University of Mumbai

Examinations Commencing from 7th January 2021 to 20th January 2021

Program: Computer Engineering

Curriculum Scheme: Rev2016

Examination: TE Semester V

Course Code: **CSC504** and Course Name: **Theory of Computer Science**

Time: 2 hour Max. Marks: 80

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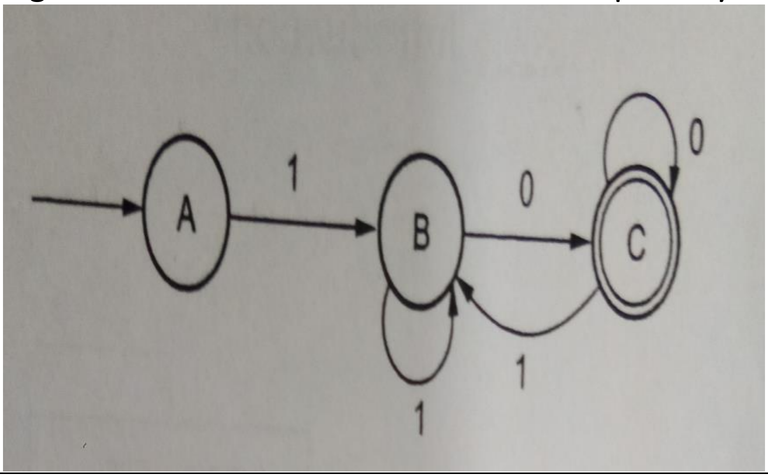
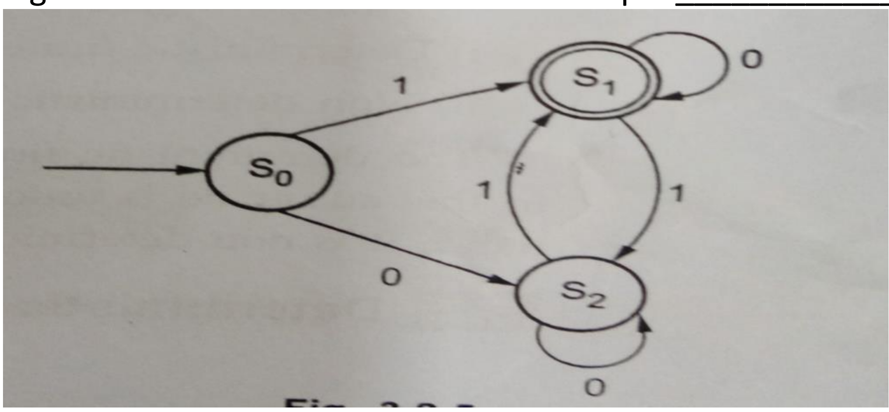
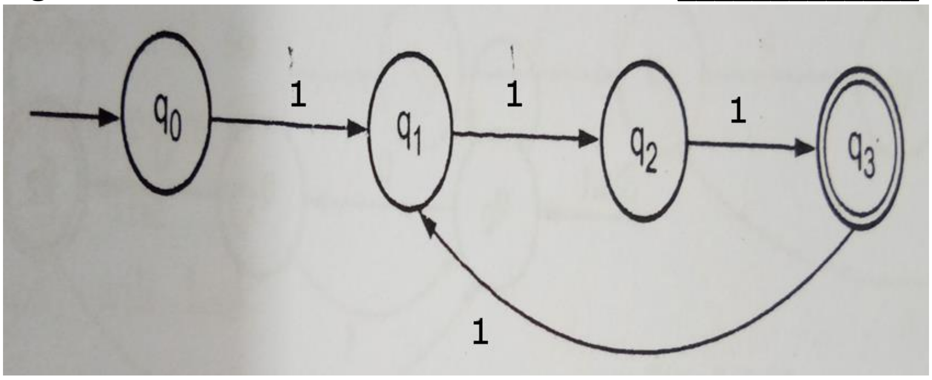
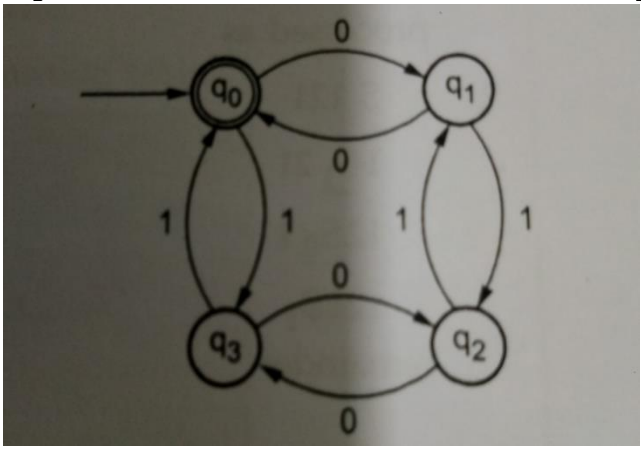
<table>
<tr><td>Q1.</td><td>Choose the correct option for following questions. All the Questions are compulsory and carry equal marks</td></tr>
<tr><td></td><td></td></tr>
<tr><td>1.</td><td>Figure shows finite automata which accepts only those strings ___________

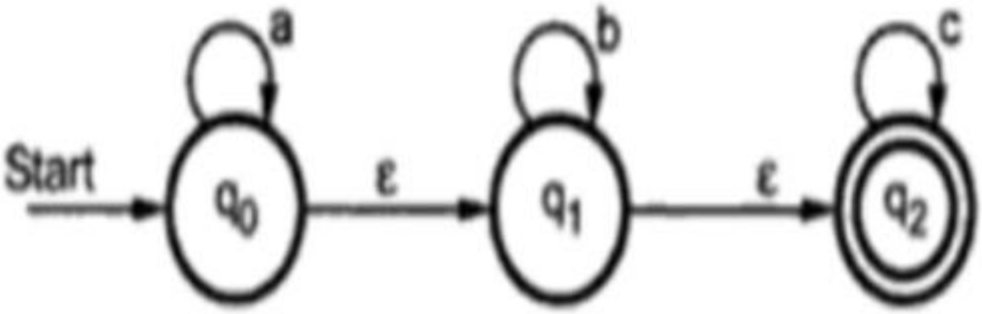
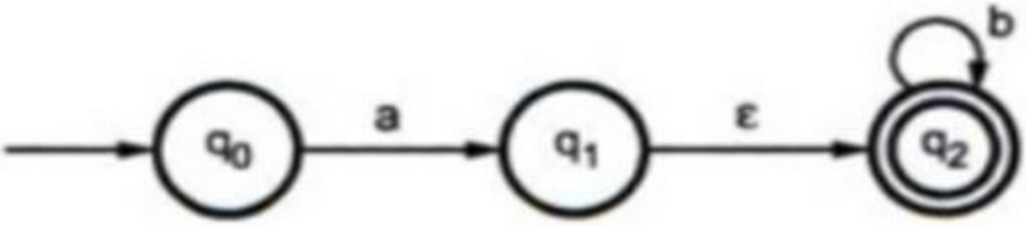


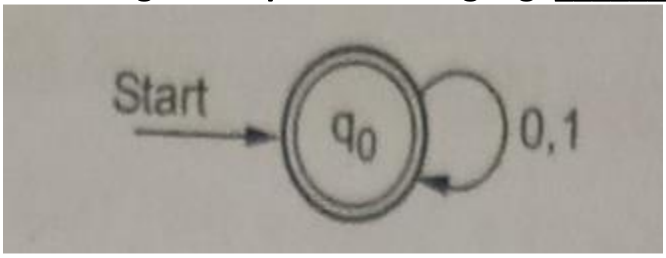
</td></tr>
<tr><td>Option A:</td><td>which start with 1 and ends with 0</td></tr>
<tr><td>Option B:</td><td>which contains only input 101</td></tr>
<tr><td>Option C:</td><td>which start with 1 and ends with 1</td></tr>
<tr><td>Option D:</td><td>which start with Ɛ and ends with 1</td></tr>
<tr><td></td><td></td></tr>
<tr><td>2.</td><td>Figure shows finite automata which accepts _________________



</td></tr>
</table>

Option A:	odd number of 1's and any number of 0's.
Option B:	odd number of 0's and any number of 1's.
Option C:	even number of 1's and any number of 0's.
Option D:	odd number of 0's and even number of 1's.
3.	**Figure shows finite automata which checks ______________** 
Option A:	whether the given unary number is divisible by 3
Option B:	whether the given unary number is divisible by 2
Option C:	whether the given unary number is divisible by 4
Option D:	whether the given unary number is divisible by 0
4.	**Figure shows finite automata which accepts ______________** 
Option A:	**Even number of 0's and odd number of 1's**

Option B:	**Odd number of 0's and even number of 1's**
Option C:	**Even number of 0's and even number of 1's**
Option D:	**Odd number of 0's and odd number of 1's**
5.	**Following NFA with Ɛ represents language consisting__________** 
Option A:	The strings of any number of a's followed by any number of b's followed by any number of c's
Option B:	The strings of any number of a's followed by any number of Ɛ, followed by any number of c's
Option C:	The strings of any number of a's followed by any number of b's followed by any number of Ɛ
Option D:	The strings of any number of Ɛ followed by any number of b's followed by any number of c's
6.	**Ɛ-closures of q_0,q_1 and q_2 are obtained as____________for following NFA with Ɛ** 
Option A:	Ɛ-closure(q_0)={ q_0}, Ɛ-closure(q_1)={ q_1, q_2}, Ɛ-closure(q_2)={q_2}
Option B:	Ɛ-closure(q_0)={ q_0, q_1}, Ɛ-closure(q_1)={ q_1, q_2}, Ɛ-closure(q_2)={q_2}

Option C:	Ɛ-closure(q_0)={ q_0, q_1}, Ɛ-closure(q_1)={ q_1}, Ɛ-closure(q_2)={q_2}
Option D:	Ɛ-closure(q_0)={ q_0}, Ɛ-closure(q_1)={ q_1}, Ɛ-closure(q_2)={q_2}
7.	**Following DFA represents Language____________** 
Option A:	Containing any combination of 0 and 1
Option B:	Containing equal number of zeros and 1's
Option C:	Containing all the string except Ɛ
Option D:	Containing odd number of 0's and 1's
8.	**Regular expression =0(00)* represents the language________**
Option A:	having odd number of 0's
Option B:	having even number of 0's
Option C:	having equal number of 0's
Option D:	having any number of 0's as well as empty string
9.	___________is the regular expression to denote the language L over the set ∑={a,b,c} such that every string will have atleast one a followed by atleast one b followed by atleast one c
Option A:	$a^{+}b^{+}c^{+}$
Option B:	$a^{*}b^{*}c^{*}$
Option C:	$a^{*}b^{*}c$

Option D:	ab^*c^*
10.	_________is R.E. for the language L which accepts all the strings with atleast two b's over the set ∑={a,b}
Option A:	(a+b)* b (a+b)* b (a+b)*
Option B:	(a+b)* (a+b)* (a+b)*
Option C:	$(a+b)^+$ (a+b)*$(a+b)^+$
Option D:	(a+b) (a+b) (a+b)*
11.	**Production rules for the CFG for the language having any number of a's over the set ∑={a}**
Option A:	S → aS and S → Ɛ
Option B:	S → aS
Option C:	S → a
Option D:	S→ S
12.	The rule for________________is Non terminal=one terminal.Any number of non-terminals
Option A:	GNF
Option B:	CNF
Option C:	Simplified grammer
Option D:	LBA
13.	In____________we can remove epsilon production, unit production and useless symbol without changing the meaning.
Option A:	Finite Automata

Option B:	Context free grammer
Option C:	Turing machine
Option D:	Linear bounded automata
14.	The grammar S → (S) | SS | ϵ is not suitable for predictive parsing because the grammar is
Option A:	Right recursive
Option B:	Left recursive
Option C:	Ambiguous
Option D:	An operator grammar
15.	____________is the instantaneous description to design PDA for accepting language $L=a^n b^{2n} \| n \geq 1$
Option A:	$\delta(q_0,a,Z_0) = (q_0,aaZ_0)$ $\delta(q_0,a,a) = (q_0,aaa)$ $\delta(q_0,b,a) = (q_1,\varepsilon)$ $\delta(q_1,b,a) = (q_1,\varepsilon)$ $\delta(q_1,\varepsilon,Z_0) = (q_2,\varepsilon)$
Option B:	$\delta(q_0,a,Z_0) = (q_0,aZ_0)$ $\delta(q_0,a,a) = (q_0,a)$ $\delta(q_0,b,a) = (q_1,ba)$ $\delta(q_1,b,a) = (q_1,ab)$ $\delta(q_1,\varepsilon,Z_0) = (q_2,\varepsilon)$
Option C:	$\delta(q_0,a,Z_0) = (q_0,a)$ $\delta(q_0,a,a) = (q_0,aa)$ $\delta(q_0,b,a) = (q_1,b)$ $\delta(q_1,b,a) = (q_1,a)$ $\delta(q_1,\varepsilon,Z_0) = (q_1, Z_0)$
Option D:	$\delta(q_0,a,Z_0) = (q_0,a)$ $\delta(q_0,a,a) = (q_0,aa)$ $\delta(q_0,b,a) = (q_1,ab)$ $\delta(q_1,b,a) = (q_1,ab)$ $\delta(q_1,\varepsilon,Z_0) = (q_1, Z_0)$

16.	$L=0^m1^n0^{m+n}$ can be constructed by using _________
Option A:	DFA
Option B:	NFA
Option C:	PDA
Option D:	Moore
17.	Logic to construct turing machine for the language $L=a^nb^n$ where $n \geq 1$ is ____________
Option A:	Convert a by A and then move ahead along the input tape and find out the b convert it to B. Repeat this process for all a's and b's
Option B:	Convert b by B and then move ahead along the input tape and find out the a convert it to A.
Option C:	Convert a by A and then move ahead along the input tape and find out the b convert it to B.
Option D:	Convert all a's by A first and then convert all b's to B.
18.	In the high level languages use of ____________ built the modularity in the program development process
Option A:	Subroutines
Option B:	Function
Option C:	stack
Option D:	code
19.	**Logic to construct TM for the addition function for the unary number system is ______________**
Option A:	**To simply replace + by 1 and move ahead right for searching end of the string and then we will convert last 1 to Δ.**

Option B:	**To move ahead right for searching end of the string and then we will convert last 1 to Δ.**
Option C:	**To simply replace + by 1 and move ahead right for searching end of the string Δ.**
Option D:	**To move ahead right for searching end of the string.**
20.	The undecidability of strings is determined with the help of __________
Option A:	Post correspondence theorem
Option B:	Rice theorem
Option C:	halting
Option D:	pre-correspondence theorem

Q2. (20 Marks Each)	**Solve any Four out of Six** **5 marks each**
A	Design a DFA to accept string of a's and b's ending with 'abb' over I/P z={a,b}
B	Design PDA for the language that accepts the strings with $n_a(w) < n_b(w)$ where w Ɛ (a+b)*
C	Design a mealy machine to find 2's complement of a given binary number.
D	Remove the Ɛ production from following CFG by preserving meaning of it. $S \rightarrow XYX$ $X \rightarrow 0X \mid \varepsilon$ $Y \rightarrow 1Y \mid \varepsilon$
E	Construct Turing Machine for $L=a^nb^nc^n \mid n \geq 1$
F	Write short note on Rice Theorem

Q3. (20 Marks Each)	**Solve any Two Questions out of Three** **10 marks each**

A	Consider the following grammar $S \rightarrow iCtS \mid iCtSeS \mid a$ $C \rightarrow b$ For the string ibtibtaea find the following i)Leftmost derivation ii) Rightmost derivation iii) Parse Tree iv) Check if the above grammar is ambiguous.
B	Convert the following NFA to DFA. P is the initial state and r and s are the final states. <table><tr><th>δ</th><th>0</th><th>1</th></tr><tr><td>p</td><td>{p, r}</td><td>{q}</td></tr><tr><td>q</td><td>{r, s}</td><td>{p}</td></tr><tr><td>r*</td><td>{p, s}</td><td>{r}</td></tr><tr><td>s*</td><td>{q, r}</td><td>{ }</td></tr></table>
C	Construct PDA for the grammar $E \rightarrow E + E \mid E - E \mid (E) \mid id$