

Program: **Electronics and Computer Science**

Curriculum Scheme: 2019 'C' Scheme

Examination: SE SemesterIV

Course Code: ECC405 and Course Name: Discrete Structures and Automata Theory

Time: 2 hours

Max. Marks: 80

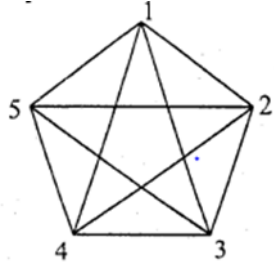
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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Let $L = \{ab, aa, baa\}$, Which among the following string is in L^* ?
Option A:	abaaabbbaaba
Option B:	aaaaabaaaab
Option C:	abaabaaabaa
Option D:	baaabbaaba
2.	The cardinality of the set of odd positive integers less than 10 is ?
Option A:	10
Option B:	5
Option C:	3
Option D:	6
3.	Finite State Machine is a _____ tuple machine
Option A:	4
Option B:	5
Option C:	6
Option D:	Unlimited
4.	State the type of function for following example “ To each country assign the number of people living in the country”
Option A:	Many-One
Option B:	One-Many
Option C:	One-One
Option D:	Many-Many
5.	An NFA's transition function returns
Option A:	A Boolean value
Option B:	A state
Option C:	A Set of states
Option D:	An edge
6.	Let a set $S = \{2, 4, 8, 16, 32\}$ and \leq be the partial order defined by $S \leq R$ if a divides b. Number of edges in the Hasse diagram of it is _____
Option A:	6
Option B:	4
Option C:	5
Option D:	9

7.	Finite Automate is used for recognizing _____ type of language.
Option A:	Type 0
Option B:	Type 1
Option C:	Type 2
Option D:	Type 3
8.	Which sentence can be generated by following CFG? $S \rightarrow iCtS \mid iCtSeS \mid a \quad C \rightarrow b$
Option A:	ibbitaea
Option B:	ibtibtaea
Option C:	ibtiibtea
Option D:	ibtibea
9.	The instantaneous description of a PDA is represented by 3 tuple-(q, w, y) where
Option A:	{q= current state w = stack contents y= remaining input}
Option B:	{q= current state w = remaining input y= stack contents}
Option C:	{q= remaining input w = current state y= stack contents}
Option D:	{q= remaining input w = stack contents y= current state}
10.	What is the correct translation of the following statement into mathematical logic? "Some real numbers are rational"
Option A:	$\exists x(\text{real}(x) \vee \text{rational}(x))$
Option B:	$\forall x(\text{real}(x) \rightarrow \text{rational}(x))$
Option C:	$\exists x(\text{real}(x) \wedge \text{rational}(x))$
Option D:	$\exists x(\text{rational}(x) \rightarrow \text{real}(x))$
11.	The Regular expression of language which is starting and ending with different symbols is
Option A:	$a(a+b)^*b$
Option B:	$a(a+b)^*b+b(a+b)^*a$
Option C:	$b(a+b)^*$
Option D:	a^*b^*
12.	Which of the following is a Tautology?
Option A:	$(\sim p \vee p) \wedge q$
Option B:	$(p \vee q) \rightarrow (p \rightarrow q)$
Option C:	$((p \vee q) \wedge \sim p) \rightarrow q$
Option D:	$(\sim p \vee \sim q) \rightarrow (p \rightarrow q)$
13.	In Moore Machine, the Output depends upon?
Option A:	Present State
Option B:	Previous State
Option C:	Present State and Input
Option D:	Only input
14.	Determine the partitions of the set {3, 4, 5, 6, 7} from the following subsets.
Option A:	{3,5}, {3,6,7}, {4,5,6}
Option B:	{3,4,6}, {7}
Option C:	{5,6}, {5,7}

Option D:	{3}, {4,6}, {5}, {7}
15.	The binary relation $\{(1,1), (2,1), (2,2), (2,3), (2,4), (3,1), (3,2)\}$ on the set $\{1, 2, 3,4\}$ is _____.
Option A:	Reflexive, Symmetric and Transitive
Option B:	Irreflexive, Symmetric and Transitive
Option C:	Neither Reflexive, nor Irreflexive but Transitive
Option D:	Irreflexive and Antisymmetric
16.	In Finite Automata Transition function maps _____.
Option A:	$\Sigma^* Q \rightarrow \Sigma$
Option B:	$Q * \Sigma \rightarrow Q$
Option C:	$Q*Q \rightarrow \Sigma$
Option D:	$\Sigma*\Sigma=Q$
17.	An undirected graph has 8 vertices labeled 1, 2, ...,8 and 31 edges. Vertices 1, 3, 5, 7 have degree 8 and vertices 2, 4, 6, 8 have degree 7. What is the degree of vertex 8?
Option A:	15
Option B:	5
Option C:	23
Option D:	8
18.	Let $A=\{1,2,3,4,5,6,7,8\}$. Let xRy whenever y is divisible by x , so R is a _____
Option A:	Equivalence Relation
Option B:	Partial Order Relation
Option C:	Symmetric
Option D:	Neither Equivalence Nor Partial Order Relation
19.	Consider P : Food is good , Q : Service is good , R : Restaurant is 5-star. Write the symbolic notation of the statement “ It is not true that 5 star rating always means good food and good service”
Option A:	$(P \wedge Q) \rightarrow R$
Option B:	$P \wedge \sim Q$
Option C:	$R \rightarrow \sim(P \wedge Q)$
Option D:	$\sim(R \rightarrow (P \wedge Q))$
20.	The following production rules of a regular grammar generate a language L : $A \rightarrow aA \mid bA \mid a \mid b$ The regular expression of L is _____.
Option A:	$a + b$
Option B:	$(a + b)^*$
Option C:	$(a + b)(a + b)^*$
Option D:	$(aa + bb) a^*b^*$

Q2 .A.	Solve any 2 questions out of 3.	5 marks each
1	Define and give examples of injective, surjective and bijective functions. Check the injectivity and surjectivity of the following function $f : \mathbb{N} \rightarrow \mathbb{N}$ given by $f(x)=x^3$	

2	Find the CNF form of $(\sim a \rightarrow b) \wedge (a \leftrightarrow b)$
3	Prove using Mathematical Induction that n^3+2n is divisible by 3 for all $n \geq 1$
Q.2.B.	Solve any 1 question out of 3. 10 marks each
1	<p>Define with example Euler path, Euler circuit, Hamiltonian path, and Hamiltonian circuit. Determine if the following diagram has Euler circuit and Hamiltonian circuit and state the path/circuit.</p> 
2	<p>Let D_{60} be the poset consisting of all the positive divisors of 60 Under the partial order of divisibility.</p> <p>(a) Write down the elements of D_{60}? (b) Draw the Hasse Diagram of D_{60}. (c) Is D_{60} a lattice? Give a reason for your answer</p>

Q3 .A.	Solve any 2 questions out of 3. 5 marks each
1	Design a DFA to check whether a given unary number is divisible by 3
2	<p>Define Regular Expression and give Regular Expression for following language</p> <p>i) Set of all strings that end with 1 and has no substring 00 ii) Set of all strings on $\{a,b\}$ with even number of a's followed by odd number of b's</p>
3	Design Moore Machine to generate output A if string is ending with aba, B if string ending with abb and C otherwise over alphabet (a,b)
Q.3.B.	Solve any 1 question out of 3. 10 marks each
1	Define PDA and design a PDA to accept an even palindrome over $\{a,b\}$
2	Construct NFA from $(0+1)^*(00+11)$ and convert into DFA form.