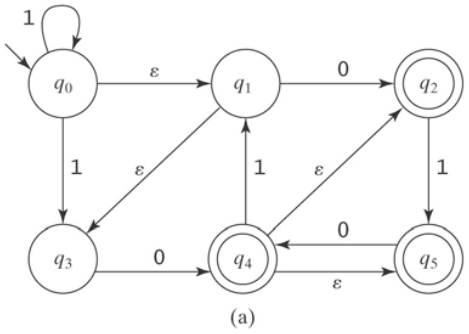
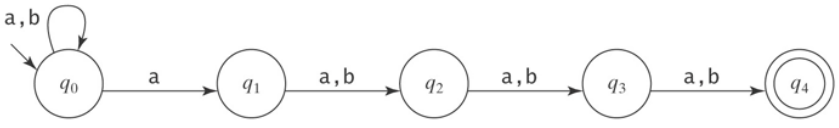
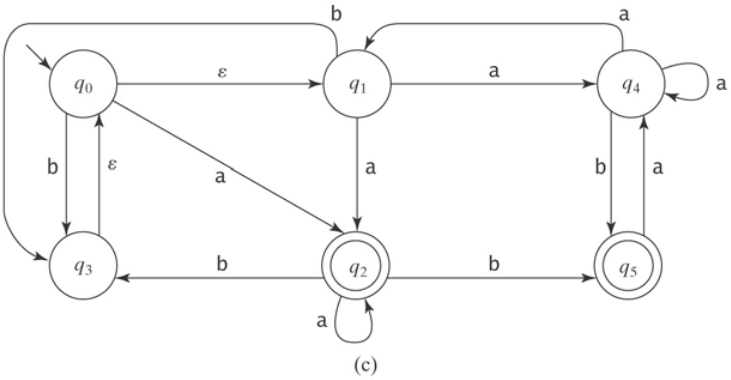
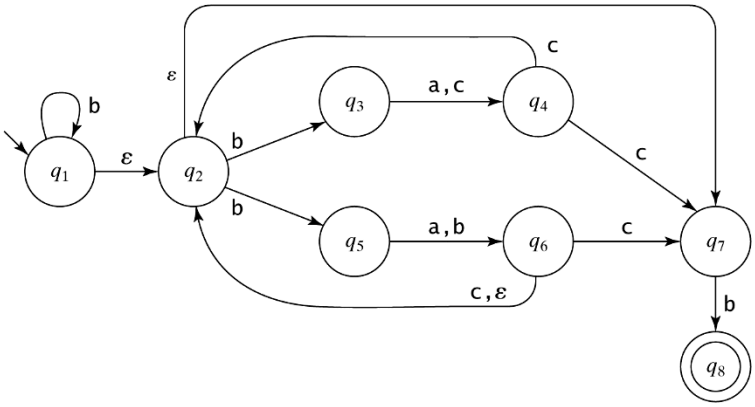
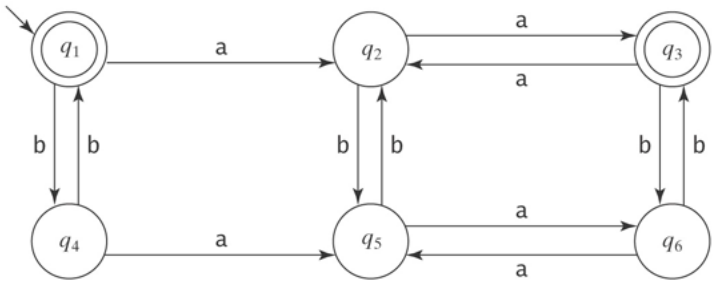
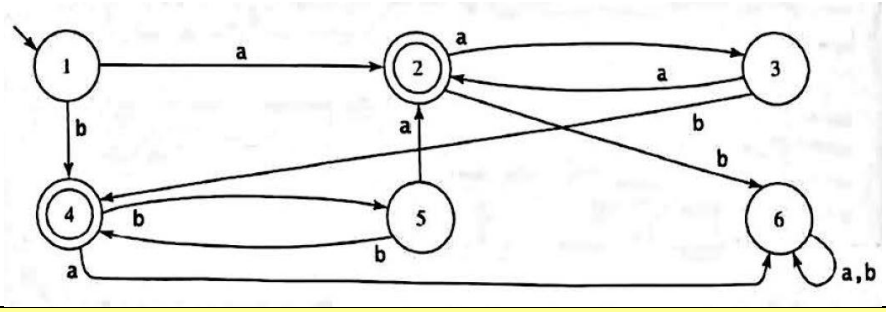
Automata Theory and Computability - 15CS54

Module-1: Review Questions

Sl. No.	Question	Marks
Introduction, Strings, Languages		
1.	What is the use of studying Theory of Computation?	5
2.	With example define i) String ii) Alphabet ii) Length of string iii) Concatenation of strings iv) string reversal v) prefix and vi) suffix	6
3.	Define Languages and Functions over languages.	6
Deterministic Finite State Machines		
4.	Define DFSM an Regular language with example.	5
5.	Explain the difference between DFSM and NDFSM.	5
6.	Build a deterministic FSM for each of the following languages. List a string belonging to the L and a string not belonging to L. Give the configurations for the strings listed. a) L = {*w* ∈ {a, b}* : every a in *w* is immediately preceded & followed by b}. b) L = {*w* ∈ {a, b}* : *w* does not end in ba }. c) L = {*w* ∈ {a, b}* : *w* has bbab as a substring}. d) L = {*w* ∈ {a, b}* : *w* has neither ab nor bb as a substring}. e) L = {*w* ∈ {0, 1}* : *w* is of even length and begins with 01}. f) L = {*w* ∈ {0, 1}* : strings such that number of 1's is even and the number of 0's is a multiple of 3 }	8 each
7.	Build a deterministic FSM for each of the following languages. a) L = {w ∈ {0, 1}* : w corresponds to the binary encoding, without leading 0's, of natural numbers that are evenly divisible by 4}. b) L = {w ∈ {0, 1}* : w corresponds to the binary encoding, without leading 0's, of natural numbers that are powers of 4}. c) L = {w ∈ {0, 1}* : w has 001 as a substring}. d) L = {w ∈ {0, 1}* : w does not have 001 as a substring}. e) L = {w ∈ {a, b}* : w contains at least two b's that are not immediately followed by a's}. f) The set of binary strings with at most one pair of consecutive 0's and at most one pair of consecutive 1's. g) L = {w ∈ {a, b}* : $\|w\| \equiv_5 0$ }	8 each

	h) L = {w ∈ {a, b}* : |w| mod 3 = 0 } i) L = {w ∈ {a, b}* : In w, 4th character from last is a } j) L = {w ∈ {a, b}* : w is not ending with abb }. k) L = {w ∈ {a, b}* : all strings with at least one 'a' and exactly two 'b's} l) L = {w ∈ {a-z}* : all five vowels occur in w in alphabetical order } m) L = {w ∈ {a, b}* : w has both aa and bb as a substrings}. n) L = {$(01)^i 2^j$ | i≥1, j≥1} o) L = {w ∈ {0,1}* : strings represented in binary, that are divisible by 4 p) L = {w ∈ {0-9}* : strings represented in decimal, that are divisible by 3	
Non-Deterministic FSM		
8.	Define NDFSM with example.	5
9.	Give the difference between DFSM and FSM	5
10.	Design Non-Deterministic FSM for the following languages a) L = {w ∈ {a - z}* : all five vowels a, e, i o, and u occur in w in alphabetical order} b) *L* = {*w* ∈ {a, b}* : *w* is made up of an optional a followed by aa followed by zero or more b's}. c) *L* = {*w* ∈ {a, b}* : *w* = aba or |*w*| is even}. d) *L* = {*w* ∈ {a, b, c}* : ∃*x, y* ∈ {a, b, c}* (*w* = *x* abcabb *y*)}. e) *L* = {*w* ∈ {a, b}* : the fourth to the last character is a} f) ∑={a, b, c, d}, L = { w : there is a symbol a_1 ∈ ∑ not appearing in w}.	5
11.	Give the algorithm to convert NDFSM to DFSM	10
12.	Convert following NDFSMs to DFSM. Give the eps() states for all states.  (a)  (b)	10

	  (d)	
13.	Give the algorithm for DFSM simulation.	6
14.	Give the algorithm for NDFSM simulation.	6
Minimizing FSMs		
15.	Describe the algorithm to minimize DFSMs	8
16.	Give the usefulness of canonical form of regular languages. Also give the procedure to find the canonical form of regular languages.	12
17.	Minimize following DFSMs (a) 	

	(b) 	
Finite State Transducers		
18.	Define finite state transducers.	5
19.	Explain Moore machine with example.	10
20.	Explain Mealy machine with example.	10
21.	Write a note on bidirectional transducers with example.	10