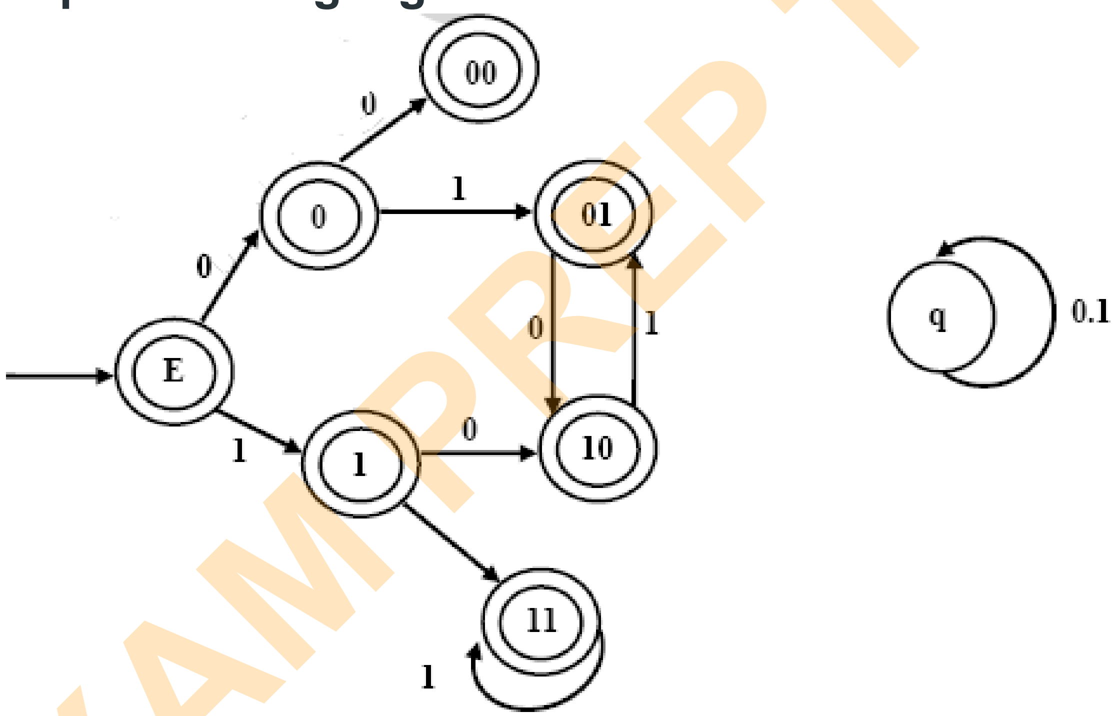
EPT-TEST-35(TOC)
Total Questions: 15
Time: 45 minutes

Q1. Consider the set of strings on {0,1} in which every substring of 3 symbols has at most two zeros. For example, 001110 and 011001 are in the language, but 100010 is not. All strings of length less than 3 are also in the language. A partially completed DFA that accepts this language is shown below.



The missing arcs in the DFA are

(A)

	00	01	10	11	q
00	1	0			
01				1	
10	0				
11			0		

(B)

	00	01	10	11	q
00		0			1
01		1			
10				0	
11		0			

(C)

	00	01	10	11	q
00		1			0
01		1			
10			0		
11		0			

(D)

	00	01	10	11	q
00		1			0
01				1	
10	0				
11			0		

Q2. Let k>=2, let L be the set of Q2. strings in (0,1)* such that x belongs to L if the number of 0's in x is divisible by k and the number of 1's in x is odd. The minimum number of states in a deterministic finite automata (DFA) that recognizes L is

(a) k+2

(b) 2k

(c) k log k

(d) 2^k

Q3. Let $L \subseteq \{0,1\}^*$ be an arbitrary regular language accepted by a minimal DFA with k states. Which one of the following languages must necessarily be accepted by a minimal DFA with k states?

A. $L - \{01\}$

B. $L \cup \{01\}$

C. $\{0,1\}^* - L$

D. $L \cdot L$

Q4. Which one of the following languages over $\sum = \{a, b\}$ is NOT context-free?
(A) $\{a^n b^i \mid i \in \{n, 3n, 5n\}, n \geq 0\}$
(B) $\{wa^n w^R b^n \mid w \in \{a, b\}^*, n \geq 0\}$
(C) $\{ww^R \mid w \in \{a, b\}^*\}$
(D) $\{wa^n\, b^n\, w^R \mid w \in \{a, b\}^*, n \geq 0\}$

Q5. Let L = {w|w contains an equal number of occurrences of 01 & 10}. Then number of states in min-DFA for the language L is ----------(NAT)

Q6. A minimum state deterministic finite automaton accepting the language L={w | w ε {0,1} * & w equivalent decimal value divisible by 5}
(A) 5 states
(B) 2 states
(C) 10 states
(D) 9 states

Q7.

Consider the following languages:

$L_1 = \{a^n b^m c^{n+m} : m, n \geq 1\}$

$L_2 = \{a^n b^n c^{2n} : n \geq 1\}$

Which one of the following is TRUE?

A. Both L_1 and L_2 are context-free.
B. L_1 is context-free while L_2 is not context-free.
C. L_2 is context-free while L_1 is not context-free.
D. Neither L_1 nor L_2 is context-free.

Q8.

$L_1 = \{0^{n+m}1^n0^m \mid n, m \geq 0\}$,
$L_2 = \{0^{n+m}1^{n+m}0^m \mid n, m \geq 0\}$ and
$L_3 = \{0^{n+m}1^{n+m}0^{n+m} \mid n, m \geq 0\}$.

Which of these languages are NOT context free?

A. L_1 only
B. L_3 only
C. L_1 and L_2
D. L_2 and L_3

Q9.

In the context-free grammar below, S is the start symbol, a and b are terminals, and ϵ denotes the empty string.

- $S \rightarrow aSAb \mid \epsilon$
- $A \rightarrow bA \mid \epsilon$

The grammar generates the language

A. $((a+b)^*b)$
B. $\{a^mb^n \mid m \leq n\}$
C. $\{a^mb^n \mid m = n\}$
D. a^*b^*

Q10.

Consider the following context-free grammar over the alphabet ∑ = {a, b, c} with S as the start symbol:

S ⟶ abScT | abcT

T ⟶ bT | b

Which of the following represents the language

generated by the above grammar?
(A) $\{(ab)^n(cb)^n \mid n >= 1 \}$
(B) $\{(ab^ncb^m{}_1\, cb^m{}_2 \ldots\, cb^m{}_n \mid n, m_1, m_2, \ldots.., m_n >= 1 \}$
(C) $\{(ab)^n(cb^m)^n \mid n >= 1 \}$
(D) $\{(ab)^n(cb^n)^m \mid m, n >= 1 \}$

Q11. Let <M> be the encoding of a Turing machine as a string over $\sum$= {0, 1}. Let L= { <M> |M is a Turing machine that accepts a string of length 2014 }. Then, L is

(A) decidable and recursively enumerable
(B) undecidable but recursively enumerable
(C) undecidable and not recursively enumerable
(D) decidable but not recursively enumerable

Q12. Let L(R) be the language represented by regular expression R. Let L(G) be the language generated by a context free grammar G. Let L(M) be the language accepted by a Turing machine M. Which of the following decision problems are undecidable?

I. Given a regular expression R and a string w, is w ϵ L(R)?
II. Given a context-free grammar G, is L(G)=∅
III. Given a context-free grammar G, is L(G)=Σ^* for some alphabet Σ?
IV. Given a Turing machine M and a string w, is w ϵ L(M)?

(A) I and IV only

(B) II and III only

(C) II, III and IV only

(D) III and IV only

Q13. 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)

Q14. Which of the following are decidable?

1. Whether the intersection of two regular languages is infinite

II. Whether a given context-free language is regular

III. Whether two push-down automata accept the same language

IV. Whether a given grammar is context-free

(A) I and II

(B) I and IV

(C) II and III

(D) II and IV

Q15. Consider the following problems.

L(G) denotes the language generated by a grammar G.

L(M) denotes the language accepted by a machine M.

(I) For an unrestricted grammar G and a string w, whether $w \in L(G)$

(II) Given a Turing machine M, whether L(M) is regular

(III) Given two grammar G_1 and G_2, whether $L(G_1) = L(G_2)$

(IV) Given an NFA N, whether there is a deterministic PDA P such that N and P accept the same language

Which one of the following statements is correct?

(A) Only I and II are undecidable

(B) Only II is undecidable

(C) Only II and IV are undecidable

(D) Only I, II and III are undecidable

ANSWERS

A1. D

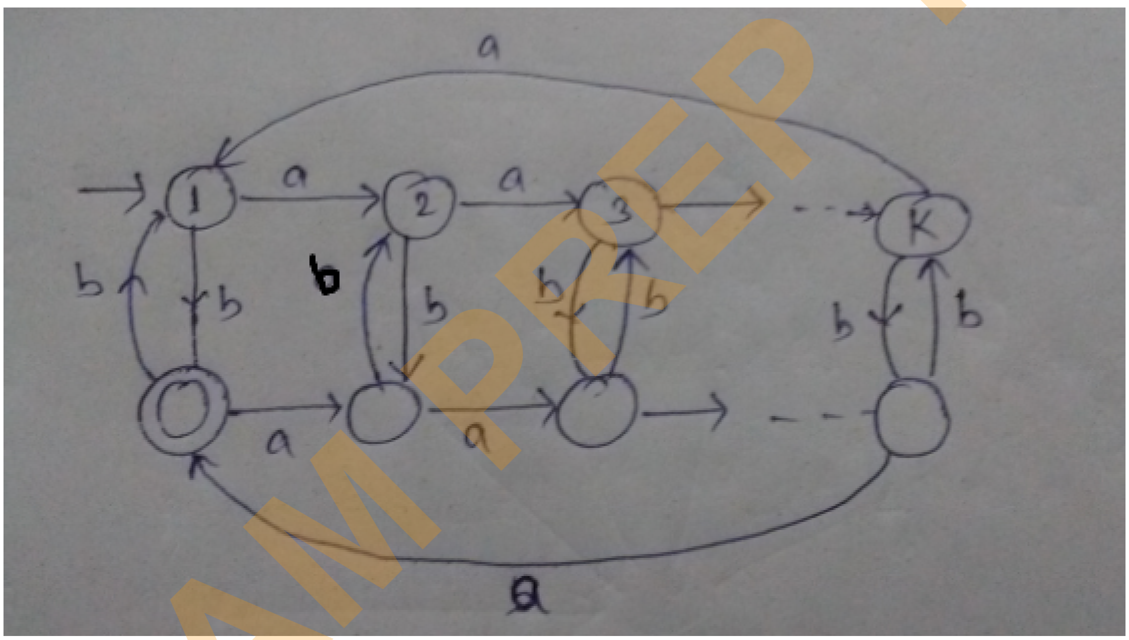
From 00 state '0' should take the DFA to the dead state-q.
From 11 “0' should go to 10 representing the 10 at the end of the string, similarly from 00 ‘1’ should go to 01 from 01 ‘1’ should go to 11 and from 10 '0’ should go to 00.

A2. B

Assume (0 , 1) => (a, b).
L1 : x is divisible by k , dfa will have k states

L2: no of 1's in x is odd, dfa will have 2 states

DFA for L1 ∩ L2 will have k x 2 = 2k states , using cross product of dfa's M1 x M2 , that will be minimal as none of individual dfa contain dead state.

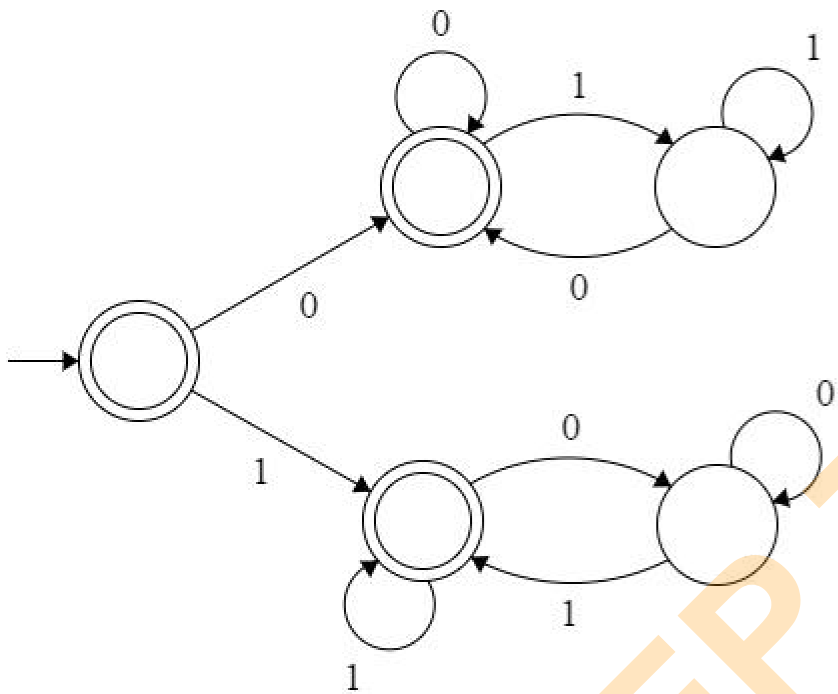


A3. C

If minimal dfa contain n states then its complemented dfa also contain n states

A4. B

A5. 5



A6. A
A7. B
A8. B
A9. B
A10. B
A11. B

There are only a finite number of strings of length 2014. So, we can give all those strings to TM simulating each string for 1 step, then 2 step and so on, and if the TM accepts any of them we can say "yes". So, L is recursively enumerable.

(If the TM doesn't accept any string of length 2014, it can go to an infinite loop and hence we can't say the method is decidable).

A12. D
A13. D
A14. B
A15. D

For every nfa equivalent dpda possible

Checking two dpda's equal or not is decidable
Checking two nfa's equal or not is also decidable