

University of Mumbai
Examination May 2022

Examinations Commencing from 17th May 2022

Program: **Information Technology**

Curriculum Scheme: Rev 2019

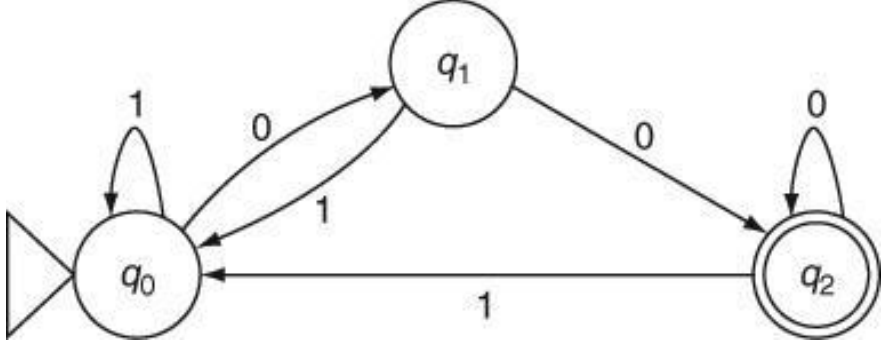
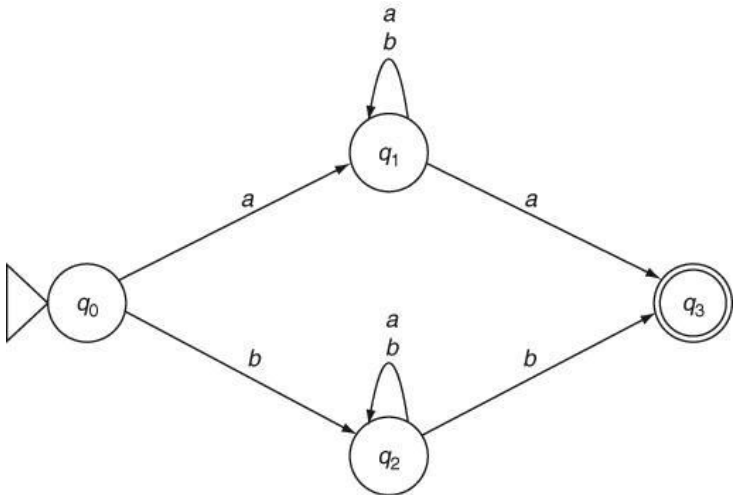
Examination: SE Semester IV

Course Code: ITC404 and Course Name: AUTOMATA THEORY

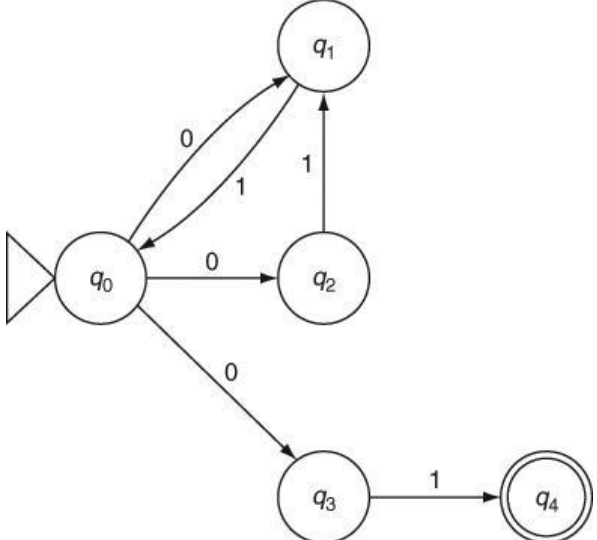
Time: 2 : 30 hours

Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks	20M
1.	Transition function of any automata defines	
Option A:	$\Sigma^* Q \rightarrow \Sigma$	
Option B:	$Q^* \Sigma \rightarrow \Sigma$	
Option C:	$\Sigma^* \Sigma \rightarrow Q$	
Option D:	$Q^* \Sigma \rightarrow Q$	
2.	What is the correct form of production in Chomsky's Normal Form?	
Option A:	$S \rightarrow aS$	
Option B:	$S \rightarrow AB$	
Option C:	$S \rightarrow Sa$	
Option D:	$S \rightarrow A$	
3.	Which of the following is a regular expression for binary strings with no consecutive 1's?	
Option A:	$(01+10)^*$	
Option B:	$(1+\lambda)(01+0)^*$	
Option C:	$(0+1)^*(0+\lambda)$	
Option D:	$(10+0)^*(1+\lambda)^*$	

4.	
Option A:	Given DFA is for binary numbers divisible 2
Option B:	Given DFA is for binary numbers divisible 3
Option C:	Given DFA is for binary numbers divisible 4
Option D:	Given DFA is for every 0 followed by 1
5.	
Option A:	Given DFA is for strings with the same first and last symbol
Option B:	Given NFA is for strings with the same first and last symbol
Option C:	Given NFA is for strings for searching the keyword “aba” or “bab”
Option D:	Given NFA is for strings with any combination of a’s and b’s
6.	$S \rightarrow 1S / 01S$ $S \rightarrow 0A$ $A \rightarrow 0B$ $B \rightarrow 1B / 10B / \lambda$
Option A:	The regular expression for above grammar is $(1 + 01)^*00(\lambda + 0)^*$
Option B:	The regular expression for above grammar is $(1 + 01)^*00(1 + 10)^*$
Option C:	The regular expression for above grammar is $(1 + 01)^*000(1 + 10)^*$
Option D:	The regular expression for above grammar is $(0 + 01)^*0(1 + 01)^*$

7.	The grammar for the language where a's followed by twice as many b's, i.e, $a^n b^{2n}$ Where $n \geq 1$.
Option A:	$S \rightarrow aSbb \mid b$
Option B:	$S \rightarrow aSbb$
Option C:	$S \rightarrow aSbb \mid \lambda$
Option D:	$S \rightarrow aSbb \mid ab$
8.	What is the language of Finite Automata ?
Option A:	Recursive sensitive Language
Option B:	Regular Language
Option C:	Context Sensitive Languages
Option D:	Context free Language
9.	Theis a programmable machine that can compute anything that is computable
Option A:	Deterministic Finite Automata
Option B:	Non Deterministic Finite Automata
Option C:	Universal Turing Machine
Option D:	Push down Automata
10.	Which of the following relates to the Chomsky hierarchy?
Option A:	Regular < CFL < CSL < Unrestricted
Option B:	CFL < CSL < Unrestricted < Regular
Option C:	CSL < Unrestricted < CF < Regular
Option D:	CSL < Unrestricted < Regular < CF

Q2.	Solve any Four questions out of Six. 5 marks each
A	<p>Convert given NFA to DFA</p>  <pre> graph LR start(()) --> q0((q0)) q0 -- 0 --> q1((q1)) q0 -- 1 --> q2((q2)) q1 -- 0 --> q0 q1 -- 1 --> q2 q2 -- 0 --> q0 q2 -- 1 --> q1 q0 -- 0 --> q3((q3)) q3 -- 1 --> q4(((q4))) </pre>
B	<p>Construct only a Mealy machine for the following: For input from, Σ^*, where $\Sigma = \{0,1\}$, if the input ends in '101', the output should be 'x'; if the input ends in '110', output should be 'y' otherwise output should be 'z'. (transition table and diagram both are expected)</p>
C	<p>Give Regular Expressions for</p> <ol style="list-style-type: none"> For all strings over 0,1 that starts with 10 and ends with 01 For all strings over a,b which contains exactly 3 occurrence of 'b' over $\Sigma = \{a,b\}$
D	<p>Consider the following CFG: $G = \{ (S, A), (a, b), P, S \}$, where P consists of : $S \rightarrow aAS \mid a$ $A \rightarrow SbA \mid SS \mid ba$ Derive the string 'aabbaa' using leftmost derivation and rightmost derivation.</p>
E	<p>Compare and Contrast between FA, PDA and TM</p>
F	<p>what is Ambiguous Grammar, find if the following grammar is ambiguous or not by generating $(x + 2.0) * y / (z - 6.0)$</p> $S \rightarrow S + S$ $S \rightarrow S * S$ $S \rightarrow S - S$ $S \rightarrow S / S$ $S \rightarrow (S)$ $S \rightarrow \text{variable} \mid \text{constant}$

Q3.	Solve any Two Questions out of Three 10 marks each
A	<p>What are steps for converting CFG to CNF ? Convert the given grammar G to CNF. G:</p> <p>$S \rightarrow a \mid aA \mid B \mid C$</p> <p>$A \rightarrow aB \mid \epsilon$</p> <p>$B \rightarrow Aa$</p> <p>$C \rightarrow aCD \mid a$</p> <p>$D \rightarrow ddd$</p>
B	Give a formal definition of Turing Machine (TM). Design a TM that performs the addition of two unary numbers. (transition table and diagram both are expected)
C	Design PDA for odd length palindrome, let $\Sigma = \{0,1\}$, $L = \{W X W^R\}$
Q.4	Solve any Two Questions out of Three 10 marks each
A	Explain Chomsky's Hierarchy with neat diagram
B	Construct DFA for given regular expression $(a+b)^* aba (a+b)^*$
C	Construct NFA with ϵ moves for "Zero or more number of 0's followed by zero or more number of 1's followed by zero or more number of 2's . convert this to DFA.