Noida Institute of Engineering & Technology, Greater Noida

Department of Computer Science & Engineering

Assignment 3

Subject Name : Theory of Automata & Formal Languages

Subject Code : ACSE0404 **Unit – 1 and 2**

Q1. Convert the NDA to DFA given $M = (\{q_0, q_1, q_2\}, \{a, b\}, \delta, q_0, \{q_1\})$ with state table as given below

	a	b
q_0	$\{q_1, q_2\}$	$\varnothing$
q_1	$\varnothing$	$\{q_2\}$
q_2	$\varnothing$	$\{q_2\}$

Q.2. Construct the state diagram for the finite-state machine with the state table shown below.

	g		h	
	Input		Input	
State	0	1	0	1
s_0	s_1	s_0	1	0
s_1	s_3	s_0	1	1
s_2	s_1	s_2	0	1
s_3	s_2	s_1	0	0

Q.3. Design a DFA, the language recognized by the Automaton being L= {a^n b : n>=0}

Q.4 . Obtain the DFA that accepts/recognizes the language L(M) = {w | w ε {a,b,c}* and w contains the pattern abac.

Q.5 . Construct an FA accepting all strings in {0,1}* having even number of 0's.

Q.6. Construct a finite automaton accepting all strings over {0, 1}

(a) having odd number of 0's

(b) having even number of 0's and even number of 1's

Q.7. Determine an FA, M accepting L, where L = { w ∈ {0 ,1 }* : Every 0 in w has a 1 immediately to its right}.

Q.8. Determine an NFA that accepts the language L = (aa* (a+b)).

Q.9. Determine a deterministic Finite State Automaton from the given Nondeterministic FSA.

$$M = (\{q_0, q_1\}, \{a, b\}, \delta, q_0, \{q_1\})$$

with the state table diagram for δ given below.

δ	a	b
q_0	$\{q_0, q_1\}$	$\{q_1\}$
q_1	$\varnothing$	$\{q_0, q_1\}$

Q.10. Determine a NFA accepting {ab, ba} and use it to find a DFA accepting it.

Q.11. Obtain the regular expressions for the following sets:

(a) The set of all strings over $\{a, b\}$ beginning and ending with 'a'.
(b) $\{b^2, b^5, b^8, \ldots\ldots\}$
(c) $\{a^{2n+1} \mid n > 0\}$

Q.12. Obtain the regular expressions for the languages given by

(a) $L_1 = \{a^{2n} b^{2m+1} \mid n \geq 0, m \geq 0\}$
(b) $L_2 = \{a, bb, aa, abb, ba, bbb, \ldots\ldots\}$
(c) $L_3 = \{w \in \{0,1\}^* \mid w$ has no pair of consecutive zeros$\}$
(d) $L_4 = \{$strings of 0's and 1's ending in 00$\}$

Q.13 Give Regular expressions for the following on Σ = { a ,b ,c }

(a) all strings containing exactly one a
(b) all strings containing no more than three a's

Q.14 . Find regular expressions over Σ = {a , b } for the language defined as follows:

(a) $L_1 = \{a^m b^m : m > 0\}$
(b) $L_2 = \{b^m a b^n : m > 0, n > 0\}$

Q.15. Determine all strings in $L((a+b)^* b(a+ab)^*)$ of **length less than four.**

Q.16. Find the regular expressions for the languages defined by

(i) $L_1 = \{a^n b^m : n \geq 1,\ m \geq 1,\ nm \geq 3\}$

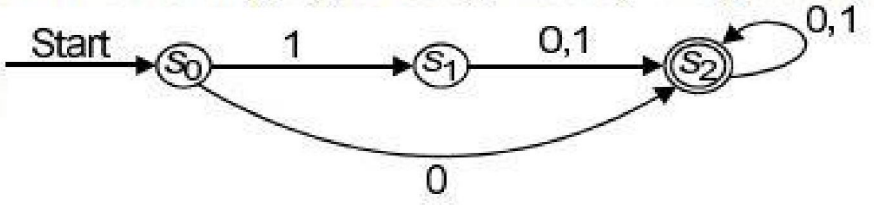
(ii) $L_2 = \{ab^n w : n \geq 3, w \in \{a, b\}^+\}$

(iii) $L_3 = \{vwv : v, w \in \{a, b\}^*, |v| = 2\}$

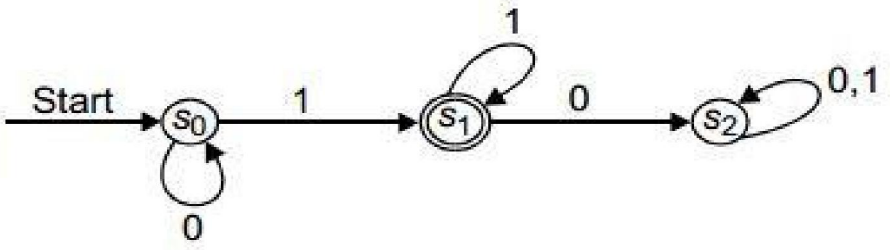
Q.17

Determine the languages recognized by the given DFA.

(a)



(b)



Q.18.

What are the strings in the regular sets specified by the regular expressions given below.

(a) 10^*

(b) $(10)^*$

(c) $0 \cup 01$

(d) $0(0 \cup 1)^*$

(e) $(0 * 1)^*$.

Q.19. Construct a NDA that recognizes the regular set 1*∪ 01 .

Q.20 Find an NDA which recognizes the set 0*1* .

Q.21

Convert the regular expression $(ab \cup a)^*$ to an NFA.

Convert the regular expression $(a \cup b)^* aba$ to an NFA.

Q.22 Give regular expressions for each of the following subsets of {a, b}*,

(a) {x | x contains an even number of a's }

(b) {x| x contains an odd number of b's}

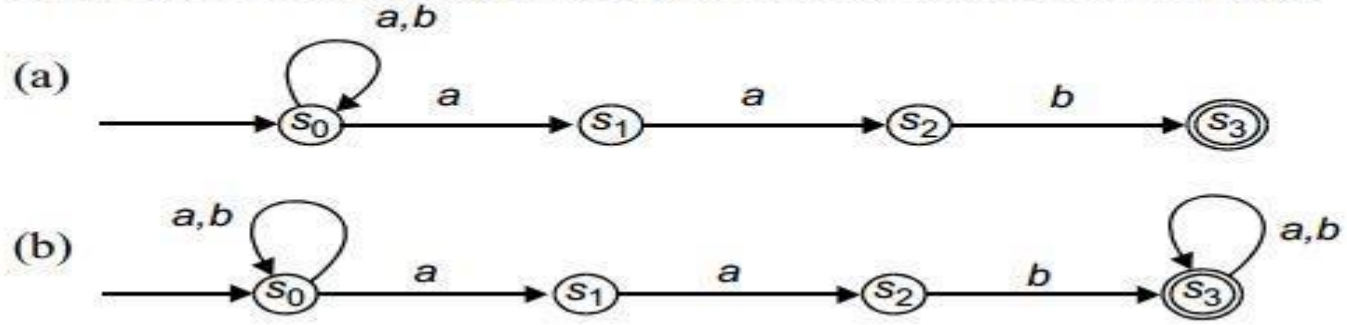
(c) {x| x contains an even number of a's or an odd number of b's}

Q.23 Give the DFA accepting the sets of strings matching the following regular expressions:

(a) (000* + 111*)*
(b) (01 + 10) (01 + 10) (01 + 10)
(c) (0 + 1 (01*0)*1)*

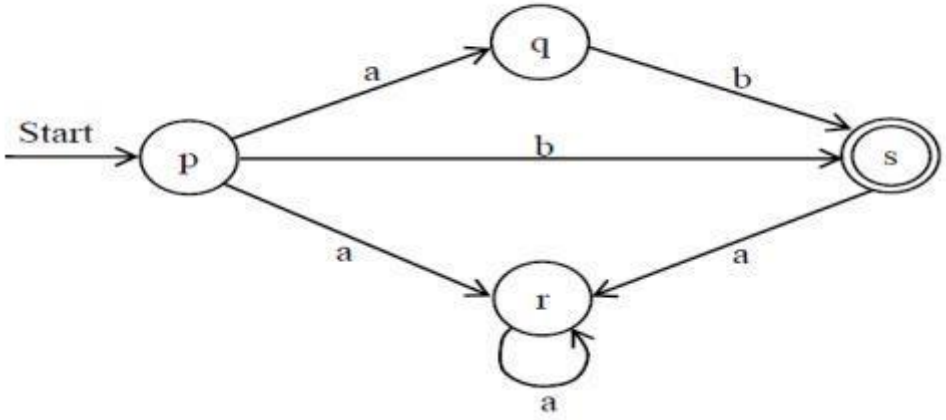
.Q.24.

Convert the NDA to equivalent DFA for each of the following:



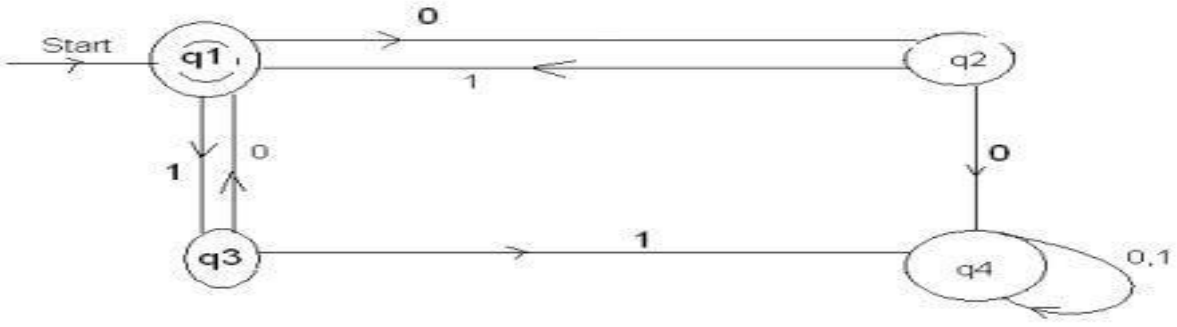
Q.25.

Convert the following NFA to DFA



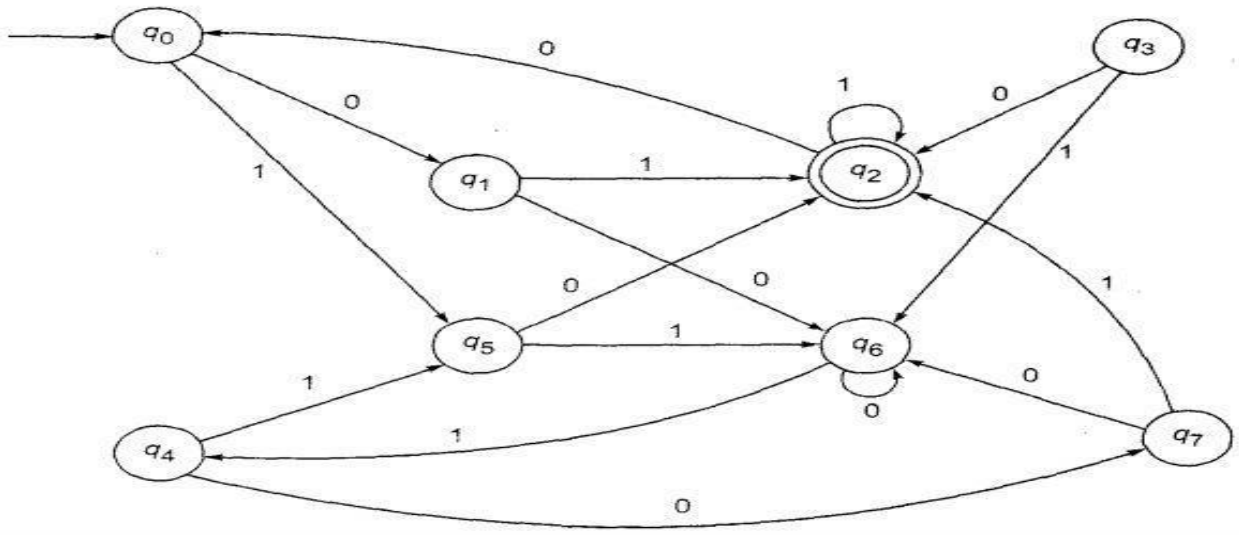
Q.26.

Convert the following DFA into regular expression.



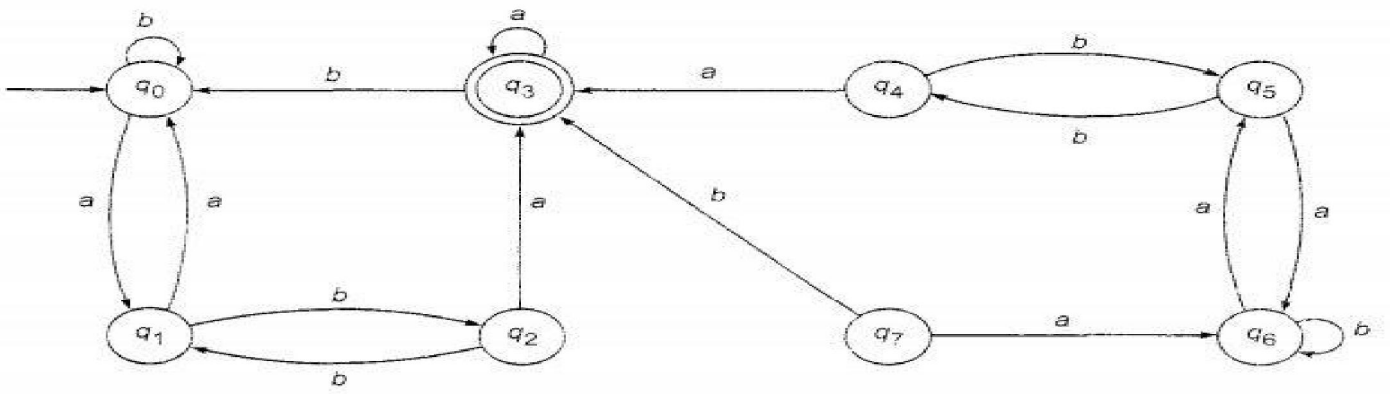
Q.27

Construct a minimum state automaton equivalent to the finite automaton described by



Q.28

Construct the minimum state automaton equivalent to the transition diagram given by Fig. 3.14.



Q.29

Construct a minimum state automaton equivalent to a DFA whose transition table is defined by Table

TABLE DFA

State	a	b
$\rightarrow q_0$	q_1	q_2
q_1	q_4	q_3
q_2	q_4	q_3
(q_3)	q_5	q_6
(q_4)	q_7	q_6
q_5	q_3	q_6
q_6	q_6	q_6
q_7	q_4	q_6

Q.30.

Construct a Mealy machine which is equivalent to the Moore machine defined by Table

TABLE Moore Machine

Present state	*Next state*		*Output*
	a = 0	*a* = 1	
$\rightarrow q_0$	q_1	q_2	1
q_1	q_3	q_2	0
q_2	q_2	q_1	1
q_3	q_0	q_3	1

Q.31.

Construct a Moore machine equivalent to the Mealy machine M defined by Table

TABLE Mealy Machine

Present state	*Next state*			
	a = 0		*a* = 1	
	state	*output*	*state*	*output*
$\rightarrow q_1$	q_1	1	q_2	0
q_2	q_4	1	q_4	1
q_3	q_2	1	q_3	1
q_4	q_3	0	q_1	1

Q.32

Construct a minimum state automaton equivalent to the DFA described by