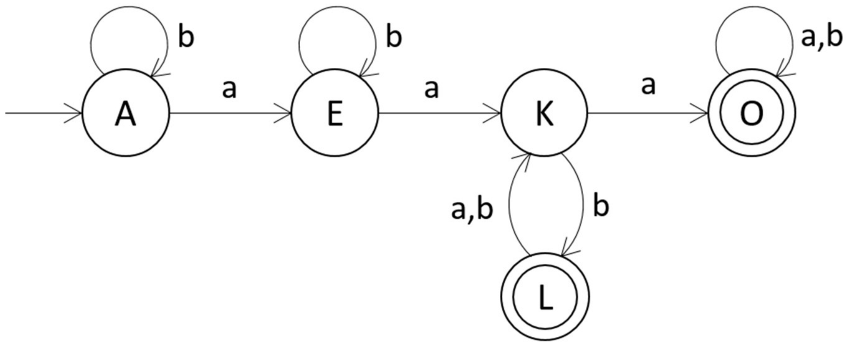
Step 6: Determine the states accessible from the start/initial state.

Here, the accessible states are: {A, E, K, L, O}.

Step 7: Draw the Transition Function for the accessible states only.

δ	0	1
→A	E	A
E	K	E
K	O	L
*O	O	O
*L	K	K

Step 8: Draw the DFA using the Transition Function.



Step 9: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

Q = {A, E, K, L, O}

Σ = {a, b}

A is the initial/start state

F = {L, O}

Lazy Evaluation Method:

Step 1: q_0 is start/initial state of the required DFA.

δ_D (q_0, a) = δ_N (q_0, a) = [q_0q_1]

δ_D (q_0, b) = δ_N (q_0, b) = [q_0]

Step 2: Using the states obtained from each transition, proceed with the calculation as follows:

δ_D ([q_0q_1], a) = δ_N (q_0, a) U δ_N (q_1, a) = {q_0, q_1} U {q_2} = [$q_0q_1q_2$]

δ_D ([q_0q_1], b) = δ_N (q_0, b) U δ_N (q_1, b) = {q_0} U {q_1} = [q_0q_1]

δ_D ([$q_0q_1q_2$], a) = δ_N (q_0, a) U δ_N (q_1, a) U δ_N (q_2, a) = {q_0, q_1} U {q_2} U {q_3} = [$q_0q_1q_2q_3$]

δ_D ([$q_0q_1q_2$], b) = δ_N (q_0, b) U δ_N (q_1, b) U δ_N (q_2, b) = {q_0} U {q_1} U {q_3} = [$q_0q_1q_3$]

δ_D ([$q_0q_1q_2q_3$], a) = δ_N (q_0, a) U δ_N (q_1, a) U δ_N (q_2, a) U δ_N (q_3, a) = {q_0, q_1} U {q_2} U {q_3} U ϕ = [$q_0q_1q_2q_3$]

δ_D ([$q_0q_1q_2q_3$], b) = δ_N (q_0, b) U δ_N (q_1, b) U δ_N (q_2, b) U δ_N (q_3, a) = {q_0} U {q_1} U {q_3} U {q_2} = [$q_0q_1q_2q_3$]

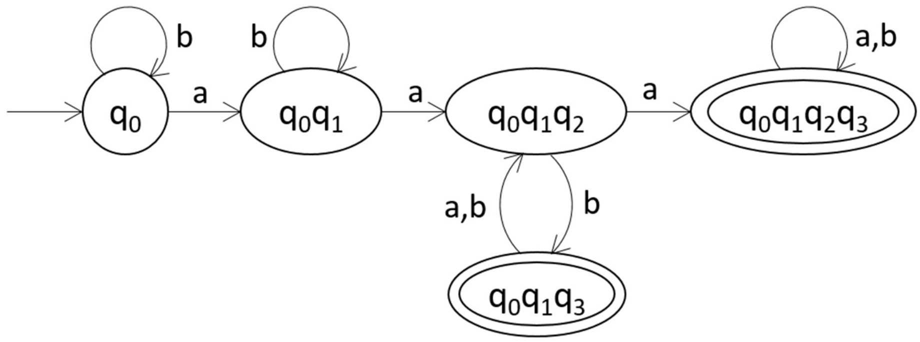
$\delta_D([q_0q_1q_3], a) = \delta_N(q_0, a) \cup \delta_N(q_1, a) \cup \delta_N(q_3, a) = \{q_0, q_1\} \cup \{q_2\} \cup \phi = [q_0q_1q_2]$

$\delta_D([q_0q_1q_3], b) = \delta_N(q_0, b) \cup \delta_N(q_1, b) \cup \delta_N(q_3, b) = \{q_0\} \cup \{q_1\} \cup \{q_2\} = [q_0q_1q_2]$

Step 3: Draw the Transition Function for the above determined states.

δ	**0**	**1**
→[q_0]	[q_0q_1]	[q_0]
[q_0q_1]	[$q_0q_1q_2$]	[q_0q_1]
[$q_0q_1q_2$]	[$q_0q_1q_2q_3$]	[$q_0q_1q_3$]
***[$q_0q_1q_2q_3$]**	[$q_0q_1q_2q_3$]	[$q_0q_1q_2q_3$]
***[$q_0q_1q_3$]**	[$q_0q_1q_2$]	[$q_0q_1q_2$]

Step 4: Draw the DFA using the Transition Function.



Step 5: Define the five tuples of the DFA: $A = \{Q, \Sigma, \delta_D, q_0, F\}$

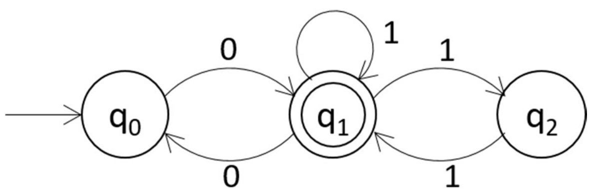
$Q = \{[q_0], [q_0q_1], [q_0q_1q_2], [q_0q_1q_3], [q_0q_1q_2q_3]\}$

$\Sigma = \{a, b\}$

q_0 is the initial/start state

$F = \{[q_0q_1q_3], [q_0q_1q_2q_3]\}$

7. Convert the following NFA into its equivalent DFA.



Subset Construction Method:

Step 1: q_o is the start/initial state of the required DFA.

Step 2: NFA has 3 states. Therefore, DFA has 8 (= 2^3) states, namely $[q_o]$, $[q_1]$, $[q_2]$, $[q_0q_1]$, $[q_1q_2]$, $[q_0q_2]$, $[q_0q_1q_2]$, ϕ.

Step 3: Evaluate δ_D using δ_N and determine the Transition function of the DFA as follows:

$\delta_D\ (q_0, 0) = \delta_N\ (q_0, 0) = [q_1]$

$\delta_D\ (q_0, 1) = \delta_N\ (q_0, 1) = \phi$

$\delta_D\ (q_1, 0) = \delta_N\ (q_1, 0) = [q_0]$

$\delta_D\ (q_1, 1) = \delta_N\ (q_1, 1) = [q_1q_2]$

$\delta_D\ (q_2, 0) = \delta_N\ (q_2, 0) = \phi$

$\delta_D\ (q_2, 1) = \delta_N\ (q_2, 1) = [q_1]$

$\delta_D\ ([q_0q_1], 0) = \delta_N\ (q_0, 0) \cup \delta_N\ (q_1, 0) = \{q_1\} \cup \{q_0\} = [q_0q_1]$

$\delta_D\ ([q_0q_1], 1) = \delta_N\ (q_0, 1) \cup \delta_N\ (q_1, 1) = \phi \cup \{q_1q_2\} = [q_1q_2]$

$\delta_D\ ([q_0q_2], 0) = \delta_N\ (q_0, 0) \cup \delta_N\ (q_2, 0) = \{q_1\} \cup \phi = [q_1]$

$\delta_D\ ([q_0q_2], 1) = \delta_N\ (q_0, 1) \cup \delta_N\ (q_2, 1) = \phi \cup \{q_1\} = [q_1]$

$\delta_D\ ([q_1q_2], 0) = \delta_N\ (q_1, 0) \cup \delta_N\ (q_2, 0) = \{q_0\} \cup \phi = [q_0]$

$\delta_D\ ([q_1q_2], 1) = \delta_N\ (q_1, 1) \cup \delta_N\ (q_2, 1) = \{q_1q_2\} \cup \{q_1\} = [q_1q_2]$

$\delta_D\ ([q_0q_1q_2], 0) = \delta_N\ (q_0, 0) \cup \delta_N\ (q_1, 0) \cup \delta_N\ (q_2, 0) = \{q_1\} \cup \{q_0\} \cup \phi = [q_0q_1]$

$\delta_D\ ([q_0q_1q_2], 1) = \delta_N\ (q_0, 1) \cup \delta_N\ (q_1, 1) \cup \delta_N\ (q_2, 1) = \phi \cup \{q_1q_2\} \cup \{q_1\} = [q_1q_2]$

$\delta_D\ (\phi, 0) = \delta_N\ (\phi, 0) = \phi$

$\delta_D\ (\phi, 1) = \delta_N\ (\phi, 1) = \phi$

δ	**0**	**1**
→$[q_0]$	$[q_1]$	ϕ
***$[q_1]$**	$[q_0]$	$[q_1q_2]$
$[q_2]$	ϕ	$[q_1]$
***$[q_0q_1]$**	$[q_0q_1]$	$[q_1q_2]$
$[q_0q_2]$	$[q_1]$	$[q_1]$
***$[q_1q_2]$**	$[q_0]$	$[q_1q_2]$
***$[q_0q_1q_2]$**	$[q_0q_1]$	$[q_1q_2]$
ϕ	ϕ	ϕ

Step 4: Now, change the names of the states $\{[q_0], [q_1], [q_2], [q_0q_1], [q_0q_2], [q_1q_2], [q_0q_1q_2], \phi\}$ as {A, B, C, D, E, F, G, H}.

Step 5: Draw the Transition Function for the newly named states.

δ	**0**	**1**
→A	B	H
***B**	A	F
C	H	B
***D**	D	F
E	B	B
***F**	A	F
***G**	D	F
H	H	H

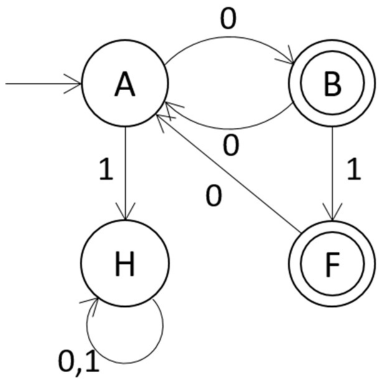
Step 6: Determine the states accessible from the start/initial state.

Here, the accessible states are: {A, B, F, H}.

Step 7: Draw the Transition Function for the accessible states only.

δ	0	1
→A	B	H
*B	A	F
H	H	H
*F	A	F

Step 8: Draw the DFA using the Transition Function.



Step 9: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

Q = {A, B, F, H}

Σ = {0, 1}

A is the initial/start state

F = {B, F}

Lazy Evaluation Method:

Step 1: q_0 is start/initial state of the required DFA.

$\delta_D (q_0, 0) = \delta_N (q_0, 0) = [q_1]$

$\delta_D (q_0, 1) = \delta_N (q_0, 1) = \phi$

Step 2: Using the states obtained from each transition, proceed with the calculation as follows:

$\delta_D (\phi, 0) = \delta_N (\phi, 0) = \phi$

$\delta_D (\phi, 1) = \delta_N (\phi, 1) = \phi$

$\delta_D (q_1, 0) = \delta_N (q_1, 0) = [q_0]$

$\delta_D (q_1, 1) = \delta_N (q_1, 1) = [q_1q_2]$

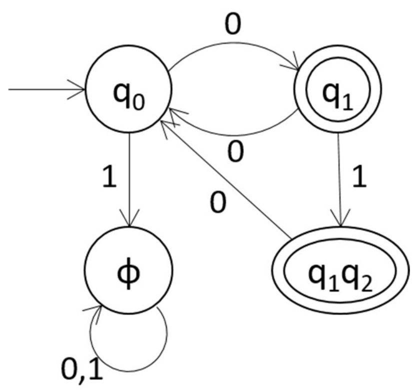
$\delta_D ([q_1q_2], 0) = \delta_N (q_1, 0) \cup \delta_N (q_2, 0) = \{q_0\} \cup \phi = [q_0]$

δ_D ([q_1q_2], 1) = δ_N (q_1, 1) U δ_N (q_2, 1) = {q_1q_2} U {q_1} = [q_1q_2]

Step 3: Draw the Transition Function for the above determined states.

δ	**0**	**1**
→[q_0]	[q_1]	φ
***[q_1]**	[q_0]	[q_1q_2]
φ	φ	φ
***[q_1q_2]**	[q_0]	[q_1q_2]

Step 4: Draw the DFA using the Transition Function.



Step 5: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

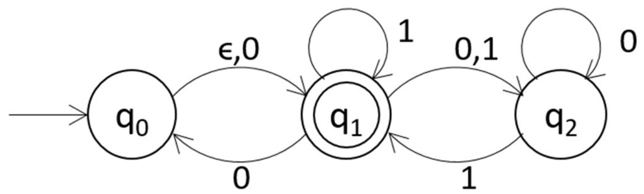
Q = {[q_0], [q_1], [q_1q_2], φ}

Σ = {0, 1}

q_0 is the initial/start state

F = {[q_1], [q_1q_2]}

8. Convert the following Epsilon-NFA into its equivalent DFA.



Lazy Evaluation Method:

Step 1: Find Eclose of every state in the given E-NFA.

Eclose (q_0) = {q_0, q_1}

Eclose (q_1) = {q_1}

Eclose (q_2) = {q_2}

Step 2: [q_0q_1] is start/initial state of the required DFA.

δ_D ([q_0q_1], 0) = Eclose (δ_N ([q_0q_1], 0)) = Eclose (δ_N (q_0, 0) U δ_N (q_1, 0)) = Eclose ({q_1} U {q_0q_2}) = [$q_0q_1q_2$]

δ_D ([q_0q_1], 1) = Eclose (δ_D ([q_0q_1], 1)) = Eclose (δ_N (q_0, 1) U δ_N (q_1, 1)) = Eclose ({q_1} U {q_2}) = [q_1q_2]

Step 3: Using the states obtained from each transition, proceed with the calculation as follows:

δ_D ([$q_0q_1q_2$], 0) = Eclose (δ_N (q_0, 0) U δ_N (q_1, 0) U δ_N (q_2, 0)) = Eclose ({q_1} U {q_2, q_0} U {q_2}) = [$q_0q_1q_2$]

δ_D ([$q_0q_1q_2$], 1) = Eclose (δ_N (q_0, 1) U δ_N (q_1, 1) U δ_N (q_2, 1)) = Eclose ({q_1q_2} U {q_1}) = [q_1q_2]

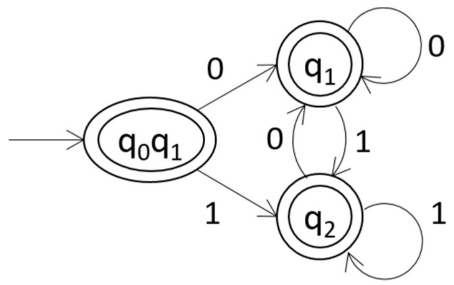
δ_D ([q_1q_2], 0) = Eclose (δ_N (q_1, 0) U δ_N (q_2, 0)) = Eclose ({q_0q_2} U {q_2}) = [$q_0q_1q_2$]

δ_D ([q_1q_2], 1) = Eclose (δ_N (q_1, 1) U δ_N (q_2, 1)) = Eclose ({q_1q_2} U {q_1}) = [q_1q_2]

Step 4: Draw the Transition Function for the above determined states.

δ	0	1
→*[q_0q_1]	[$q_0q_1q_2$]	[q_1q_2]
***[q_1q_2]**	[$q_0q_1q_2$]	[q_1q_2]
***[$q_0q_1q_2$]**	[$q_0q_1q_2$]	[q_1q_2]

Step 5: Draw the DFA using the Transition Function.



Step 6: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

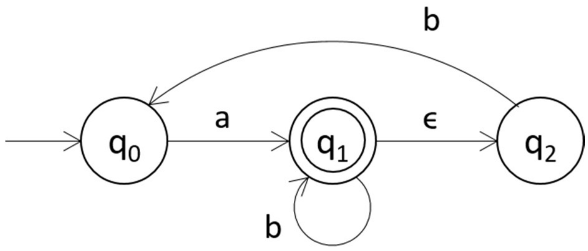
Q = {[q_0q_1], [q_1q_2], [$q_0q_1q_2$]}

Σ = {0, 1}

[q_0q_1] is the initial/start state

F = {[q_0q_1], [q_1q_2], [$q_0q_1q_2$]}

9. Convert the following E-NFA into its equivalent DFA.



Lazy Evaluation Method:

Step 1: Find Eclose of every state in the given E-NFA.

Eclose (q_0) = {q_0}

Eclose (q_1) = {q_1, q_2}

Eclose (q_2) = {q_2}

Step 2: q_0 is start/initial state of the required DFA.

δ_D (q_0, a) = Eclose (δ_N (q_0, a)) = Eclose (q_1) = [q_1q_2]

δ_D (q_0, b) = Eclose (δ_N (q_0, b)) = Eclose (ϕ) = ϕ

Step 3: Using the states obtained from each transition, proceed with the calculation as follows:

δ_D ([q_1q_2], a) = Eclose (δ_N (q_1, a) U δ_N (q_2, a)) = Eclose (ϕ) = ϕ

δ_D ([q_1q_2], b) = Eclose (δ_N (q_1, b) U δ_N (q_2, b)) = Eclose ({q_1} U {q_0}) = [$q_0q_1q_2$]

δ_D (ϕ, a) = Eclose (δ_N (ϕ, a)) = ϕ

δ_D (ϕ, b) = Eclose (δ_N (ϕ, b)) = ϕ

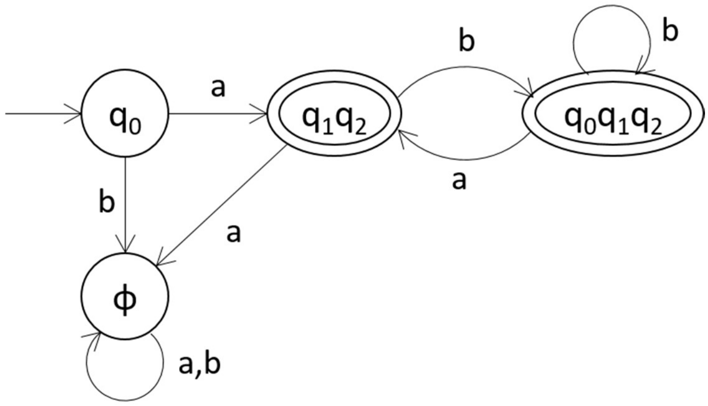
δ_D ([$q_0q_1q_2$], a) = Eclose (δ_N (q_0, a) U δ_N (q_1, a) U δ_N (q_2, a)) = Eclose ({q_1} U ϕ) = [q_1q_2]

δ_D ([$q_0q_1q_2$], b) = Eclose (δ_N (q_0, b) U δ_N (q_1, b) U δ_N (q_2, b)) = Eclose (ϕ U {q_1} U {q_0}) = [$q_0q_1q_2$]

Step 4: Draw the Transition Function for the above determined states.

δ	**0**	**1**
→[q_0]	[q_1q_2]	ϕ
***[q_1q_2]**	ϕ	[$q_0q_1q_2$]
ϕ	ϕ	ϕ
***[$q_0q_1q_2$]**	[q_1q_2]	[$q_0q_1q_2$]

Step 5: Draw the DFA using the Transition Function.



Step 6: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

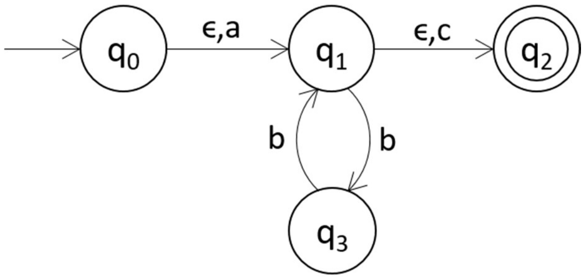
Q = {[q_0], [q_1q_2], [$q_0q_1q_2$], ϕ}

Σ = {a, b}

q_0 is the initial/start state

F = {[q_1q_2], [$q_0q_1q_2$]}

10. Convert the following E-NFA into its equivalent DFA.



Lazy Evaluation Method:

Step 1: Find Eclose of every state in the given E-NFA.

Eclose (q_0) = {q_0, q_1, q_2}

Eclose (q_1) = {q_1, q_2}

Eclose (q_2) = {q_2}

Eclose (q_3) = {q_3}

Step 2: [$q_0q_1q_2$] is start/initial state of the required DFA.

δ_D ([$q_0q_1q_2$], a) = Eclose (δ_N (q_0, a) U δ_N (q_1, a) U δ_N (q_2, a)) = Eclose ({q_1} U ϕ) = [q_1q_2]

δ_D ([$q_0q_1q_2$], b) = Eclose (δ_N (q_0, b) U δ_N (q_1, b) U δ_N (q_2, b)) = Eclose (ϕ U {q_3} U ϕ) = [q_3]

δ_D ([$q_0q_1q_2$], c) = Eclose (δ_N (q_0, c) U δ_N (q_1, c) U δ_N (q_2, c)) = Eclose (ϕ U {q_2}) = [q_2]

Step 3: Using the states obtained from each transition, proceed with the calculation as follows:

δ_D ([q_0q_1], a) = Eclose (δ_N (q_0, a) U δ_N (q_1, a)) = Eclose ({q_1} U ϕ) = [$q_0q_1q_2$]

δ_D ([q_0q_1], b) = Eclose (δ_N (q_0, b) U δ_N (q_1, b)) = Eclose (ϕ U {q_3}) = [q_3]

δ_D ([q_0q_1], c) = Eclose (δ_N (q_0, c) U δ_N (q_1, c)) = Eclose (ϕ U {q_2}) = [q_2]

δ_D (q_3, a) = Eclose (δ_N (q_3, a)) = Eclose (ϕ) = ϕ

δ_D (q_3, b) = Eclose (δ_N (q_3, b)) = Eclose (q_1) = [q_1q_2]

δ_D (q_3, c) = Eclose (δ_N (q_3, c)) = Eclose (ϕ) = ϕ

δ_D (q_2, a) = Eclose (δ_N (q_2, a)) = Eclose (ϕ) = ϕ

δ_D (q_2, b) = Eclose (δ_N (q_2, a)) = Eclose (ϕ) = ϕ

δ_D (q_2, c) = Eclose (δ_N (q_2, c)) = Eclose (ϕ) = ϕ

δ_D ([q_1q_2], a) = Eclose (δ_N (q_1, a) U δ_N (q_2, a)) = Eclose (ϕ) = ϕ

δ_D ([q_1q_2], b) = Eclose (δ_N (q_1, b) U δ_N (q_2, b)) = Eclose (ϕ U {q_3}) = [q_3]

δ_D ([q_1q_2], c) = Eclose (δ_N (q_1, c) U δ_N (q_2, c)) = Eclose (ϕ U {q_2}) = [q_2]

δ_D (ϕ, a) = δ_N (ϕ, a) = ϕ

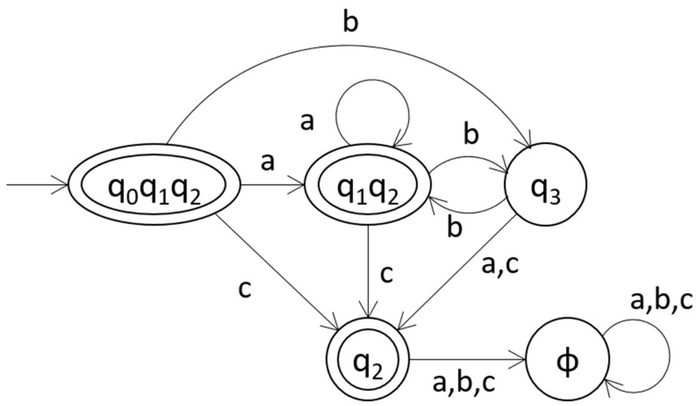
δ_D (ϕ, b) = δ_N (ϕ, b) = ϕ

δ_D (ϕ, c) = δ_N (ϕ, c) = ϕ

Step 4: Draw the Transition Function for the above determined states.

δ	**a**	**b**	**c**
→*[$q_0q_1q_2$]	[q_1q_2]	[q_3]	[q_2]
***[q_1q_2]**	[q_1q_2]	[q_3]	[q_2]
[q_3]	ϕ	[q_1q_2]	ϕ
***[q_2]**	ϕ	ϕ	ϕ
ϕ	ϕ	ϕ	ϕ

Step 5: Draw the DFA using the Transition Function.



Step 6: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

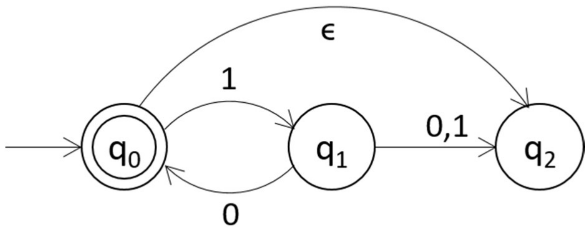
Q = {[q_3], [q_2], [q_1q_2], [$q_0q_1q_2$], ϕ}

Σ = {a, b, c}

[$q_0q_1q_2$] is the initial/start state

F = {[q_2], [q_1q_2], [$q_0q_1q_2$]}

11. Convert the following E-NFA into its equivalent DFA.



Lazy Evaluation Method:

Step 1: Find Eclose of every state in the given E-NFA.

Eclose (q_0) = {q_0, q_2}

Eclose (q_1) = {q_1}

Eclose (q_2) = {q_2}

Step 2: [q_0q_2] is start/initial state of the required DFA.

δ_D ([q_0q_2], 0) = Eclose (δ_N (q_0, 0) U δ_N (q_2, 0)) = Eclose (ϕ) = ϕ

δ_D ([q_0q_2], 1) = Eclose (δ_N (q_0, 1) U δ_N (q_1, 1)) = Eclose ({q_1} U ϕ) = [q_1]

Step 3: Using the states obtained from each transition, proceed with the calculation as follows:

δ_D (ϕ, 0) = Eclose (δ_N (ϕ, 0)) = Eclose (ϕ) = ϕ

δ_D (ϕ, 1) = Eclose (δ_N (ϕ, 1)) = Eclose (ϕ) = ϕ

δ_D (q_1, 0) = Eclose (δ_N (q_1, 0)) = Eclose (q_2) = [q_2]

δ_D (q_1, 1) = Eclose (δ_N (q_1, 1)) = Eclose (q_2) = [q_2]

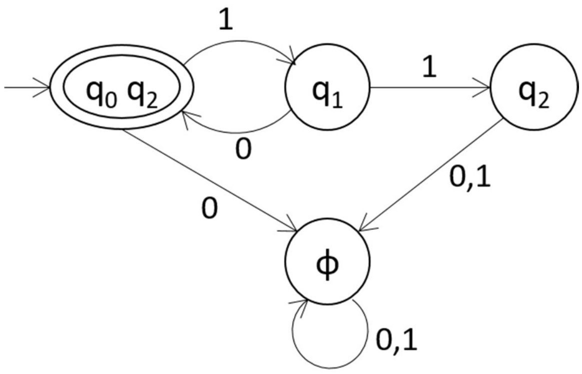
δ_D (q_2, 0) = Eclose (δ_N (q_2, 0)) = Eclose (ϕ) = ϕ

δ_D (q_2, 1) = Eclose (δ_N (q_2, 1)) = Eclose (ϕ) = ϕ

Step 4: Draw the Transition Function for the above determined states.

δ	**0**	**1**
→*[q_0q_2]	ϕ	[q_1]
ϕ	ϕ	ϕ
***[q_1]**	[q_0q_2]	[q_2]
[q_2]	ϕ	ϕ

Step 5: Draw the DFA using the Transition Function.



Step 6: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

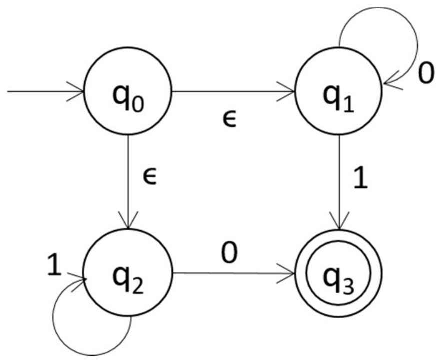
Q = {[q_1], [q_2], [q_0q_2], ϕ}

Σ = {0, 1}

[q_0q_2] is the initial/start state

F = {[q_0q_2]}

12. Convert the following E-NFA into its equivalent DFA.



Lazy Evaluation Method:

Step 1: Find Eclose of every state in the given E-NFA.

Eclose (q_0) = {q_0, q_1, q_2}

Eclose (q_1) = {q_1}

Eclose (q_2) = {q_2}

Eclose (q_3) = {q_3}

Step 2: [$q_0q_1q_2$] is start/initial state of the required DFA.

δ_D ([$q_0q_1q_2$], 0) = Eclose (δ_N (q_0, 0) U δ_N (q_1, 0) U δ_N (q_2, 0)) = Eclose (ϕ U {q_1} U {q_3}) = [q_1q_3]

δ_D ([$q_0q_1q_2$], 1) = Eclose (δ_N (q_0, 1) U δ_N (q_1, 1) U δ_N (q_2, 1)) = Eclose (ϕ U {q_3} U {q_2}) = [q_2q_3]

Step 3: Using the states obtained from each transition, proceed with the calculation as follows:

δ_D ([q_1q_3], 0) = Eclose (δ_N (q_1, 0) U δ_N (q_3, 0)) = Eclose ({q_1} U ϕ) = [q_1]

δ_D ([q_1q_3], 1) = Eclose (δ_N (q_1, 1) U δ_N (q_3, 1)) = Eclose ({q_3} U ϕ) = [q_3]

δ_D ([q_2q_3], 0) = Eclose (δ_N (q_2, 0) U δ_N (q_3, 0)) = Eclose ({q_3} U ϕ) = [q_3]

δ_D ([q_2q_3], 1) = Eclose (δ_N (q_2, 1) U δ_N (q_3, 1)) = Eclose ({q_2} U ϕ) = [q_2]

δ_D (q_1, 0) = Eclose (δ_N (q_1, 0)) = Eclose (q_1) = [q_1]

δ_D (q_1, 1) = Eclose (δ_N (q_1, 1)) = Eclose (q_3) = [q_3]

δ_D (q_3, 0) = Eclose (δ_N (q_3, 0)) = Eclose (ϕ) = ϕ

δ_D (q_3, 1) = Eclose (δ_N (q_3, 1)) = Eclose (ϕ) = ϕ

δ_D (q_2, 0) = Eclose (δ_N (q_2, 0)) = Eclose (q_3) = q_3

δ_D (q_2, 1) = Eclose (δ_N (q_2, 1)) = Eclose (q_2) = q_2

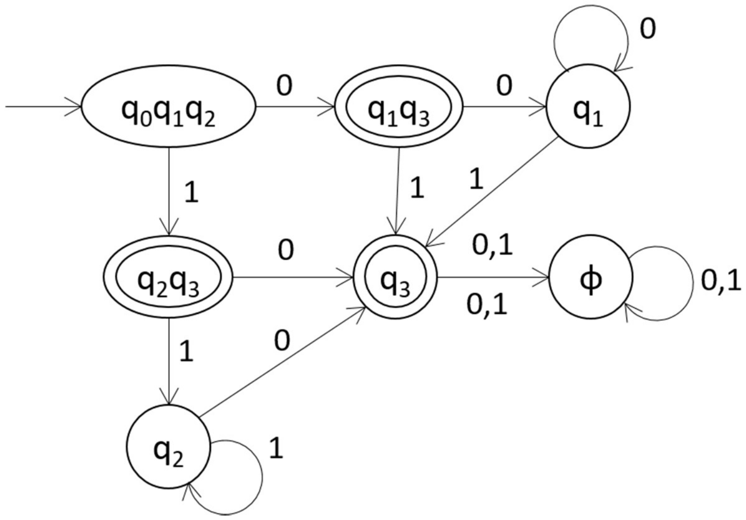
δ_D (ϕ, 0) = Eclose (δ_N (ϕ, 0)) = Eclose (ϕ) = ϕ

δ_D (ϕ, 1) = Eclose (δ_N (ϕ, 1)) = Eclose (ϕ) = ϕ

Step 4: Draw the Transition Function for the above determined states.

δ	0	1
→$[q_0q_1q_2]$	$[q_1q_3]$	$[q_2q_3]$
*$[q_1q_3]$	$[q_1]$	$[q_3]$
*$[q_2q_3]$	$[q_3]$	$[q_2]$
$[q_1]$	$[q_1]$	$[q_3]$
$[q_2]$	$[q_3]$	$[q_2]$
*$[q_3]$	ϕ	ϕ
ϕ	ϕ	ϕ

Step 5: Draw the DFA using the Transition Function.



Step 6: Define the five tuples of the DFA: A = {Q, Σ, δ_D, q_0, F}

Q = {$[q_3]$, $[q_1]$, $[q_2]$, $[q_1q_2]$, $[q_1q_3]$, $[q_0q_1q_2]$, ϕ}

Σ = {0, 1}

$[q_0q_1q_2]$ is the initial/start state

F = {$[q_3]$, $[q_1q_3]$, $[q_2q_3]$}