ATC (22CSE54)
Internal 1 Question Bank
Module 1

List and explain the four functions on string. (4M)

If w and x are strings, then prove $(wx)^R = x^R w^R$ (4M)

Discuss the standard Functions/Operations on Languages.
If L1 = { Ɛ, 1, 01, 11} and L2 = {1, 01, 101} then
(i) L1 - L2 (ii) L2 - L1

1) Design DFSM to accept each of the following languages: (3M each)
   i. L= {w∊{0,1}* : w has 011 as a substring}
   ii. L= {w∊{0,1}* : w begins with 011}
   iii. L= {w∊{a,b}* : w consists of aab as substring}
   iv. L= {w∊{a,b}* : w does not contain aab as substring}
   v. L= {w∊{a,b}* : every a's in w is of even length}

2) Construct DFSM to accept each of the following languages over {a,b} (4M each)
   i. Strings containing even number of b's and odd number of a's
   ii. Strings containing even number of a's and odd number of b's
   iii. Strings ending with ab or ba: L={w(ab+ba) | w ∈(a,b)*}
   iv. Strings that end with the substring abb
   v. Strings that do not end with the substring abb
   vi. L={w ∈(a,b)*}Strings w contains No more than one b
   vii. {w ∈ {a, b}* : w has neither ab nor bb as a substring}.

Define DFSM and NFSM. Give the differences/Comparison between DFSM and NFSM.

Briefly explain DFSM, NDFSM and ∈-NDFSM (6M)

Construct NDFSM for the language, L={w∈{a,b}* : w=aba or |w| is even}

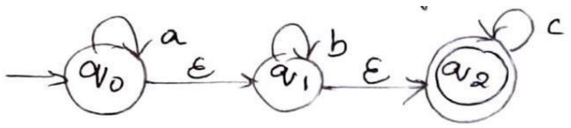
Build NFSM for L={w∈{a,b}* : w contains at-least one occurrence of the substring **abbaa** or the substring **baba**}

How do you handle ∈-transitions in NDFSM? Explain with an algorithm and example.

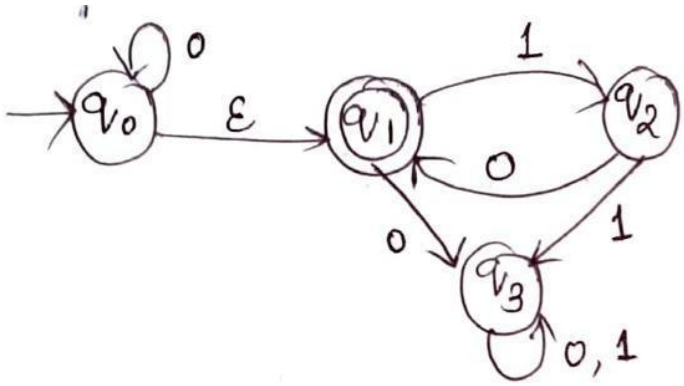
Write an algorithm to convert NFSM to DFSM.

(Theorem: Given an NDFSM M = (K, Σ, δ, s, A) that accepts some language L, there exists an equivalent DFSM that accepts L.)

Convert the following NDFSM to DFSM: (8M each)

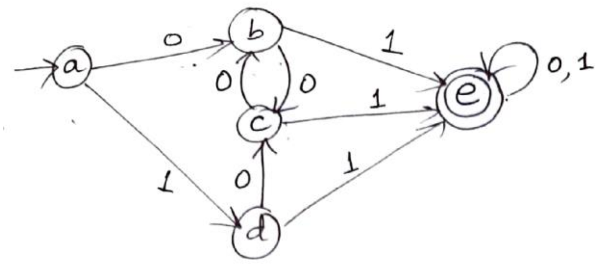


δ	**∈**	**a**	**b**	**c**
p	ϕ	{p}	{q}	{r}
q	{p}	{q}	{r}	ϕ
r	{q}	{r}	ϕ	{p}



Write an algorithm for minimizing a DFSM.

Construct minimum DFSM for the following DFSM



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

Module 2

Define Regular expression.

Obtain Regular Expression for the following

Strings of 0’s and 1’s with atleast 3 consecutive zeros

Strings end with ab or ba

L={w∈{a,b}* : Strings ending with either a or bb}

L={w∈{a,b}*: even number of a’s followed by odd number of b’s}

Strings of a’s and b’s with alternate a’s and b’s

Strings of a’s and b’s where the 5^{th} symbol from the right is ‘a’

Strings of 0’s and 1’s where the 3^{rd} symbol is 0

Language over {0,1} consisting of strings that contain exactly two 1’s?

L={$a^n b^m$ | m+n is even}

L={$a^n b^m$ | m≥1, n≥1, nm≥3}

L= {w∈{a,b}*: w contains both aa and aba as substring}

Prove the Kleene's Theorem, 'For Every Regular Expression There is an Equivalent FSM'.

Write algorithms to build a Regular Expression from an FSM (heuristic technique)
(Theorem: For every FSM there is an Equivalent Regular Expression)

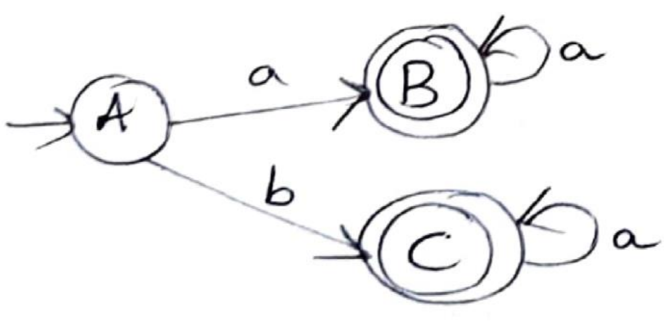
Obtain FSM for the regular expression and show the steps involved:

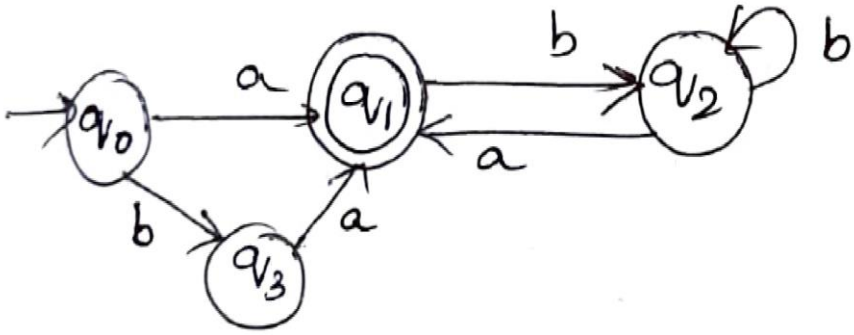
- ab(aUb)*
- (aUb)*aa(aUb)*

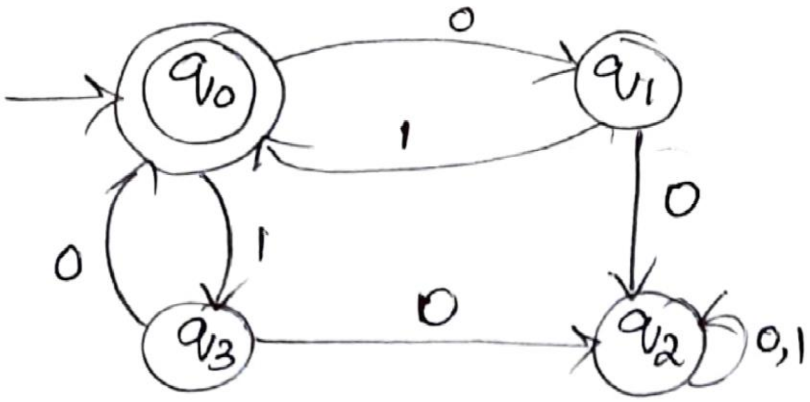
Construct an NDFSM for the regular expression 10+(0+11)0*1

Obtain NDFSM for the following regular expression (a+b)* abb

Build a regular expression for the following FSMs







Prove that the class of languages that can be defined with regular grammars is exactly the regular languages.

Write the FSM and the regular grammar for L={w∈ {a,b}*: w contains an odd number of a's and w ends in a}. Also, generate the string **baaba** by using this regular grammar.

Obtain the regular grammar for the language L={w∈{a,b}*: w contains an even number of a's and an odd number of b's}

Write a Regular expression, Regular grammar and FSM for the language L = {w∈{a,b}* :w ends with the pattern aaaa}

Show that the regular languages are closed under union, concatenation and Kleene star. (6M)

Show that regular languages are closed under complement and intersection.

Prove that if L1 and L2 are regular languages then so are L1∩ L2 and L1- L2. (6M)