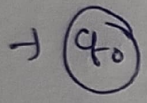
Tutorial #	2	Student ID	2300032601
Date		Student Name	M. KOUSHIK

Pre-Tutorial (To be completed by student before coming to tutorial class)

1. Draw a NFA that accepts the language $\emptyset^*$. Explain your answer.

Solution:

The language $\emptyset^*$ represent the set all string over the alphabet Σ that are in the Klene star of the empty set $\emptyset$



$S = \{q_0\}$

$A = \Sigma$

$IS = q_0$

$FS = q_1$

No Transition

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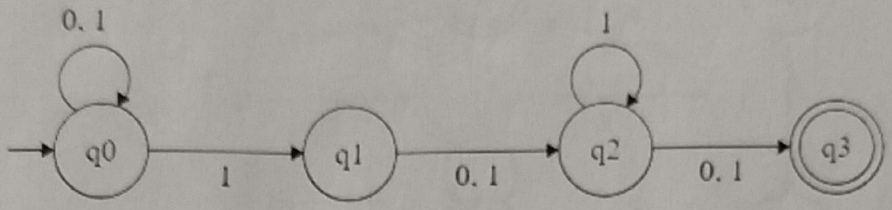
2. Consider the finite automaton in the following figure.



What is the set of reachable states for the input string 0011? What is the language accepted by the above automaton.

Solution:

$L = \{(0+1)^* 1 (0+1)^* (0+1)\}$

$L = \{w \in \{0,1\}$ condition on odd numbers of 1's$\}$

	0	1
q_0	q_{01}	$q_1 q_{12}$
q_1	q_2	q_2
q_2	q_3	$q_1 q_3$
$*q_3$	ϕ	ϕ

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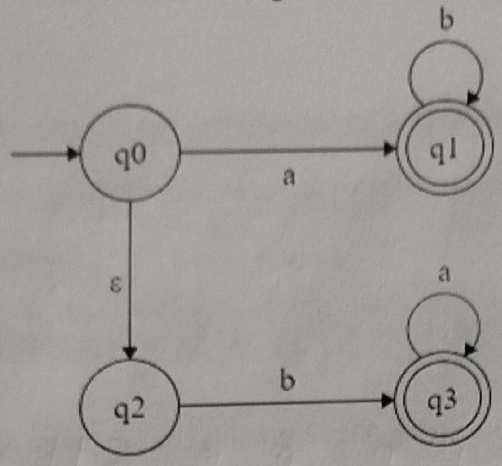
3. Convert the following ε-NFA to NFA without ε- transition.



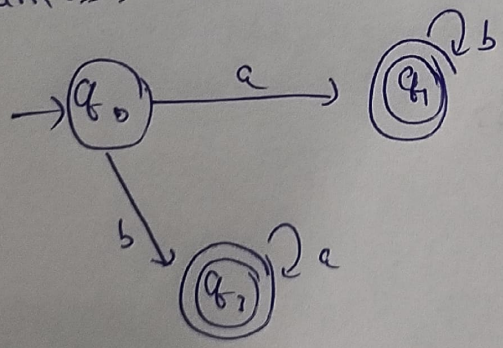
Solution:

E-NFA to NFA

NFA →

	a	b
q_0	q_1	q_3
q_1*	∅	q_1
q_2*	q_3	∅

⇒ Diagram ....



→ If we can read to final state from that node by using 'ϵ' then it will be a final state

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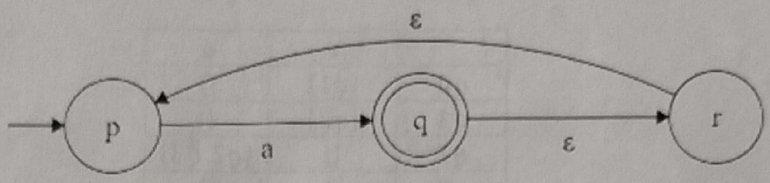
IN-TUTORIAL (To be carried out in presence of faculty in classroom)

1. What is the complement of the language accepted by the NFA shown below? Draw the NFA for the language found out. Assume $\sum = \{a\}$ and ε is the empty string.



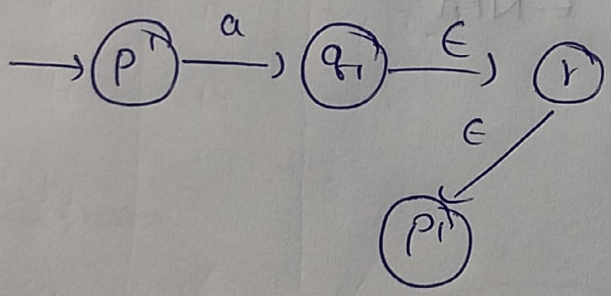
Solution:

State = {p, q, r}

ϵ closure (p) = {p, q, r}

ϵ closure (q) = {q, r}

ϵ closure (r) = {p, r}



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2. Consider the following ε-NFA, $M = (\{q0, q1, q2, q3\}, \{a\}, \delta, q0, \{q3\})$ where δ is given in the transition table below. What is the minimum length of string to reach to the final state.

	ε	a
q0	$\{q1\}$	{}
q1	$\{q2\}$	{}
q2	{}	$\{q2, q3\}$
q3	{}	{}

Solution:

$M = (\{q_0, q_1, q_2, q_3\}, \{a\}, \{q_0, q_3\})$

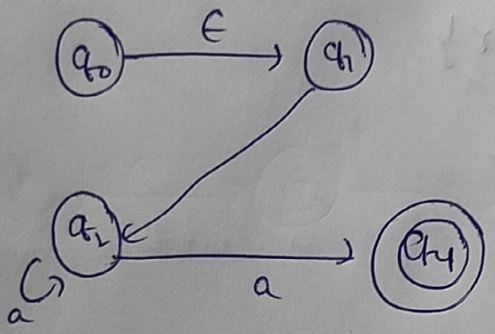

Diagram of ϵ-NFA

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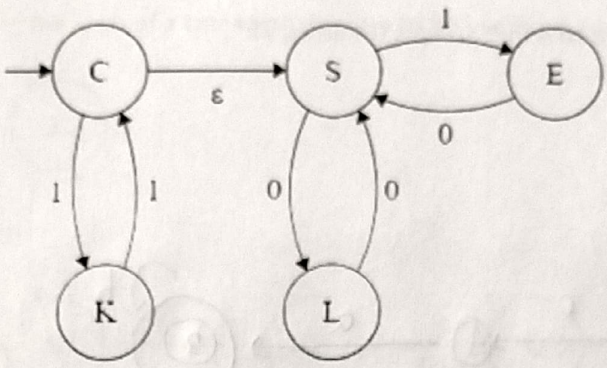
3. Convert the following ε-NFA to NFA without ε-transitions.

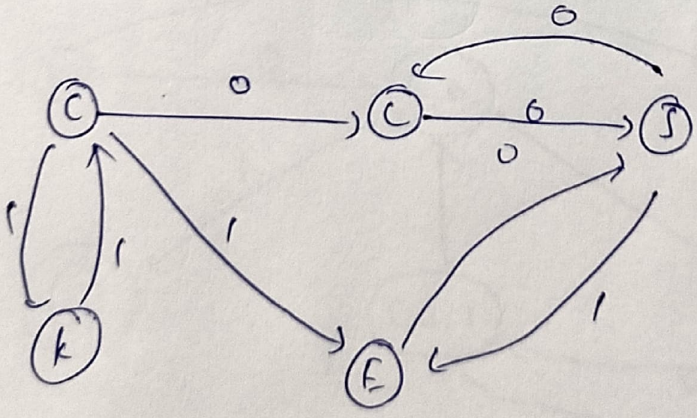


Solution:

Table of NFA

	0	1
C	L	K, E
L	S	∅
K	∅	C
E	S	–
S	L	E

Diagram



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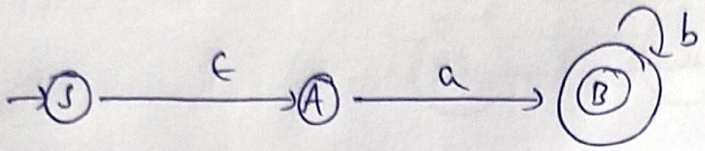
Post-Tutorial (To be carried out by student after Tutorial session is over)

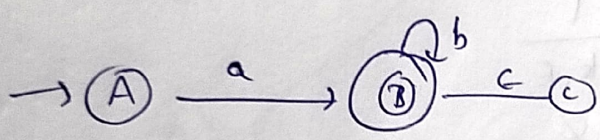
1. Construct an ε-NFA that accepts the string ab*.

Solution:

ab*



(or)



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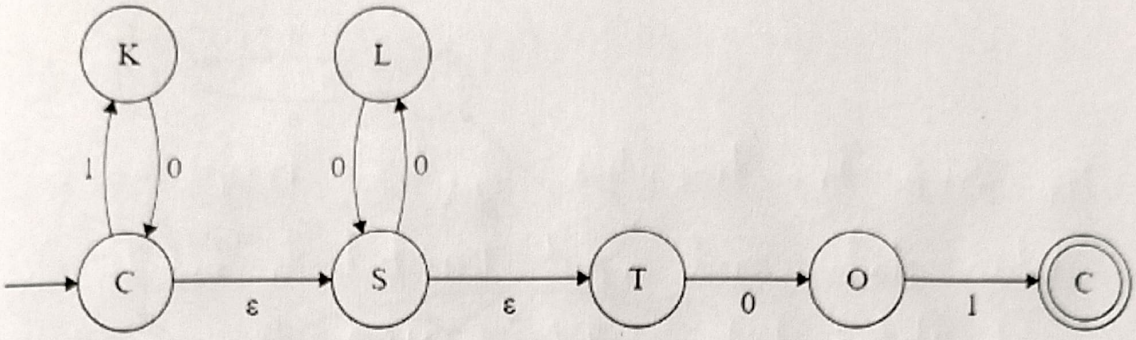
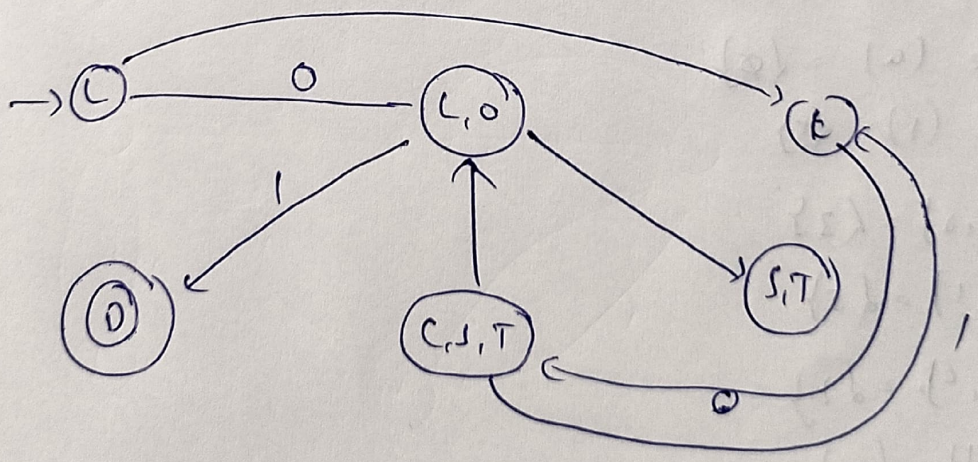
2. Convert the ε-NFA given in the form of a transition diagram to NFA without ε-transition.



Solution:

	0	1
C	L, O	K
L, O	S, T	D
K	C S T	~~Ø~~
D	Ø	Ø
C S T	L, O	K



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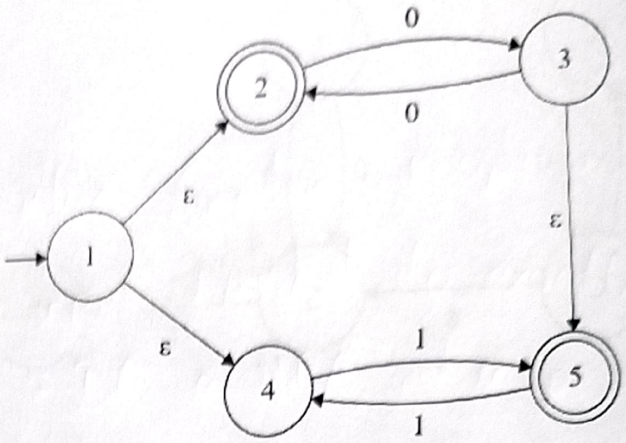
3. Transform the following ε-NFA to NFA.



Solution:

$Q = \{1,2,3,4,5\}$

$\Sigma = \{0,1\}$

$\epsilon\text{-close}(1) = \{1,2,4\}$

$\epsilon\text{-close}(2) = \{\emptyset\}$

$\epsilon\text{-close}(3) = \{3,5\}$

$\epsilon\text{-close}(4) = \{\emptyset\}$

$\epsilon\text{-close}(5) = \{5\}$

$\delta'(1,0) = \{3\}$

$\delta'(1,1) = \{5\}$

$\delta'(3,0) = \{2\}$

$\delta'(3,1) = \{\emptyset\}$

$\delta'(5,0) = \{\emptyset\}$ $\delta'(5,1) = \{4\}$

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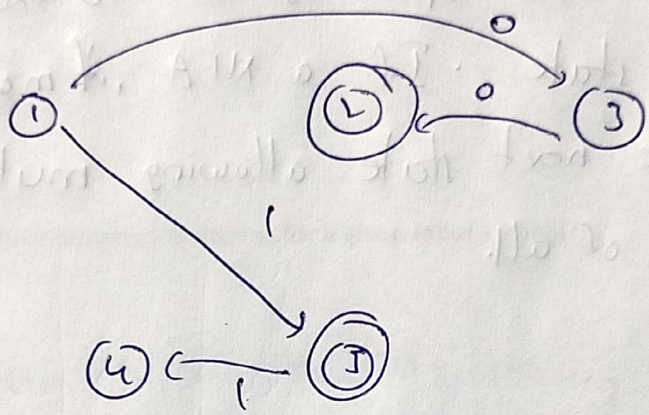
$\delta'(1,0) = \epsilon\text{closure}(1) = \{2,4\}$

$\delta'(1,1) = \epsilon\text{closure}(0) = \{5\}$

Diagram of NFA



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Viva Questions

1. **How does an NFA differ from a DFA in terms of the transition function?**

Answer:

In DFA the transition function maps each ~~future~~ state and input symbol to exactly one next ~~state~~ state. If a NFA, it maps to set of possible next state allowing multiple transi or next of all.

2. **What is the purpose of ε-transitions in an NFA?**

Answer:

They allows the NFA to move b/w the without consuming any input symbolic provides more flexibility

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3. How does an NFA determine whether an input string is accepted?

Answer:

An NFA accepts an input if there exists at least one path through the stated that leads to an accepting state.

4. Can an NFA have missing transitions for a given input symbol?

Answer:

Yes, an NFA can have missing transition for some input symbols, It can still accepting the string if there of least one valid path to an accepting state.

Comment of the Evaluator (if Any)	**Evaluator's Observation** Marks Secured:_____out of **50** Full Name of the Evaluator: Signature of the Evaluator Date of Evaluation:

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