

Sample Questions

Information Technology

Subject Name: Automata Theory

Course Code: ITC404

Semester: IV

Multiple Choice Questions

Choose the correct option for following questions. All the Questions carry equal marks	
1.	Which of the following is not a regular expression?
Option A:	$(0+1)^*. (00+11)^*$
Option B:	$(0+1)-(01+01)^*(0+1)^*$
Option C:	$(01+11+10)^*$
Option D:	$(1+2+0)^*(1+2)^*$
2.	which language is represented by Regular expressions ?
Option A:	Recursive language
Option B:	Regular language
Option C:	Context free language
Option D:	Ambiguous Language
3.	The set of all strings over $\Sigma = \{0,1\}$ in which a single 0 is followed by any number of 1's or a single 1 followed by any number of 0's is-----
Option A:	$01^* + 10^*$
Option B:	01^*10^*
Option C:	$0^*1 + 1^*0$
Option D:	0^*
4.	The language accepted by this DFA is
<pre> graph LR start(()) --> q0((q0)) q0 -- a --> q1(((q1))) q1 -- a --> q0 q1 -- b --> q1 q0 -- b --> q2((q2)) </pre>	
Option A:	ababaabaa
Option B:	abbbaa

Option C:	abbbaabb
Option D:	abbaabbaa
5.	Moore Machine is an application of:
Option A:	Finite automata without input
Option B:	Finite automata with output
Option C:	Non- Finite automata with output
Option D:	Non- Finite automata without output
6.	In regular expressions, the operator '*' stands for-----
Option A:	Concatenation
Option B:	Addition
Option C:	Selection
Option D:	Iteration
7.	The number of elements present in the ϵ -closure(B) in the given diagram.
Option A:	0
Option B:	1
Option C:	2
Option D:	3
8.	Grammar is called ambiguous if -----
Option A:	Two or more productions have the same non-terminal on the left-hand side
Option B:	Derivation tree has more than one associated sentence
Option C:	There is a sentence with more than one derivation tree corresponding to it
Option D:	Brackets are not present in the grammar
9.	$S \rightarrow aSa$ $S \rightarrow bSb$ $S \rightarrow a$ $S \rightarrow b$ The language generated by the above grammar over the alphabet $\{a,b\}$ is the set of
Option A:	All Palindromes
Option B:	All Odd length Palindromes
Option C:	All even length palindromes

Option D:	String with null value
10.	Unrestricted grammar is also called _____ Grammar
Option A:	Type 3
Option B:	Type 2
Option C:	Type 1
Option D:	Type 0
11.	The Trees which represent derivations in CFG are called
Option A:	Parse tree
Option B:	Derivation Tree
Option C:	Both A and B
Option D:	Binary Tree
12.	A Multitape Turing machine is _____ powerful than a single tape Turing machine.
Option A:	More
Option B:	Less
Option C:	Equal
Option D:	Not equal
13.	At Pushdown automata is _____ if there is at most one transition applicable to each configuration.
Option A:	Deterministic
Option B:	Non-Deterministic
Option C:	Finite
Option D:	Non-Finite
14.	Select value of n, if Push down automata is defined using n-tuples:
Option A:	7
Option B:	5
Option C:	6
Option D:	3
15.	In pushdown automata notation, what does the symbol Z_0 represents?
Option A:	An element of G
Option B:	Initial stack symbol
Option C:	Top stack alphabet
Option D:	Head
16.	The language recognized by Turing machine is:
Option A:	Context free language
Option B:	Context sensitive language
Option C:	Recursively enumerable language
Option D:	Regular language
17.	In Multi Tape Turing machine there are

Option A:	Having more stack
Option B:	More than one input tapes of Turing machine
Option C:	Similar to the basic model of Turing machine
Option D:	More than one head going in only one direction
18.	Which of the following statement is false for a Turing machine?
Option A:	There exists an equivalent deterministic Turing machine for every non-deterministic Turing machine
Option B:	Turing decidable languages are closed under intersection and complementation
Option C:	Turing recognizable languages are closed under union and intersection
Option D:	Turing recognizable languages are closed under union and complementation
19.	Which of the following is the most general phase structured grammar?
Option A:	Regular
Option B:	Context-sensitive
Option C:	Context free
Option D:	Recursive
20.	The concept of FSA is much used in this part of the compiler
Option A:	Lexical analysis
Option B:	Parser
Option C:	Code Generation
Option D:	Code Optimization
21.	Which symbol is used to represent a Transition Function of Finite Automata?
Option A:	β
Option B:	δ
Option C:	Σ
Option D:	ϵ
22.	What is the language of Finite Automata?
Option A:	Recursive Language
Option B:	Context-Sensitive Language
Option C:	Regular Language
Option D:	Context-Free Language
23.	Number of states in NFA are
Option A:	Less than or equal to equivalent DFA
Option B:	Less than equivalent DFA
Option C:	Greater than equivalent DFA
Option D:	Greater than or equal to equivalent DFA
24.	What is the correct form of productions in Chomsky Normal Form?
Option A:	$A \rightarrow aB$
Option B:	$A \rightarrow BC$

Option C:	$A \rightarrow B$
Option D:	$A \rightarrow Ba$
25.	The language WW^R is accepted by-
Option A:	Deterministic Pushdown Automata
Option B:	Non-Deterministic Finite Automata
Option C:	Deterministic Finite Automata
Option D:	Non-Deterministic Pushdown Automata
26.	The transition $\delta(q_1, a, a) = (q_i, \epsilon)$ of PDA is -
Option A:	Performing delete and pop operation
Option B:	Performing delete operation only
Option C:	Performing pop operation only
Option D:	Performing push operation
27.	What is the language of the Turing machine?
Option A:	Regular language
Option B:	Context free language
Option C:	Recursive enumerable language
Option D:	Context sensitive language
28.	What is the limitation of regular grammar?
Option A:	Can generate simple strings
Option B:	Can only describe regular language
Option C:	Can't generate long strings
Option D:	Too difficult to understand
29.	DFA designed to accept strings with no more than 2 a's can accept:
Option A:	a b a b
Option B:	a b a a
Option C:	b a a a
Option D:	a b a b a b a b
30.	The length of Moore machine compared to Mealy machine is:
Option A:	Equal to Mealy machine for given input
Option B:	Smaller than Mealy machine for given input
Option C:	One smaller than Mealy machine for given input
Option D:	One longer than Mealy machine for given input
31.	Derivation process is one which-
Option A:	Parses given string
Option B:	Generates new string
Option C:	Convert string to right linear grammar
Option D:	Convert string to left linear grammar
32.	Language of PDA is:
Option A:	Recursively Enumerable language
Option B:	Regular Language

Option C:	Context sensitive language
Option D:	Context free language
33.	The tuple Σ in Turing machine represents-
Option A:	Tape symbol
Option B:	Output symbol
Option C:	Tape alphabet
Option D:	Input alphabet
34.	A Turing Machine can compute problems which are-
Option A:	Complex
Option B:	Simple
Option C:	Unsolvable
Option D:	Computable
35.	Which of the following languages are most suitable for implementing context free languages?
Option A:	C
Option B:	Perl
Option C:	Assembly Language
Option D:	Compiler language
36.	With reference to the process of conversion of a context free grammar to CNF, the number of variables to be introduced for the terminals are: $S \rightarrow AB^0$ $A \rightarrow 001$ $B \rightarrow A1$
Option A:	3
Option B:	4
Option C:	2
Option D:	5
37.	Next move function δ of a Turing machine $M = (Q, \Sigma, \Gamma, \delta, q_0, B, F)$ is a mapping
Option A:	$\delta : Q \times \Sigma \rightarrow Q \times \Gamma$
Option B:	$\delta : Q \times \Gamma \rightarrow Q \times \Sigma \times \{L, R\}$
Option C:	$\delta : Q \times \Sigma \rightarrow Q \times \Gamma \times \{L, R\}$
Option D:	$\delta : Q \times \Gamma \rightarrow Q \times \Gamma \times \{L, R\}$
38.	1. Which of the following grammars are in Chomsky Normal Form:
Option A:	$S \rightarrow AB BC CD, A \rightarrow AB, B \rightarrow CD, C \rightarrow 2, D \rightarrow 3$
Option B:	$S \rightarrow AB, S \rightarrow BCA 0 1 2 3$
Option C:	$S \rightarrow ABa, A \rightarrow aab, B \rightarrow Ac$
Option D:	$S \rightarrow ABa, A \rightarrow AAB, B \rightarrow Ac$
39.	0. The lexical analysis for a high level language needs the power of which one of the following machine models?

Option A:	Turing Machine
Option B:	Deterministic pushdown automata
Option C:	Finite state automata
Option D:	Non-Deterministic pushdown automata
40.	Which of the following relates to 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
41.	$(r+s)^*$ is equivalent to:
Option A:	s^*r^*
Option B:	$(r^*s^*)^*$
Option C:	r^*s^*
Option D:	rs
42.	$X \rightarrow Y \alpha$ is the production rule for _____
Option A:	Regular Grammar
Option B:	Context Free Grammar
Option C:	Right Linear Grammar
Option D:	Left Linear Grammar
43	Let $L = \{ab, aa, baa\}$, then which of the following does not belong to the L^* ?
Option A:	ϵ
Option B:	abab
Option C:	abba
Option D:	aaabbaa
44.	<i>Epsilon</i> -closure of a state is a combination of self state and _____
Option A:	Initial state
Option B:	Final state
Option C:	Non-epsilon reachable state
Option D:	ϵ reachable state
45.	Number of states required to accept the string that ends with 10.
Option A:	1
Option B:	2
Option C:	3
Option D:	4
46.	The finite automata is called NFA when there exists _____ for a specific input from current state to next state.
Option A:	More than one paths
Option B:	Single path
Option C:	No path
Option D:	Infinite paths

47.	Which of the following is FALSE:
Option A:	Any given mealy machine has an equivalent moore machine.
Option B:	Any given moore machine has an equivalent mealy machine.
Option C:	Mealy and moore machines are FSM with output capability.
Option D:	Moore machine does not have an equivalent mealy machine.
48.	The transition function of deterministic finite automata is _____ and non-deterministic finite automata is _____
Option A:	$\delta: Q \times \Sigma \rightarrow Q$ $\delta: Q \times \Sigma \rightarrow 2^Q$
Option B:	$\delta: Q \times \Sigma \rightarrow Q$ $\delta: Q \times \Sigma \rightarrow Q^2$
Option C:	$\delta: Q \times \Sigma \rightarrow \{Q, \Sigma\}$ $\delta: Q \times \Sigma \rightarrow 2^Q$
Option D:	$\delta: Q \times \Sigma \rightarrow \{Q, \Sigma\}$ $\delta: Q \times \Sigma \rightarrow Q$
49.	Generation of a language using specific rule is called _____
Option A:	Optimization
Option B:	Derivation
Option C:	Analysis
Option D:	Transition
50.	In a production rule, if one non-terminal derives another non-terminal then it is called as _____
Option A:	ϵ -Production
Option B:	Null Production
Option C:	Useless Symbol
Option D:	Unit Production
51.	Which of following does not belong to 4-tuples of CFG?
Option A:	Start Symbol
Option B:	Terminal Symbol
Option C:	Non-terminal symbol
Option D:	End symbol
52.	In simplification of grammar, the variable which produces an epsilon is called _____
Option A:	terminal
Option B:	nullable
Option C:	Empty variable
Option D:	Useless symbol
53.	Which of the following productions are not accepted by Chomsky Grammar?
Option A:	$A \rightarrow ABC$
Option B:	$A \rightarrow BC$
Option C:	$A \rightarrow a$
Option D:	$A \rightarrow \epsilon$
54.	_____ is accepted by Non-deterministic PDA but not by deterministic PDA.

Option A:	Even Palindromes
Option B:	Odd Palindromes
Option C:	Equal no of a's and b's
Option D:	String ending with a particular terminal
55.	The language, $\{a^n b^n \mid n \geq 1\}$ is generated by the CFG:
Option A:	$S \rightarrow aSb \mid ab \mid \epsilon$
Option B:	$S \rightarrow aaSbb \mid \epsilon$
Option C:	$S \rightarrow aaSbb \mid aabb$
Option D:	$S \rightarrow aSb \mid ab$
56.	Transition function of Turing machine is given by:
Option A:	$Q \times \Sigma \rightarrow Q \times \Sigma \times \{L,R\}$
Option B:	$Q^* \times \Sigma \rightarrow Q \times \Sigma \times \{L,R\}$
Option C:	$Q \times \Sigma^* \rightarrow Q \times \Sigma \times \{L,R\}$
Option D:	$Q \times \Sigma \rightarrow Q^* \times \Sigma^* \times \{L,R\}$
57.	According to Chomsky hierarchy, Recursively Enumerable language comes under _____
Option A:	Type 0
Option B:	Type 1
Option C:	Type 2
Option D:	Type 3
58.	Which of the following can accept even palindrome over $\{a,b\}$?
Option A:	Deterministic Push down Automata
Option B:	Turing machine
Option C:	NFA
Option D:	DFA
59.	If L and L' are recursively enumerable, then L is
Option A:	regular
Option B:	Context sensitive
Option C:	Context free
Option D:	recursive
60.	In a compiler, keywords of a language are recognized during:
Option A:	Parsing of the program
Option B:	Code generation
Option C:	Lexical analysis of the program.
Option D:	Data flow analysis

Descriptive Questions

10 marks each
1. Explain the concepts, acceptance by final state and acceptance by empty stack of a Pushdown automata. Construct a PDA for the language, $L = \{ a^{2n}b^n \mid n \geq 1 \}$
2. 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)
3. Write a short note on Chomsky hierarchy. Convert the following grammar to Chomsky Normal Form: $S \rightarrow ABA$ $A \rightarrow aA \mid \epsilon$ $B \rightarrow bB \mid \epsilon$
4. Construct a Mealy machine and Moore 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)
5. Convert the given grammar G to CNF. $G: S \rightarrow a \mid aA \mid B \mid C, A \rightarrow aB \mid \epsilon, B \rightarrow Aa, C \rightarrow aCD \mid a, D \rightarrow ddd.$
6. Design a Turing Machine for 2's Complement of a binary number
7. Design PDA for odd length palindrome let $\Sigma = \{0, 1\}, \square = \{wcw^R\} \square h \square \square \square w \in \Sigma^*$
8. Construct DFA for given regular expression $(a+b)^* aba (a+b)^*$
9. Design Turing Machine to accept language $L = \{ a^n b^n c^n \mid n \geq 1 \}$
10. Consider the following grammar $S \rightarrow aB \mid bA$ $A \rightarrow a \mid aS \mid bAA$ $B \rightarrow b \mid bS \mid aBB$ with S as start symbol ,find Left most derivation, Right most derivation and parse tree for the string 'bbaaabbaba'.
11. Construct Turing Machine accepting palindromes over $\Sigma = \{a,b\}$

5 marks each

1. Give formal definition of NFA. Construct a DFA equivalent to the NFA: $(\{p, q, r, s\}, \{0,1\}, \delta, p, \{q,s\})$, where ' δ ' is given by:

$Q \quad \Sigma$	0	1
$\rightarrow p$	q,r	q
q^*	r	q,r
r	s	p
s^*	--	p

2. 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.

3. Give regular expression for

a. All strings containing an even number of 0's over the alphabet $\{0,1\}$

b. All strings that do not end with 'ab' over the alphabet $\{a,b\}$

4. Construct a DFA that reads a strings made up of $\{0,1\}$ and accepts only those strings which end in either '00' or '11'. (transition table and diagram both are expected)

5. Briefly explain the types of Turing Machine.

6. Construct a Context-free grammar equivalent to the following Push Down Automata (described with the help of the given set of equations):

$\delta (q_0, b, Z_0) = \{(q_0, ZZ_0)\}$

$\delta (q_0, \epsilon, Z_0) = \{(q_0, \epsilon)\}$

$\delta (q_0, b, Z) = \{(q_0, ZZ)\}$

$\delta (q_0, a, Z) = \{(q_1, Z)\}$

$\delta (q_1, b, Z) = \{(q_0, \epsilon)\}$

$\delta (q_1, a, Z_0) = \{(q_0, Z_0)\}$

7. Construct DFA to accept strings that ends with substring 110 for $\Sigma = \{0,1\}$

8. Design a Moore machine which counts the occurrence of substring bab in an input string for $\Sigma = \{a, b\}$.

<p>9. Give Regular Expressions for</p> <p style="padding-left: 40px;">i) For all strings over a,b which contains exactly 3 occurrence of b over $\Sigma=\{a,b\}$</p> <p style="padding-left: 40px;">ii) For all strings over 0,1 that starts with 10 and ends with 01</p>
<p>10. Let G be the grammar having the following set of production.</p> <p>$S \rightarrow ABA$,</p> <p>$A \rightarrow aA \mid bA \mid$</p> <p>$B \rightarrow bbb$</p> <p>Find LMD and RMD for string “ababbbba”</p>
<p>11. Write Short Note on Chomsky Hierarchy</p>
<p>12. Compare and Contrast between FA, PDA and TM</p>
<p>13. Give Regular Expression for a language over the alphabet $\Sigma=\{a,b\}$ containing at most two a's</p>
<p>14. Convert Following CFG grammar into CNF</p> <p>$Sa \rightarrow AbB$</p> <p>$A \rightarrow Aa \mid a$</p> <p>$B \rightarrow bB \mid b$</p>
<p>15. Design PDA to check well formedness of parenthesis.</p>
<p>16. Design a Moore Machine for binary adder</p>
<p>17. State and explain closure properties of regular languages</p>
<p>18. Differentiate between Moore and Mealy machine</p>