1. The basic limitation of an FSM is
   i) It cannot remember arbitrary large
      amount of information
   ii) It sometimes recognizes grammar
      that is regular
   iii) It sometimes fails to recognize
      regular grammar
   iv) All of these.

2. Choose the incorrect statement:
   i) Moore and Mealy machines are
      FSM with output capabilities
   ii) Any given Moore machine has an
      equivalent Mealy machine
   iii) Any given Mealy machine has an
      equivalent Moore machine
   iv) Moore machine is not an FSM.

3. The intersection of CFL and regular
   language
   i) Regular
   ii) CFL
   iii) Both regular and CFL
   iv) None of these.

4. Palindromes cannot be recognized by
   an FSM because
   i) An FSM cannot remember arbitrary
      large amount of information
   ii) An FSM cannot deterministically fix
      the mid-point
   iii) An FSM cannot match the second
      half of the string with first half
   iv) None of these.

5. Can a DFA simulate an NFA?
   i) Yes, it can
   ii) No, it cannot

6. \((P + Q)^* = ?\)
   i) \((P* + Q*)\)
   ii) \(P* + Q*\)
   iii) \((P* Q^*)^*\)
   iv) Both i) and iii).

7. What is the RE for the language set
   strings with at least one 1, one 2 and
   one 3?
   i) \(1 + 2 + 3\)
   ii) \(11* 22* 33*\)
   iii) \(1* 2 * 3\)
   iv) Both i) and ii).

8. Which of the following sets are regular?
   i) \(\{a^i | i = n^2, n >=1 \}\)
   ii) \(\{a^p | p is prime \}\)
   iii) \(\{ww | w \in \{a, b\}^+\}\)
   iv) \(\{a^{2n} | n >=1 \}\)

9. The regular expression representing the
   set of all strings over \(\{X, Y\}\) ending with
   XX and beginning with Y is
   i) \(XX (X + Y)^* Y\)
   ii) \(YY (X + Y)^* X\)
   iii) \(Y (X + Y)^* XX\)
   iv) \(Y (XY)^* XX\).

10. The regular expression \((a/b)(a/b)\)
    denotes the set
    i) \(\{a, b, ab, aa\}\)
    ii) \(\{a, b, ba, bb\}\)
    iii) Both i) and ii)
    iv) None of these.

11. Moore machine output depends on
    i) Input
ii) Input and present state
iii) Present state
iv) None of these.

12. FSM can recognize

i) A grammar depending on the characteristics of FSM
ii) An CFG
iii) Any unambiguous grammar
iv) Only regular grammar.

13. DFA has a transition function

i) Q x Σ → Q
ii) Q x Σ → 2^Q
iii) Both i) and ii)
iv) None of these.

14. The class of CFG is not closed under

i) Concatenation
ii) Intersection
iii) Union
iv) Repeated Concatenation.

15. Consider the CFG as defined:

X → XY
X → aX / bX / a
Y → Ya / Yb / b

Any string of terminals, which can be generated by the CFG

i) Has at least one b
ii) Ends with a
iii) Has no consecutive a’s and b’s
iv) Has at least 2 a’s.

16. A grammar that produces more than one parse tree for the same sentence is called

i) Contiguous
ii) Ambiguous
iii) Unambiguous
iv) Regular

17. The following production rules of a regular grammar generate a language L:

S → aS / bS / a / b

The regular expression of L is

i) a + b
ii) (a + b)^*
iii) (a + b)(a + b)^*

iv) (aa + bb) a*b*.

18. If Q is the number of states of a NFA, the equivalent DFA can have a maximum number of states

i) Q
ii) Q - 1
iii) 2Q - 1
iv) 2^Q.

19. A Shift Register is

i) A Mealy machine
ii) A Moore machine
iii) A Turing machine
iv) All of these.

20. A Push Down Automaton is different from a finite automaton because of

i) A read head
ii) A memory in the form of a stack
iii) A set of states
iv) All of these.

21. The production grammar { S → aSbb , S → abb} is

i) Type 3 grammar
ii) Type 2 grammar
iii) Type 1 grammar
iv) Type 0 grammar.

22. The loop-free testing graph indicates that

i) The machine has finite memory
ii) The machine has non-finite memory
iii) The machine has finite states
iv) The machine has non-finite states.

23. Consider the following regular expression

R = ( ab + abb )* bbab

Which of the following is not a set denoted by R?

i) ababab
ii) ababbabbbab
iii) abbbab
iv) abbbabbbab.

24. Which of the following is correct?

i) A language can be derived from the FA
ii) Regular expressions can be derived from the FA

iii) FA can be derived from the language

iv) Both i) and iii).

25. The reduced grammar of $S \rightarrow AB \mid a, A \rightarrow a$ is

i) $S \rightarrow a; A \rightarrow a$

ii) $S \rightarrow a \mid A ; A \rightarrow a$

iii) $S \rightarrow a$

iv) $S \rightarrow aa$.

26. Which of the following grammars generates strings with any number of 1’s?

i) $S \rightarrow 1A, A \rightarrow \varepsilon$

ii) $S \rightarrow 1S, S \rightarrow \varepsilon$

iii) $S \rightarrow S1, S \rightarrow \varepsilon$

iv) Both ii) and iii).

27. Input sequence of an information lossless machine can be determined from the knowledge of

i) Only output sequence

ii) Output sequence and the initial state

iii) Output sequence, initial state and final state

iv) Initial state.

28. Context Free Grammar can be recognized by

i) Finite State Automata

ii) 2-way Linear Bounded Automata

iii) Push Down Automata

iv) Both ii) and iii).

29. A Mealy machine accepts a string of length $k$; the output string length is

i) $k$

ii) $2k$

iii) $k + 1$

iv) $k - 1$

30. $a^*(a+b)^*$ is equivalent to

i) $a^* + b^*$

ii) $a*b^*$

iii) $(ab)^*$

iv) None of these

31. Which is true for the transition statement: $\delta(q, ab)$?

i) $\delta(q, a) \cup \delta(q, b)$

ii) $\delta(\delta(q, a), b)$

iii) $\delta(\delta(q, a), b)$

iv) $\delta(q, a) \cap \delta(q, b)$

32. Which of the following statements is incorrect?

i) A Turing Machine cannot solve Halting problem

ii) Set of recursively enumerated languages is closed under union

iii) A FSM with 3 stacks is more powerful than FSM with 2 stacks

iv) Context sensitive grammar can be recognized by a linearly bounded memory machine.

33. A string after full traversal, if not accepted by an FA, ends up at

i) Some non-final states

ii) One of the final states

iii) One non-final state

iv) Some non-final states

34. A FA with the same initial and final state

i) Not possible to define such an FA

ii) Can produce arbitrary output

iii) Can accept Null string

iv) Can accept any input

35. A NFA with $\varepsilon$-transition includes

i) No transition for an input

ii) Multiple transitions for an input

iii) One or more transition without any input

iv) Transition to a Null state

36. What is true for a dead or sink state

i) It cannot be reached any time

ii) There is no necessity of the state

iii) If the state is reached, there is no way to come out of the state

iv) None of the above

37. An Incompletely specified FA is defined such as
i) All next states are not mentioned
ii) All outputs are not mentioned
iii) Both of i) and ii)
iv) All inputs are not mentioned

38. Two states are called 1-equivalent if
   i) Both of the states produces the output 1
   ii) Both of the states produces the same output for a string of length 1
   iii) Both of the states produces the same output for any input
   iv) Both of the states produces the same output for input 1

39. Two states are called k-equivalent if
   i) Both of the states are equivalent for all levels above k
   ii) Both of the states are equivalent for all levels from 0 to k-1
   iii) Both of the states have at least k number of states
   iv) Both of the states have exactly k number of states

40. Two states of an Incompletely specified FA are compatible if
   i) Both of the states have identical outputs for same input
   ii) Both of the states have compatible next states for all inputs
   iii) Both of the states have identical output and compatible next states for same input
   iv) None of the above

41. A Moore machine accepts a string of length k; the length of the output string is
   i) k
   ii) 2k
   iii) k + 1
   iv) k - 1

42. Which is true of the following?
   i) Merger Graph is a directed graph
   ii) Compatibility Graph is a directed graph
   iii) Both are directed
   iv) None of these

43. The logic of pumping lemma is a good example of
   i) The pigeon-hole principle
   ii) The Divide and Conquer technique
   iii) Recursion
   iv) Iteration

44. Which of the following strings can be obtained by the language: \( L = \{a^i b^{2i} \mid i \geq 1\} \)
   i) aabbbbbbb
   ii) aabb
   iii) abbabbbba
   iv) aaaaabbabbb

45. Which of the following production rule is in CNF?
   i) \( S \rightarrow aA \)
   ii) \( SA \rightarrow AS \)
   iii) \( S \rightarrow AB \)
   iv) All of these

46. The solution for the equation \( R = Q + RP \) is
   i) \( R = QP^* \)
   ii) \( R = Q^*P \)
   iii) \( P = RQ^* \)
   iv) \( R = P \)

47. Consider the following language: \( L = \{ a^n b^n c^n d^n \mid n \geq 1 \} \)
   i) CFL but not regular
   ii) CSL but not CFL
   iii) Regular
   iv) Type 0 not Type 1

48. A CFG is not closed under:
   i) Product
   ii) Union
   iii) Complementation
   iv) Kleene Star

49. Compatible Pairs are obtained from
   i) Merger Graph
   ii) Compatibility Graph
   iii) Testing Table
50. Consider the grammar: \( S \rightarrow aSA \mid \epsilon; \) \( A \rightarrow bA \mid \epsilon; \)
The grammar generates strings in the form \( a^i b^j \) for some \( i, j \geq 0 \). What are the conditions for \( i \) & \( j \)?
   i) \( i = j \)
   ii) \( j \leq 2i \)
   iii) \( j \geq 2i \)
   iv) \( i \leq j \)

51. Let \( N \) be an NFA with \( n \) states and let \( M \) be the minimized DFA with \( m \) states recognizing the same language. Which of the following is NECESSARILY true?
   i) \( m \leq 2^n \)
   ii) \( n \leq m \)
   iii) \( M \) has one accept state
   iv) \( m = 2^n \)

52. The string 1101 does not belong to the set represented by
   i) \( 110^*(0+1) \)
   ii) \( 1(0+1)^*101 \)
   iii) \( (10)^*(01)^*(00+11)^* \)
   iv) \( (00+11)^*(01)^* \)

53. Which of the following is common for both CNF & GNF?
   i) \( (NT) \rightarrow (Single \ T)(String \ of \ NT) \)
   ii) \( (NT) \rightarrow (Single \ of \ exactly \ two \ NT) \)
   iii) \( (NT) \rightarrow (String \ of \ NT) \)
   iv) \( (NT) \rightarrow (Single \ T) \)

54. The difference between Turing Machine and Two Way FA is in:
   i) Input Tape
   ii) Read Write Head
   iii) Finite Control
   iv) All of these

55. Recursive languages are
   i) Closed under insertion
   ii) Recursively enumerable
   iii) Closed under complementation
   iv) All of these

56. Consider the following languages:

57. Context Sensitive Grammar can be recognized by
   i) Linear bounded memory machine
   ii) Deterministic push down machine
   iii) Non-deterministic push down machine
   iv) Finite State Machine

58. Let \( A = (a+b)^*a \) and \( B = b(a+b)^* \), then \( A \) intersection \( B \) will be
   i) \((a+b)^*ab\)
   ii) \(ab(a+b)^*\)
   iii) \(a(a+b)^*b\)
   iv) \(b(a+b)^*a\)

59. Which of the following is the most general phase structured grammar?
   i) Regular
   ii) Context Sensitive
   iii) PDA
   iv) None of these

60. Pumping Lemma is generally used to prove
   i) A grammar is regular
   ii) A grammar is not regular
   iii) Two Regular expressions are equal
   iv) None of these

61. Automata is a/an ………….. device
   i) Acceptor only
   ii) Acceptor/Rejecter
   iii) Rejecter only
   iv) Generating

62. Which of the following is true for the language \( L = \{a^p \mid p \text{ is prime}\} \)?
   i) It is Regular
   ii) It is not Regular but Context Free
iii) It is neither Regular nor Context Free
iv) None of the above
63. A Push Down Machine will behave like a Finite State Machine if the stack memory size is:
i) 0
ii) 1
iii) 2
iv) None of the above
64. Let \( L = \{w : w \in \{0, 1\}^*\} \), where \( w \) contains an even number of 1’s; the regular expression representing \( L \) is
i) \( (0^*10^*)^* \)
ii) \( 0^*(10^*1^*)^*0^* \)
iii) \( 0^*1(10^*1^*)^*10^* \)
iv) Both i) and iii)
65. State which of the following statement is false:
i) Halting problem of Turing Machine is undecidable
ii) Determining whether a Context Free Grammar is ambiguous is undecidable
iii) Given \( G_1 \) and \( G_2 \), two arbitrary Context Free Grammars, it is undecidable if \( L(G_1) = L(G_2) \)
iv) Given \( G_1 \) and \( G_2 \), two Regular Grammars, it is undecidable if \( L(G_1) = L(G_2) \)
66. A Language that can be accepted by a Finite Automata, if and only if it is:
i) Context Sensitive
ii) Context Free
iii) Regular
iv) None of these
67. Every Context Free Grammar can be converted to:
i) Greibach Normal Form
ii) Chomsky Normal Form
iii) Both i & ii
iv) All of the above
68. The set \( \{a^n b^n | n \geq 1\} \) is generated by the CFG:
i) \( S \to aSb | ab \)
ii) \( S \to aSb | ab | \epsilon \)
iii) \( S \to aaSbb | ab \)
iv) \( S \to aaSbb | aabb | ab \)
69. Given the grammar \( S \to aSa|bSb|a|b \), the language generated is the set of
i) All palindromes
ii) Even palindromes
iii) Odd palindromes
iv) All of the above
70. The following CFG:
\[
S \to aB | bA \\
A \to b | aS | bAA \\
B \to a | bS | aBB
\]
generates strings that have:
i) Equal number of a’s and b’s
ii) Odd number of a’s and odd number of b’s
iii) Even number of a’s and even number of b’s
iv) None of the above
71. Let \( L_1 \) and \( L_2 \) be two Context Free Languages and \( R \) be any regular language. Which of the following is/are correct?
A. \( L_1 \cup L_2 \) is Context Free
B. \( ^cL_2 \) is Context Free
C. \( L_1 \cap R \) is Context Free
D. \( L_1 \cap L_2 \) is Context Free
i) A, B & D only
ii) A & C only
iii) B & D only
iv) A only
72. What is the minimum number of states for a Deterministic Automata that accepts the Regular Language
\[
L = \{w_1w_2 | w_1, w_2 \in \{a, b\}^*, |w_1|=2, |w_2| \geq 3\}
\]
73. Identify the language generated by the following grammar:
\[
S \to XY; X \to aX|a; Y \to aYb|\epsilon
\]
i) \{a^m b^n \mid m \geq n, n > 0\}
ii) \{a^m b^n \mid m \geq n, n \geq 0\}
iii) \{a^m b^n \mid m > n, n \geq 0\}
iv) \{a^m b^n \mid m > n, n > 0\}

74. Consider the following grammar G:

\begin{align*}
S & \rightarrow E - T | T; T \rightarrow T + F | F; F \rightarrow (E) | id \\
\text{Which of the following is not Left Recursive but equivalent to G?}
\end{align*}

i) \(S \rightarrow E - T | T; T \rightarrow T + F | F; F \rightarrow (E) | id\)

ii) \(E \rightarrow TE'; E' \rightarrow -TE' | \epsilon; T \rightarrow T + F | F; F \rightarrow (E) | id\)

iii) \(E \rightarrow TX; X \rightarrow -TX | \epsilon; T \rightarrow FY; Y \rightarrow +FY | \epsilon; F \rightarrow (E) | id\)

iv) \(E \rightarrow TX | (TX); X \rightarrow -TX | +TX | \epsilon; T \rightarrow id\)

75. The Transition Functions for a ε-NFA are:

\begin{align*}
\delta(q0, \epsilon) &= q2, \delta(q0, a) = q1, \delta(q0, b) = q0 \\
\delta(q1, \epsilon) &= q2, \delta(q1, a) = q2, \delta(q1, b) = q3 \\
\delta(q2, \epsilon) &= q2, \delta(q2, a) = \emptyset, \delta(q2, b) = \emptyset \\
\delta(q3, \epsilon) &= \emptyset, \delta(q3, a) = \emptyset, \delta(q3, b) = q2
\end{align*}

If the initial state is q0, then, \(\delta(q2, aba)\) is

i) \(\{\emptyset\}\)

ii) \(\{q0, q1, q3\}\)

iii) \(\{q0, q1, q2\}\)

iv) \(\{q0, q2, q3\}\)

76. Consider the following languages:

\begin{align*}
L1 &= \{a^p \mid p \text{ is a prime number}\} \\
L2 &= \{a^m b^n c^m \mid m, n \geq 0\} \\
L3 &= \{a^m b^n c^n \mid m, n \geq 0\} \\
L4 &= \{a^m b^n \mid n \geq 1\}
\end{align*}

Which of the following is/are correct?

A. L1 is Context Free but not Regular
B. L2 is not Context Free
C. L3 is not Context Free but Recursive
D. L4 is Deterministic Context Free

i) A, B & D only

ii) B & C only

iii) A & D only

iv) C & D only

77. Consider the language by the Regular Expression \((a+b)^*b(a+b)\). The smallest number of states required by a Deterministic Finite State Automata that accepts the language is?

78. Consider the Grammar, G, with the production rule:

\(S \rightarrow SS \mid SaS \mid aSb \mid bSa \mid \epsilon\)

If S is the Start Variable, then which of the following is not generated by G?

i) abab

ii) aaab

iii) abbaa

iv) babba

79. Consider the following grammar G1, G2 with the Production Rules:

\begin{align*}
G1 & : S \rightarrow aSb | T; T \rightarrow cT | \epsilon \\
G2 & : S \rightarrow bSa | T; T \rightarrow cT | \epsilon
\end{align*}

The language \(L(G1) \cap L(G2)\) is?

i) Finite

ii) Not finite but Regular

iii) Context Free but not Regular

iv) Recursive but not Context Free

80. Consider the following languages:

\begin{align*}
L1 &= \{a^m b^n c^m \mid m, n \geq 0\} \\
L2 &= \{a^m b^n c^n \mid m, n \geq 0\}
\end{align*}

Which of the following is Context Free?

A. L1 \(\cup\) L2

B. L1 \(\cap\) L2

i) A only

ii) B only

iii) Both A & B

iv) None of these

81. Consider the language by the Regular Expression \((0+1)^*(0+1)(0+1)^*\). The smallest number of states required by a Deterministic Finite State Automata that accepts the language is?

82. Consider the following grammars:

\begin{align*}
S1 & \rightarrow aS1b | \epsilon \\
S2 & \rightarrow abS2 | \epsilon
\end{align*}

Which of the following is true?
i) L1, L2 are both Regular
ii) L1 is Regular but L2 is not Regular
iii) L2 is Regular but L1 in not Regular
iv) Neither L1 or L2 are Regular

83. Consider the following languages:
   L1: Regular, L2: Context-Free,
   L3: Recursive and L4: Recursively Enumerabe.
Which of the following is/are true?
A. ~L1 ∪ L4 is Recursively Enumerable
B. ~L2 ∪ L3 is Recursive
C. L1* ∩ L2 is Context Free
D. L1 ∪ ~L2 is Context Free
i) A only
ii) A & C only
iii) A & D only
iv) A, B & C only

84. Consider the following languages:
   L1 = {a^n b^m c^n+m | m, n >= 1}
   L2 = {a^n b^m c^2n | n >= 1}
Which of the following is Context Free?
   i) Both L1 & L2 are Context Free
   ii) L1 is Context Free but L2 is not
   iii) L2 is Context Free but L1 is not
   iv) Neither are Context Free

85. Which of the following grammars are free of left recursion?
   i) S → AB; A → Aa | b; B → c
   ii) S → Ab | Bc | A → B | ε; B → e
   iii) S → Ab | Bc | A → B | ε; B → c
   iv) S → Ab | Bc | A → B | ε; B → c

86. Consider the Grammar, G, with the production rule:
   S → aS | bS | ε
Which of the following is generated by G?
   i) {a^m b^n | m, n >= 0}
   ii) {w ∈ {a, b}*, w has equal number of a's and b's}
   iii) {a^n | n >= 0} ∪ {b^n | n >= 0} ∪ {a^m b^n | n > 0}
   iv) {a, b}*

87. Which of the following decision problems are undecidable?
   A. Given NFA's N1 and N2, is L(N1) ∩ L(N2) = φ?
   B. Given CFG G = (N, Σ, P, S) and a string w ∈ Σ*, whether w ∈ L(G)?
   C. Given CFG's G1 and G2, whether L(G1) = L(G2)?
   D. Given a TM M, whether L(M) = φ?
   i) A & D only
   ii) B & C only
   iii) C & D only
   iv) B & D only

88. Which of the following Regular Expressions represent the language – the set of all binary strings having two consecutive 0's and two consecutive 1's?
   i) (0+1)*0011(0+1)* + (0+1)*1100(0+1)*
   ii) (0+1)*00(0+1)*11 + (11(0+1)*00)(0+1)*
   iii) (0+1)*00(0+1)* + (0+1)*11(0+1)*
   iv) 00(0+1)*11 + 11(0+1)*00

89. Consider the following Context Free Grammar, G1 & G2, with the production rules:
   G1: S → aS | A; A → Bb | b
   G2: S → aA | bb; A → aA | B | ε; B → bb | ε
Which of the following languages are generated by G1 and G2?
   i) {a^m b^n | m>0 or n>0} and {a^m b^n | m>0 and n >0}
   ii) {a^m b^n | m>0 and n>0} and {a^m b^n | m >0 or n<0}
   iii) {a^m b^n | m>=0 or n>0} and {a^m b^n | m>0 and n > 0}
   iv) {a^m b^n | m>= 0 or n>0} and {a^m b^n | m >0 or n>0}

90. Consider the following PDA with input alphabet Σ = {a,b}* states Q = {q0, q1, q2}, q0 being the initial state and {q0,
Let L be the language accepted by the PDA. Which of the following is true?

i) \(L = \{a^n b^n \mid n \geq 0\}\) and is not accepted by any Finite Automata

ii) \(L = \{a^n \mid n \geq 0\} \cup \{a^n b^n \mid n > 0\}\) and is not accepted by a Deterministic PDA

iii) L is not accepted by any Turing Machine that halts on every input

iv) \(L = \{a^n \mid n \geq 0\} \cup \{a^n b^n \mid n > 0\}\) and is Deterministic Context Free

95. Which of the following is true?

A. The complement of every Turing decidable language is Turing decidable

B. There exists some language in NP which is not Turing decidable

C. If L is an language in NP, it is Turing decidable

i) Only B

ii) Only C

iii) Only A & B

iv) Only A & C

96. Which of these languages is Regular?

\(L_1 = \{a^n b^n \mid m, n > 0\}\)

\(L_2 = \{a^n b^n \mid m, n > 0\}\)

\(L_3 = \{a^n b^n \mid m = 2n+1\}\)

Which of the following is generated by G?

i) \(L_1\) and \(L_2\) only

ii) \(L_2\) and \(L_3\) only

iii) \(L_1\) and \(L_3\) only

iv) \(L_3\) only
97. Let $X_1, X_2, X_3$ be strings with the alphabet $\Sigma \in \{0, 1\}^*$. They are related as follows:

$$
X_1 = 1X_2
X_2 = 0X_2 + 1X_3
X_3 = 0X_2 + \varepsilon
$$

Which of the following choices precisely represent the string in $X_1$?

i) $10(0^* + (10)^*)1$

ii) $10(0^* + (10)^*)*1$

iii) $1(0 + 10)^*1$

iv) $10(0^* + (10)^*)*1 + 110(0 + 10)^*1$

98. Let $L$ be the language represented by the Regular Expression $(0+1)^*(10)$. What is the number of states in a minimal DFA that recognizes $L$?

99. Let $L_1$ be a Context Free Language and $L_2$ be a Recursively Enumerable but not recursive language. Which of the following is/are necessarily true?

A. $\neg L_1$ (complement of $L_1$) is recursive

B. $\neg L_2$ (complement of $L_2$) is recursive

C. $\neg L_1$ is Context Free

D. $\neg L_1 \cup L_2$ is recursively enumerable

i) A only

ii) C only

iii) C & D only

iv) A & D only

100. The Transition Functions for DFA $M$ & $N$ are given below:

$M$: $\delta(q_0, b)=q_0$, $\delta(q_0, a)=q_1$,

$\delta(q_1, a)=q_1$, $\delta(q_1, b)=q_0$

$N$: $\delta(q_0, a)=q_0$, $\delta(q_0, b)=q_1$,

$\delta(q_1, b)=q_1$, $\delta(q_1, a)=q_0$

where $q_0$ is the initial state and $q_1$ is the final state for both DFA. The number of states for a minimal DFA that accepts $L(M) \cap L(N)$ is?

101. Consider the following PDA with input alphabet $\Sigma = \{0, 1\}$, states $Q = \{q_0, q_1, q_2\}$, $q_0$ the initial state and $\{q_2\}$ final state, stack alphabet $\Gamma = \{0, 1, Z\}$, with $Z$ being the initial stack symbol. The Transition Functions are:

$\delta(q_0, 0, Z)=(q_0, 0Z)$,

$\delta(q_0, 0/1/\varepsilon, Z)=(q_1, Z)$,

$\delta(q_1, 0, 1)=(q_1, \varepsilon)$,

$\delta(q_1, 1, 0)=(q_1, \varepsilon)$,

$\delta(q_1, \varepsilon, Z)=(q_2, \varepsilon)$

Which of the following strings must follow 1011100 such that the overall string is accepted by the automaton?

i) 10110

ii) 10010

iii) 01010

iv) 01001

102. Which of the following problems is/are undecidable?

i) Deciding if a CFG is ambiguous

ii) Deciding if a given string is generated by a given CFG

iii) Deciding if the language generated by a given CFG is empty

iv) Deciding if the language generated by a given CFG is finite

103. Consider the following languages over alphabet $\Sigma \in \{0, 1, c\}$.

$L_1 = \{wcw^R\}$, $w^R$ is the reverse of string $w$

$L_2 = \{ww^R\}$

$L_3 = \{0^n1^n \mid n \geq 0\}$

Which of the languages are Deterministic Context Free languages?

i) None of these

ii) $L_3$ only

iii) $L_1 \& L_3$ only

iv) All of them

104. Length of the shortest string ($\Sigma \in \{a, b\}$) NOT in the following Regular Expression is ___:

$a^*b^*(ba)^*a^*$

105. If $L_1 = \{a^n \mid n \geq 0\}$ and $L_2 = \{b^n \mid n \geq 0\}$, then consider

A. $L_1 \& L_2$ is a Regular Language

B. $L_1 \& L_2 = \{a^n b^n \mid n \geq 0\}$
Which of the following is CORRECT?

i) A only
ii) B only
iii) Both A & B
iv) None of these

106. Language $A \leq_m B$ denotes that language $A$ is mapping reducible to language $B$. Which of the following is FALSE?

i) If $A \leq_m B$ and $B$ is recursive then $A$ is recursive
ii) If $A \leq_m B$ and $B$ is undecidable then $A$ is undecidable
iii) If $A \leq_m B$ and $B$ is recursively enumerable then $A$ is recursively enumerable
iv) If $A \leq_m B$ and $B$ is not recursively enumerable then $A$ is not recursively enumerable

107. If $L_1 = \{ w \in \{0, 1\}^* | w$ has at least as many occurrences of (110)'s as (011)'s and $L_2 = \{ w \in \{0, 1\}^* | w$ has at least as many occurrences of (000)'s as (111)'s}, then which of the following is Correct?

i) $L_1$ is regular but not $L_2$
ii) $L_2$ is regular but not $L_1$
iii) Both of them are regular
iv) None of them are regular

108. Which of the following is true?

i) Language $L = \{ a^n b^n | n \geq 0 \}$ is regular
ii) Language $L = \{ a^p | p \text{ is a prime number} \}$ is regular
iii) Language $L = \{ w \in \{0, 1\}^* | w \text{ has 3k+1 b's, where } k \in \mathbb{N} \}$ is regular
iv) Language $L = \{ ww | w \in \{0, 1\} \}$ is regular