Sample Questions

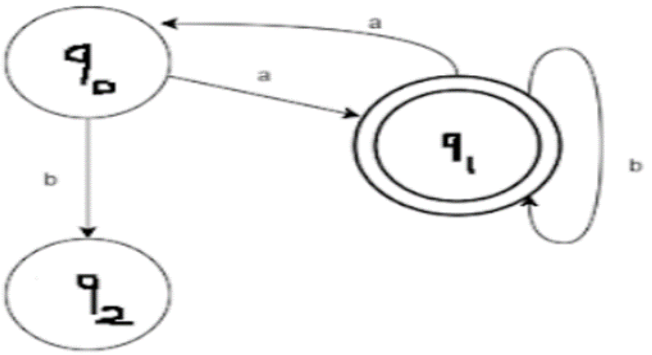
Information Technology

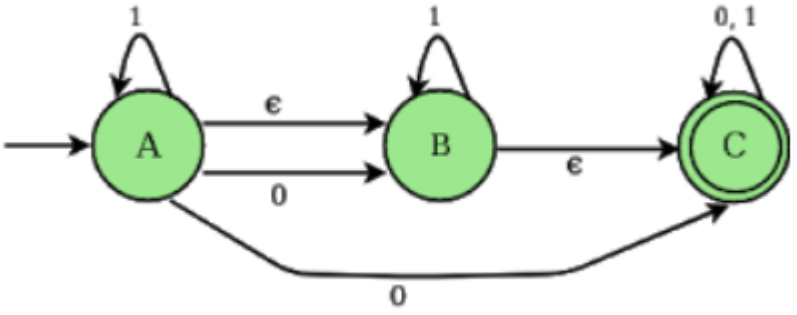
Subject Name: Automata Theory **Course Code**: ITC404

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 $\sum$ ={} 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

	
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 -> aSa S->bSb S->a S->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:	∑
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 →aB
Option B:	A →BC
Option C:	A → B
Option D:	A →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 δ (q1,a,a) = (q_r, ε) 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→AB0 A→001 B→A1
Option A:	3
Option B:	4

Option C:	2
Option D:	5
37.	Next move function δ of a Turing machine M = (Q, Σ , Γ, δ, q0, 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→AB|BC|CD, A→AB B→CD, C→2, D→3
Option B:	S→AB, S→BCA|0|1|2|3
Option C:	S→ABa, A→aab, B→Ac
Option D:	S→ABa, A→AAB, B→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→Y |α 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.	*Epsilon*-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:	$\delta: Q \times \sum \rightarrow Q$ $\delta: Q \times \sum \rightarrow 2^{Q}$
Option B:	$\delta: Q \times \sum \rightarrow Q$ $\delta: Q \times \sum \rightarrow Q^{2}$
Option C:	$\delta: Q \times \sum \rightarrow \{Q,\sum\}$ $\delta: Q \times \sum \rightarrow 2^{Q}$
Option D:	$\delta: Q \times \sum \rightarrow \{Q,\sum\}$ $\delta: Q \times \sum \rightarrow Q$
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→ABC
Option B:	A→BC
Option C:	A→a
Option D:	A→ ε

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, $\{a^n b^n \mid n>=1\}$ is generated by the CFG:
Option A:	$S \rightarrow aSb \mid ab \mid \varepsilon$
Option B:	$S \rightarrow aaSbb \mid \varepsilon$
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:	$Q \times \sum \rightarrow Q \times \sum \times \{L,R\}$
Option B:	$Q^* \times \sum \rightarrow Q \times \sum \times \{L,R\}$
Option C:	$Q \times \sum^* \rightarrow Q \times \sum \times \{L,R\}$
Option D:	$Q \times \sum \rightarrow Q^* \times \sum^* \times \{L,R\}$
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:	NDFA
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→ABA

A→ aA | ε
B→bB | ε

4. Construct a Mealy machine and Moore 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)

5. Convert the given grammar G to CNF. G: S → a | aA | B |C , A → aB | ε , B →Aa, C →aCD | a, D → ddd.

6. Design a Turing Machine for 2's Complement of a binary number

7. Design PDA for odd length palindrome let Σ = {0, 1}, $L = \{wcw^R\}$ *where* w ϵ Σ *

8. Construct DFA for given regular expression (a+b)* aba (a+b)*

9. Design Turing Machine to accept language L={ $a^n b^n c^n$ | n≥1}

10. Consider the following grammar
S→ aB | bA
A→ a | aS | bAA
B→ b | bS | 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 Σ={a,b}

5 marks each

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

Q \ ∑	0	1
→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→aAS | a A→SbA | SS | 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): $\delta(q_0, b, Z_0) = \{(q_0, ZZ_0)\}$ $\delta(q_0, \varepsilon, Z_0) = \{(q_0, \varepsilon)\}$ $\delta(q_0, b, Z) = \{(q_0, ZZ)\}$ $\delta(q_0, a, Z) = \{(q_1, Z)\}$ $\delta(q_1, b, Z) = \{(q_0, \varepsilon)\}$ $\delta(q_1, a, Z_0) = \{(q_0, Z_0)\}$
7. Construct DFA to accept strings that ends with substring 110 for Σ={0,1}
8. Design a Moore machine which counts the occurrence of substring bab in an input string for Σ = {a, b}.
9. Give Regular Expressions for i) For all strings over a,b which contains exactly 3 occurrence of b over Σ={a,b} ii) For all strings over 0,1 that starts with 10 and ends with 01
10. Let G be the grammar having the following set of production. S→ABA, A→aA | bA | B→bbb Find LMD and RMD for string “ababbbba”
11. Write Short Note on Chomsky Hierarchy
12. Compare and Contrast between FA, PDA and TM
13. Give Regular Expression for a language over the alphabet Σ={a,b} containing at most two a’s
14. Convert Following CFG grammar into CNF Sa→AbB A→Aa|a B→bB|b

15. Design PDA to check well formedness of parenthesis.
16. Design a Moore Machine for binary adder
17. State and explain closure properties of regular languages
18. Differentiate between Moore and Mealy machine