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

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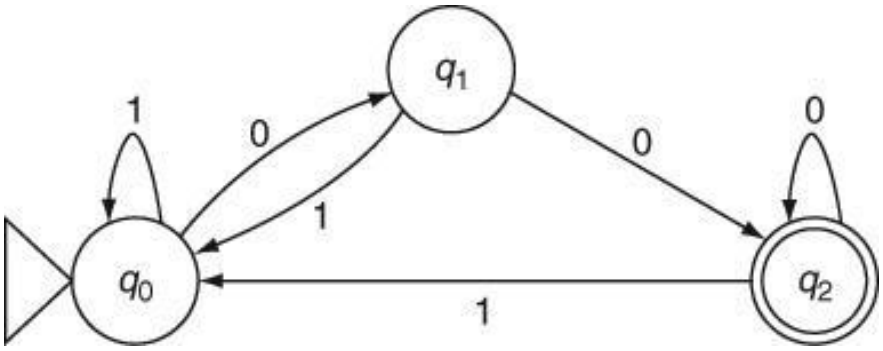
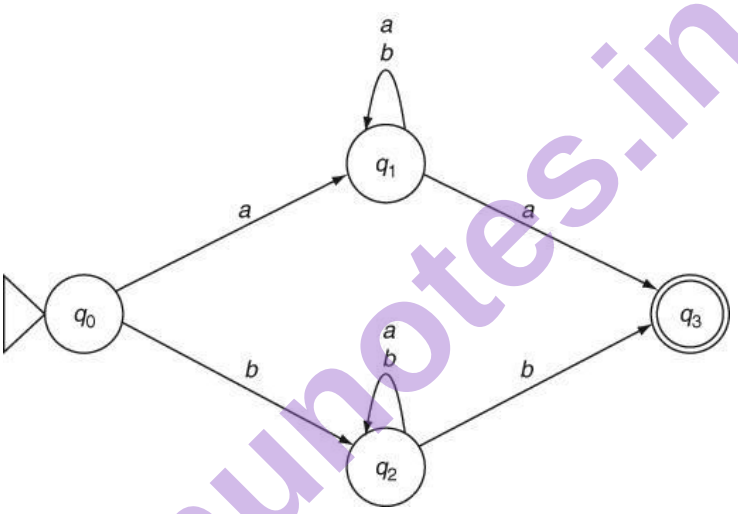
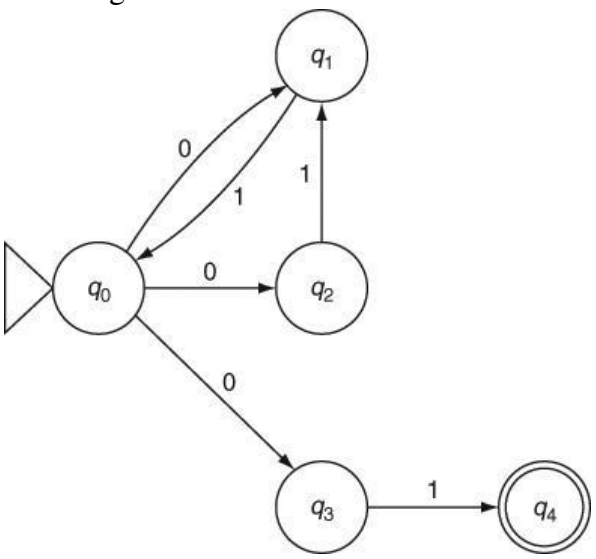
Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks 20M**
1.	Transition function of any automata defines
Option A:	Σ * Q –> Σ
Option B:	Q * Σ –> Σ
Option C:	Σ * Σ –> Q
Option D:	Q * Σ –> Q
2.	What is the correct form of production in Chomsky's Normal Form?
Option A:	S→ aS
Option B:	S→ AB
Option C:	S→ Sa
Option D:	S→ 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+λ) (01+0)*
Option C:	(0+1)*(0+ λ)
Option D:	(10+0)*(1+ λ)*

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→ 1S / 01 S** **S→ 0A** **A→ 0B** **B→ 1B / 10B / λ**
Option A:	The regular expression for above grammar is **(1 + 01)*00(λ + 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 >=1 .
Option A:	S → aSbb | b
Option B:	S → aSbb
Option C:	S → aSbb | λ
Option D:	S → aSbb | 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.	The ……is 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	Convert given NFA to DFA 
B	Construct only a Mealy machine for the following: For input from, ∑*, where ∑= **(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)
C	Give Regular Expressions for i) For all strings over 0,1 that starts with **10** and ends with **01** ii) For all strings over a,b which contains exactly 3 occurrence of ' **b**' over Σ={a,b}
D	Consider the following CFG: G = { (S, A), (a, b), P, S}, where P consists of : **S→aAS | a** **A→SbA | SS | ba** Derive the string '**aabbaa**' using leftmost derivation and rightmost derivation.
E	Compare and Contrast between FA, PDA and TM
F	what is Ambiguous Grammar, find if the following grammar is ambiguous or not by generating **(*x* + 2.0) * *y* / (*z* – 6.0)** **S → S + S** **S → S * S** **S → S – S** **S → S / S** **S → (S)** **S → variable | constant**

Q3.	Solve any Two Questions out of Three 10 marks each
A	What are steps for converting CFG to CNF ? Convert the given grammar G to CNF. G: **S → a | aA | B |C** **A → aB | ε** **B →Aa** **C →aCD | a** **D → ddd**
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 for odd length palindrome, **let** $\sum$ **={ 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 Ɛ 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.