

Course Title: FORMAL LANGUAGES AND AUTOMATION THEORY

Time Allowed: 3 hrs

Max. Marks: 60

Read the following instructions carefully before attempting the question paper.

1. Match the Paper Code shaded on the OMR Sheet with the Paper code mentioned on the question paper and ensure that both are the same.
2. This question paper contains 60 questions of 1 mark each. 0.25 marks will be deducted for each wrong answer.
3. All questions are compulsory.
4. Do not write or mark anything on the question paper except your registration no. on the designated space.
5. Submit the question paper and the rough sheet(s) along with the OMR sheet to the invigilator before leaving the examination hall.

Q. 1 Which of the following is false for an abstract machine?

- a) Turing machine
b) theoretical model of computer
c) assumes a discrete time paradigm
d) all of the mentioned
- L6 CO4

Q. 2 Fill in the blank with the most appropriate option.

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Statement: In theory of computation, abstract machines are often used in _____ regarding computability or to analyze the complexity of an algorithm.

- ~ a) thought experiments b) principle c) hypothesis d) all of the mentioned

Q. 3 The following move of a PDA is on the basis of:

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a) Present state b) Input Symbol c) Present state and Input Symbol d) None of the mentioned

Q. 4 Halting states are of two types. They are:

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a) Accept and Reject b) Reject and Allow c) Start and Reject d) None of the mentioned

Q. 5 If d is not defined on the current state and the current tape symbol, then the machine _____.

- Q. 5 If d is not defined on the current state and the current tape symbol, then the Turing machine _____
- a) does not halts b) halts c) goes into loop forever d) none of the mentioned
- L6 CO4

Q. 6 Suppose $A \rightarrow xBz$ and $B \rightarrow y$, then the simplified grammar would be:

- Q. 6 Suppose $A \rightarrow xBz$ and $B \rightarrow y$, then the simplified grammar would be:
 a) $A \rightarrow xyz$ b) $A \rightarrow xBzxyz$ c) $A \rightarrow xBz|B|y$ d) none of the mentioned

Q. 7 Given grammar G:

$$S \rightarrow aS \mid A \mid C$$
 $A \rightarrow B$

B->aa

$$C \rightarrow aCb$$

$C \rightarrow aCb$
Find the set of variables that can produce strings only with the set of terminals.

- a) {C} b) {A,B} -c) {A,B,S} d) None of the mentioned L4 CO5

Q. 8 Given grammar:

$$S \rightarrow aS \mid A$$

A → B

B->aa

B->aa
Find the number of variables reachable from the Starting Variable?

- a) 0
b) 1
c) 2
d) None of the mentioned

Q. 9 The most suitable data structure used to represent the derivations in compiler:
b) Linked List

- Q. 9 The most suitable data structure used to represent a graph is _____
- a) Queue
b) Linked List
c) Tree
d) Hash Tables
- L4 CO5

Q. 10 Let $w = xyz$ and y refers to the middle portion and $|y| > 0$. What do we call the process of repeating y 0 or more times before checking that they still belong to the language L or not?

a) Pumping b) Producing c) None of the mentioned L4 CO5

- Q. 10 Let $w = xyz$ and y belong to the language L or not?
before checking that they still belong to the language L or not?
a) Generating b) Pumping c) Producing d) None of the mentioned

Q. 11 Fill in the blank in terms of p , where p is the maximum string length in L .
_____ languages trivially satisfy the pumping lemma by having $n =$ _____

Q. 11 Fill in the blank in terms of p , where p is the maximum length of the strings in the language. Statement: Finite languages trivially satisfy the pumping lemma by having $n =$ _____
 a) p b) $p+1$ c) $p-1$ d) None of the mentioned

- Statement: Finite languages are trivially decidable.
 a) p^*1 b) $p+1$ c) $p-1$ d) None of the mentioned

- Q. 12 Let w be a string and fragmented by three variable x , y , and z as per pumping lemma. What does these variables represent?
- a) string count
 - b) string
 - c) string count and string
 - d) none of the mentioned
- L4 CO5
- Q. 13 For the expression $E^*(E)$ where $*$ and brackets are the operation, number of nodes in the respective parse tree are:
- a) 6
 - b) 7
 - c) 5
 - d) 2
- L4 CO5
- Q. 14 Which among the following is the root of the parse tree?
- a) Production P
 - b) Terminal T
 - c) Variable V
 - d) Starting Variable S
- L4 CO5
- Q. 15 The decision problem is the function from string to _____.
- a) char
 - b) int
 - c) boolean
 - d) none of the mentioned
- L2 CO6
- Q. 16 Which among the following are undecidable theories?
- a) The first order theory of boolean algebra
 - b) The first order theory of Euclidean geometry
 - c) The first order theory of hyperbolic geometry
 - d) The first order theory of the natural number with addition, multiplication, and equality
- L2 CO6
- Q. 17 A language L is said to be _____ if there is a turing machine M such that $L(M)=L$ and M halts at every point.
- a) Turing acceptable
 - b) decidable
 - c) undecidable
 - d) none of the mentioned
- L2 CO6
- Q. 18 The language accepted by a turing machine is called _____.
- a) Recursive Enumerable
 - b) Recursive
 - c) Recursive Enumerable and Recursive
 - d) None of the mentioned
- L2 CO6
- Q. 19 Decidable can be taken as a synonym to:
- a) recursive
 - b) non recursive
 - c) recognizable
 - d) none of the mentioned
- L2 CO6
- Q. 20 The problems which have no algorithm, regardless of whether or not they are accepted by a turing machine that fails to halts on some input are referred as:
- a) Decidable
 - b) Undecidable
 - c) Computable
 - d) None of the mentioned
- L2 CO6
- Q. 21 There are _____ tuples in finite state machine.
- a) 4
 - b) 5
 - c) 6
 - d) unlimited
- L2 CO1
- Q. 22 The complement of a language will only be defined when and only when the _____ over the language is defined.
- a) String
 - b) Word
 - c) Alphabet
 - d) Grammar
- L2 CO1
- Q. 23 Which among the following is not notated as infinite language?
- a) Palindrome
 - b) Reverse
 - c) Factorial
 - d) $L=\{ab\}^*$
- L2 CO1
- Q. 24 Let $u='1101'$, $v='0001'$, then $uv=11010001$ and $vu=00011101$. Using the given information what is the identity element for the string?
- a) u^{-1}
 - b) v^{-1}
 - c) $u^{-1}v^{-1}$
 - d) ϵ
- L2 CO1
- Q. 25 How many languages are over the alphabet R ?
- a) countably infinite
 - b) countably finite
 - c) uncountable finite
 - d) uncountable infinite
- L2 CO1
- Q. 26 A language is regular if and only if
- a) accepted by DFA
 - b) accepted by PDA
 - c) accepted by LBA
 - d) accepted by Turing machine
- L4 CO2
- Q. 27 How many strings of length less than 4 contains the language described by the regular expression $(x+y)^*y(a+ab)^*$?
- a) 7
 - b) 10
 - c) 12
 - d) 11
- L4 CO2
- Q. 28 Which of the following is true?

- c) $(0+1)^*01(0+1)^*+1^*0^* = (0+1)^*$ d) All of the mentioned L4 CO2
- Q. 29 Regular expression are
 a) Type 0 language b) Type 1 language c) Type 2 language d) Type 3 language L4 CO2
- Q. 30 Which of the following is true?
 a) Every subset of a regular set is regular b) Every finite subset of non-regular set is regular
 c) The union of two non regular set is not regular d) Infinite union of finite set is regular L4 CO2
- Q. 31 The entity which generate Language is termed as:
 a) Automata b) Tokens c) Grammar d) Data L4 CO5
- Q. 32 Which of the following statement is false?
 a) Context free language is the subset of context sensitive language
 b) Regular language is the subset of context sensitive language
 c) Recursively enumerable language is the super set of regular language
 d) Context sensitive language is a subset of context free language L4 CO5
- Q. 33 Which among the following cannot be accepted by a regular grammar?
 a) L is a set of numbers divisible by 2 b) L is a set of binary complement
 c) L is a set of string with odd number of 0 d) L is a set of 0^n1^n L4 CO5
- Q. 34 The Grammar can be defined as: $G=(V, \Sigma, p, S)$
 In the given definition, what does S represents?
 a) Accepting State b) Starting Variable c) Sensitive Grammar d) None of these L4 CO5
- Q. 35 For a DFA accepting binary numbers whose decimal equivalent is divisible by 4, what are all the possible remainders?
 a) 0 b) 0,2 c) 0,2,4 d) 0,1,2,3 L2 CO1
- Q. 36 Which of the following is not a notion of Context free grammars?
 a) Recursive Inference b) Derivations c) Sentential forms d) All of the mentioned L5 CO3
- Q. 37 Which of the following is/are the suitable approaches for inferencing?
 a) Recursive Inference b) Derivations
 c) Recursive Inference and Derivations d) None of the mentioned L5 CO3
- Q. 38 If w belongs to $L(G)$, for some CFG, then w has a parse tree, which defines the syntactic structure of w. w could be:
 a) program b) SQL-query c) XML document d) All of the mentioned L5 CO3
- Q. 39 $A \rightarrow aA \mid a \mid b$ The number of steps to form aab:
 a) 2 b) 3 c) 4 d) 5 L5 CO3
- Q. 40 An expression is mentioned as follows. Figure out number of incorrect notations or symbols, such that a change in those could make the expression correct.
 $L(G) = \{w \mid w \in T^* \mid S \rightarrow^* w\}$
 a) 0 Errors b) 1 Error c) 2 Error d) Invalid Expression L5 CO3
- Q. 41 Which of the following the given language belongs to?
 $L = \{a^m b^n c^m \mid m \geq 1\}$
 a) Context free language b) Regular language
 c) Context free language & Regular language d) None of the mentioned L5 CO3
- Q. 42 Which of the following statements are correct for a concept called inherent ambiguity in CFL?
 a) Every CFG for L is ambiguous b) Every CFG for L is unambiguous
 c) Every CFG is also regular d) None of the mentioned L5 CO3
- Q. 43 Which of the theorem defines the existence of Parikh's theorem?
 a) Parikh's theorem b) Jacobi theorem c) AF+BG theorem d) None of the mentioned L5 CO3
- Q. 44 Choose the correct option:
 Statement: There exists two Inference approaches: Recursive Inference & Derivation
 a) true b) partially true c) false d) none of the mentioned L5 CO3

8. $x^* a b x$ and w denotes terminal

- a) $w^* w$ b) $w^* S w$
c) Equal number of a's and b's d) None of the mentioned

L5 CO3

Q. 46 If L_1 and L_2 are context free languages, which of the following is context free?

- a) L_1^* b) $L_2 \cup L_1$ c) $L_1 \cdot L_2$ d) All of the mentioned

L4 CO5

Q. 47 For the given Regular expression, the minimum number of variables including starting variable required to derive its grammar is:

- (011+1)*(01)*
a) 4 b) 3 c) 5 d) 6

L4 CO5

Q. 48 A grammar $G=(V, T, P, S)$ is _____ if every production taken one of the two forms:

$B \rightarrow aC$

$B \rightarrow a$

- a) Ambiguous b) Regular c) Non Regular d) None of the mentioned

L4 CO5

Q. 49 Which among the following is a CFG for the given Language:

$L = \{x \in \{0,1\}^* \mid \text{number of zeroes in } x = \text{number of one's in } x\}$

a) $S \rightarrow \epsilon \mid 0S1 \mid 1S0 \mid SS$

b) $S \rightarrow 0B \mid 1A \mid \epsilon$

$A \rightarrow 0S$

$B \rightarrow 1S$

- c) All of the mentioned
d) None of the mentioned

L4 CO5

Q. 50 Which of the following languages are most suitable for implement context free languages?

- a) C b) Perl c) Assembly Language d) None of the mentioned

L4 CO5

Q. 51 A push down automaton employs _____ data structure.

- a) Queue b) Linked List c) Hash Table d) Stack

L6 CO4

Q. 52 Which of the following allows stacked values to be sub-stacks rather than just finite symbols?

- a) Push Down Automaton b) Turing Machine c) Nested Stack Automaton d) None of the mentioned

L6 CO4

Q. 53 A non deterministic two way, nested stack automaton has n -tuple definition. State the value of n .

- a) 5 b) 8 c) 4 d) 10

L6 CO4

Q. 54 Push down automata accepts _____ languages.

- a) Type 3 b) Type 2 c) Type 1 d) Type 0

L6 CO4

Q. 55 Which of the operations are eligible in PDA?

- a) Push b) Delete c) Insert d) Add

L6 CO4

Q. 56 A string is accepted by a PDA when

- a) Stack is not empty b) Acceptance state c) All of the mentioned d) None of the mentioned

L6 CO4

Q. 57 A turing machine operates over:

- a) finite memory tape b) infinite memory tape c) depends on the algorithm d) none of the mentioned

L6 CO4

Q. 58 Which of the problems were not answered when the turing machine was invented?

- a) Does a machine exists that can determine whether any arbitrary machine on its tape is circular.
b) Does a machine exists that can determine whether any arbitrary machine on its tape is ever prints a symbol
c) Hilbert Entscheidungs problem
d) None of the mentioned

L6 CO4

Q. 59 Turing machine can be represented using the following tools:

- a) Transition graph b) Transition table c) Queue and Input tape d) All of the mentioned

L6 CO4

Q. 60 The ability for a system of instructions to simulate a Turing Machine is called _____.

- a) Turing Completeness b) Simulation c) Turing Halting d) None of the mentioned

L6 CO4

--- End of Question Paper---