EPT-TEST-9 (TOC)
25 Questions
60 Minutes

Q1:
MSQ – 1 MARK
Concept Field : Uncountable
Previous year question : No
Question level : Medium
Positive and Negative mark : 1 / 0.33

Given ∑ = {a, b}, which of the following sets is not countable ?
(A) Set of all strings over ∑
(B) Set of all languages over ∑
(C) Set of all non-regular languages over ∑
(D) Set of all languages over ∑ accepted by Turing machines

Q2:
NAT – 2 MARKS
Concept Field : Finite Automata
Previous year question : No
Question level : Medium
Positive and Negative mark : 2 / 0.66

Consider the regular expression (0+1)(0+1)… 26 times. The minimum state finite automaton that recognizes the language represented by this regular expression contains —------ States.

Q3:
MCQ – 1 MARK
Concept Field : Context Free Languages
Question level : Medium
Positive and Negative mark : 1 / 0.33

Consider the following languages:

L1 = {a^nb^mc^n : m, n >= 1}

L2 = {a^nb^nc^2n : n >= 1}

Which one of the following is TRUE?

(A) Both L1 and L2 are context-free.

(B) L1 is context-free while L2 is not context-free.

(C) L2 is context-free while L1 is not context-free.

(D) Neither L1 nor L2 is context-free.

Q4:
MCQ – 1 MARK
Concept Field : Finite Automata
Question level : Medium
Positive and Negative mark : 1 / 0.33

Let T be the language represented by the regular expression Σ^*00110Σ^* where Σ = {0, 1}. What is the minimum number of states in a DFA that recognizes L' (complement of L)?

(A) 4

(B) 5

(C) 6

(D) 8

Q5:
NAT – 2 MARKS
Sub concept : Finite Automata
Concept Field : Number of states finding
Question level : Medium
Expected time to solve : 90 Seconds
Positive and Negative mark : 2/ 0.66

For an arbitrary CFG G, there exist an algorithm

a) to check if L(G) contain infinite or not

b) to check which variable appear in some sentential form

c) to check which variable are nullable

d) to check which variable are useless

e) to check string w is member of L(G) or not

f) to check L(G) is regular or not

g) to check if L(G) is empty or not

Number of statements correct is —---

Q6:
MCQ – 2 MARKS
Sub concept : Finite Automata
Concept Field : Number of states finding
Question level : Medium
Expected time to solve : 90 Seconds

Positive and Negative mark : 2/ 0.66

Let k>=2, let L be the set of strings in (0,1)* such that x belongs to L if the number of 0's in x is divisible by 2k and the number of 1's in x is odd. The minimum number of states in a deterministic finite automata (DFA) that recognizes L' (complement of L) is

(a) 2k+2
(b) 2k
(c) 4k
(d) 2^k

Q7:
MCQ – 2 MARKS
Sub concept : Finite Automata
Concept Field : Number of states finding
Question level : Medium
Expected time to solve : 90 Seconds
Positive and Negative mark : 2/ 0.66

Definition of a language L with the alphabet {a} is given as follows.
L= { a^{nk} | k > 0, n > 0 }
What is the minimum number of states needed in a DFA to recognize L?

(A) k+1
(B) n+1

(C) 1
(D) 2

Q8:
MCQ – 1 MARKS
Sub concept : Finite Automata
Concept Field : Number of states finding
Question level : Medium
Expected time to solve : 90 Seconds
Positive and Negative mark : 1/ 0.33

If L1 is regular and (L1 union L2) is always Regular, then what can be L2 ?

A)need not be Regular

B)should be Regular

C)should be CFG

D)None

Q9:
MCQ – 1 MARKS
Sub concept : Finite Automata
Concept Field : Number of states finding
Question level : Medium
Expected time to solve : 90 Seconds
Positive and Negative mark : 1/ 0.33

Which of the following statements is/are FALSE?

1.For every non-deterministic Turing machine, there exists an equivalent deterministic Turing machine.
2. Turing recognizable languages are closed under union and complementation.
3. Turing decidable languages are closed under intersection and complementation.
4. Turing recognizable languages are closed under union and intersection.
(A) 1 and 4 only
(B) 1 and 3 only
(C) 2 only
(D) 3 only

Q10:

NAT – 2 MARKS

Concept Field : Finite Automata
Previous year question : No
Question level : Medium
Positive and Negative mark : 2/ 0.66

Consider the language L given by the regular expression $(a+b)^*b(a+b)(a+b)$ over the alphabet {a,b}. The smallest number of states needed in a deterministic finite-state automaton (DFA) accepting L is ___________

Q11:
MCQ – 2 MARK
Concept Field : Theory Of Computation
Question level : Medium
Question is based on : Concept
Positive and Negative mark : 2 / 0.66

Consider the context-free grammars over the alphabet {a,b,c} given below. S and T are non-terminals.

G1: $S \to aSb \mid T,\ T \to cT \mid \epsilon$
G2: $S \to bSa \mid T,\ T \to cT \mid \epsilon$
The language $L(G1) \cap L(G2)$ is

A. Finite
B. Not finite but regular
C. Context-Free but not regular
D. Recursive but not context-free

Q12:
MCQ – 1 MARK
Concept Field : Theory Of Computation
Previous year question : No
Question level : Medium
Positive and Negative mark : 1 / 0.33

Which of the following problems are undecidable?

A. Membership problem in context-free languages.

B. Whether a given context-free language is regular.
C. Whether a finite state automation halts on all inputs.
D. Membership problem for type 0 languages.

Q13:
MCQ – 1 MARK
Concept Field : Theory Of Computation
Previous year question : No
Question level : Medium
Positive and Negative mark : 1 / 0.33

Which one of the following is not decidable?

A. Given a Turing machine M, a string s and an integer k, M accepts s within k steps
B. Equivalence of two given Turing machines
C. Language accepted by a given finite state machine is not empty
D. Language generated by a context free grammar is non-empty

Q14:
NAT – 2 MARKS
Concept Field : Theory Of Computation

Previous year question : No
Question level : Medium
Positive and Negative mark : 2/ 0.66

Which of the following statements is false?

A. **The Halting Problem of Turing machines is undecidable**
B. **Determining whether a context-free grammar is ambiguous is undecidable**
C. **Given two arbitrary context-free grammars G1 and G2 it is undecidable whether L(G1)=L(G2)**
D. **Given two regular grammars G1 and G2 it is undecidable whether L(G1)=L(G2)**
E. **Given Turing machine prints a specific letter is decidable**
F. **Given a Turing machine computes the products of two numbers is decidable.**

Number of correct statements are—------

Q15:
NAT – 2 MARKS
Concept Field : Theory Of Computation
Previous year question : No
Question level : Medium
Positive and Negative mark : 2/ 0.66

Consider the following languages over the alphabet Σ={a,b,c}.

1. $L_1=\{a^nb^nc^m \mid m,n\geq 0\}$
2. $L_2=\{a^mb^nc^n \mid m,n\geq 0\}$.
3. $L_1 \cup L_2$
4. $L_1 \cap L_2$

Number of statements which are context-free languages are —--

Q16:

NAT – 1 MARK

Concept Field : Number of states finding

Previous year question : No

Question level : Medium

Positive and Negative mark : 1/ 0.33

L={ XYZ / X= {a,b}, Y = (a+b)^*, Z = {b} }

The number of states present in minimal dfa of the language is —----

Q17:

NAT– 2 MARKS

Concept Field : Number of states finding

Previous year question : No

Question level : Medium

Positive and Negative mark : 2 / 0.66

The minimum number of states in an equivalent finite automata for the regular expression (a(a(a(a(a(ab)*b)*b)*b)*b)*b)* are _____

Q18:
MCQ – 2MARKS
Concept Field : NFA to DFA Construction
Previous year question : No
Question level : Medium
Positive and Negative mark : 1 / 0.33

Consider an NFA with 6 states, what will be the minimum number of states in a corresponding converted DFA.

A)1 B) 6 C) 64 D) None

Q19:
NAT – 1 MARKS
Concept Field : NFA to DFA Construction
Previous year question : No
Question level : Medium
Positive and Negative mark : 1 / 0.33

Construct a finite state machine with minimum number of states, accepting all strings over (a,b) such that the number of a's is divisible by two and the number of b's is not divisible by three.

Q20:
MSQ– 2 MARKS
Concept Field : NFA to DFA Construction
Previous year question : No
Question level : Medium
Positive and Negative mark : 2 / 0.66

Which of the following sets can be not recognized by a Deterministic Finite-state Automaton?

(A) The number 1, 2, 4, 8……,2^n,………. written in binary.

(B) The number 1, 2, 4,….., 2^n,………. written in unary.

(C) The set of binary strings in which the number of zeros is the same as the number of ones.

(D) The set {1, 101, 11011, 1110111,…….}

Q21:
MSQ– 1 MARKS

Concept Field : NFA to DFA Construction
Previous year question : No
Question level : Medium
Positive and Negative mark : 1 / 0.33

Which of the following are decidable?

A) Whether the intersection of two regular languages is infinite
B) Whether a given context-free language is regular
C) Whether two push-down automata accept the same language
D) Whether a given grammar is context-free

Q22:

Let L1 be the language represented by the regular expression b*ab*(ab*ab*)* and L2 = { w ∈ (a+b)* | |w| <= 4}, where |w| denotes the length of string w. The number of strings in L2 which are also in L1 is

(A) 12

(B) 18

(C) 15

(D) 24

Q23:

MCQ – 2 MARK

Concept Field : Theory Of Computation

Question level : Medium

Question is based on : Concept
Positive and Negative mark : 2 / 0.66

Which one of the following regular expressions represents the language: the set of all binary strings having two consecutive 0s and two consecutive 1s?

(A) $(0+1)^*0011(0+1)^*+(0+1)^*1100(0+1)^*$
(B) $(0+1)^*(00(0+1)^*11+11(0+1)^*00)(0+1)^*$
(C) $(0+1)^*00(0+1)^*+(0+1)^*11(0+1)^*$
(D) $00(0+1)^*11+11(0+1)^*00$

(A) A

(B) B

(C) C

(D) D

Explanation: Option A represents those strings which either have 0011 or 1100 as substring.

Option C represents those strings which either have 00 or 11 as substring.

Option D represents those strings which start with 11 and end with 00 or start with 00 and end with 11.

Q24:

MCQ – 2 MARK

Concept Field : Theory Of Computation

Question level : Medium

Question is based on : Concept

Positive and Negative mark : 2 / 0.66

Consider the following expression

r = 0* + 1*

s = 01* + 10*

number of strings of length less than or less than equal to 5 which are neither in r nor in s is/are

(A)34

(B)63

(C)64

(D)44

Q25:

MSQ – 2 MARK
Concept Field : Theory Of Computation
Question level : Medium
Question is based on : Concept
Positive and Negative mark : 2 / 0.66

Consider a context-free grammar G with the following 3 rules.

S -> aS, S -> aSbS, S -> c

Let w ∈ L(G). Let na(W), nb(W), nc(W) denote the number of times a,b,c occur in w, respectively. Which of the following statements is/are TRUE?

(A)

na (W) > nb (W)

(B)

na (W) > nc (W) – 2

(C)

nc (W) = nb (W) + 1

(D)

nc (W) = nb (W) * 2

Q1:Answer : B, C

Set of all languages over ∑ not countable
Set of all non-regular languages over ∑ not countable

Q2:Answer : 27

Because of finite automata we should take nfa, so the number of states in nfa for this language is 27.

Q3:Answer : B

For L1 cfg possible but for L2 no cfg.
Q4:Answer : C

No need of dead state, so 6 states will be there in DFA.

Q5:Answer: 5

Other than statement f remaining all are correct

Q6:Answer: c

Dfa contain 4k(2K * 2) states so complemented dfa also contain 4k states

Q7:Answer: D

This language contains all strings other than null string.

Q8:Answer: B

Q9:Answer: C

Recursive enumerable languages are not closed under complement . while recursive languages are.

Both Recursive and Recursively enumerable languages are closed under intersection, union, and kleene star.

Note: Turing decidable language means Recursive language and Turing recognizable language mean recursive enumerable language.

Q10:Answer: 8

Minimal DFA from the right hand side 3rd symbol is b will take 8 states.

Q11:Answer: B

Since while intersection all strings produced by production aSb in G1 and bSa in G2 will be 0, So only common production will be:

$S \to T, \quad T \to cT \mid \epsilon$

Which is nothing but c^* hence it is REGULAR and INFINITE

So, option is (B).

Q12:Answer: B, D

A. **Decidable.**
B. **Undecidable [Regularity is decidable till DCFL class]**
C. **Decidable**
D. **Undecidable [undecidable for RE or semi-decidable]**

Q13:Answer: Option B. Equivalence of two TMs is undecidable.

Option (A) is not a halting problem. In Halting problem no. of steps can go up to infinity and that is the only reason why it becomes undecidable. In (A) the number of steps is restricted to a finite number 'k' and simulating a TM for 'k' steps is trivially decidable because we just go to step k and output the answer.

For Options (C) and (D) we do have well defined algorithms making them decidable.

Q14:Answer: 3

A,B,C are correct, remaining wrong.

Q15:Answer: 3

1,2,3 are cfl but not 4

Q16:

Answer: 3 states, No need of dead state.

Q17:

Answer: 7

Because of nfa no need of dead state.

Q18:

Answer: A

Minimum number of states are 1, maximum number of nodes are 64,

so the answer is 1.

Q19:Answer: 6

Q20:Answer: B,C,D

Only A possible, Starting with 1 and followed by any number of 0's

Q21:Answer: A, D

Q22: Answer: (C)

Consider the expression given in question:

L1: b*ab*(ab*ab*)*

L2: (w ∈ (a+b)* | |w| <= 4}

Consider string of

Length 1: Possible cases – 1 [a]

Length 2: Possible cases – 2 [ba, ab]

Length 3: Possible Cases – 4 [bba, abb, bab, aaa]

Length 4: Possible cases = (a:1) – 4 and (a:3) – 4 – Total (8)

Hence, the total number of strings that are in L2 and also in L1 are 8 + 4 + 2 + 1 = 15.

Hence, C is the correct option.

Q23: Answer: (B)

Q24: Answer: (D)

Explanation:

r = 0* + 1*

s = 01* + 10*

Total possible string up to 5 length = 25+1 –1 = 63

0 length strings = 1 = null

1 length strings = 2 = 0,1

2 length strings = 4 = 00, 01, 10, 11

3 length strings = 2 + 2 = 000,100,011,111

4 length strings = 2 + 2 = 0000, 0111, 1000,1111

5 length strings = 2 + 2 = 00000,01111,10000,11111

Strings which are not present in both expression

= 63 19

= 44

Q25: Answer: (B) (C)