6 Theory of Computation

Practice Questions

Q.1 Number of Trivial substring in "GATE 2023" are _______

Q.2 Let the string be defined over symbols a and b then what will be the number of states in minimal DFA, if every string starts and ends with different symbols?

Q.3 The total number of substring present in "GATE" is :

Q.4 Let $\sum = \{a, b\}$, what are the number of states in Minimal DFA, length of every string congruent to Mod 5.

Q.5 A minimal DFA that is equivalent to a NFA has :

(A) Always more states

(B) Always less number of states

(C) Exactly 2^n states

(D) Sometimes more states

Q.6 $S \to AB$ **[MSQ]**

$A \to BB \mid a$

$B \to AB \mid b$

Choose correct statement?

(A) $aabbb$ can be derived from above Grammar

(B) $aabb$ can be derived from above Grammar

(C) $ababab$ can be derived from above Grammar

(D) $abbb$ can be derived from above Grammar

Q.7 One of the following Regular expressions is not the same as others. Which one?

(A) $(a^*+b^*a^*)^*$

(B) $(a^*b^*+b^*a^*)^*(a^*b^*)^*$

(C) $\left((ab)^*+a^*\right)^*$

(D) $(a+b)^*a^*b^*a^*b^*$

Q.8 The complement of CFL.

(A) Recursive

(B) Recursive enumerated but not recursive

(C) Not R.E

(D) The empty set

Q.9 What are the number of states needed in minimal DFA, that accepts $(1+1111)^*$

Q.10 Consider the following languages. **[MSQ]**

$L_1 = \left\{a^n b^n \mid n \geq 0\right\}$

$L_2 =$ Complement (L_1)

Choose appropriate options regarding languages L_1 and L_2

(A) $L_1 + L_2$ are context free

(B) L_1 is CFL but L_2 is RL

(C) L_1 is CFL but L_2 is not CSL

(D) None

Q.11 The language $L = \left\{\begin{array}{l} a^N b^N \mid 0 < N \\ < 327^{\text{th}} \\ \text{prime number} \end{array}\right\}$ is

(A) Regular
(B) Non context sensitive
(C) Not recursive
(D) None

Q.12 Let $\Sigma = \{0,1\}$

What will be the number of states in minimal DFA, if the Binary number string is congruent to (mod 8)

(A) 8 (B) 9
(C) 7 (D) 4

Q.13 What are the number of final states in Minimal DFA, where $\Sigma = \{a, b\}$, if every string starts with $'aa'$ and length of string is not congruent to 0 (mod 4),

(A) 7 (B) 6
(C) 3 (D) 5

Q.14 How many DFA with four states can be constructed over the alphabet $\Sigma = \{a, b\}$ with designated initial state?

(A) $4^{16} * 2^4$ (B) 2^{20}
(C) 2^{16} (D) 2^{24}

Q.15 Let $\Sigma = \{a\}$, assume language, $L = \left\{a^{2023\text{K}} \mid K > 0\right\}$, what is minimum number of states needed in a DFA to recognize L?

(A) $2^{2023} + 1$ (B) 2024
(C) 2^{2023} (D) None

Q.16 What type of grammar is this most accurately described as?

$S \to b \mid aD$

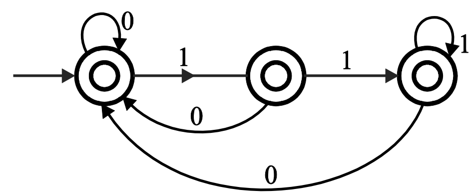
$D \to a \mid aDD$

(A) Regular grammar
(B) CFG
(C) CSG
(D) Type-0

Q.17 Let $M = (Q, \Sigma, \delta, q_0, F)$ and $M' = (Q, \Sigma, \delta, q_0, Q - F)$ where M accepts L and M' accepts L' and M is NFA, what could be the relation between L and L'?

(A) $L + L'$ are complement to each other
(B) $L + L'$ are similar to each other
(C) $L + L'$ relation cannot be predicted
(D) None of the above

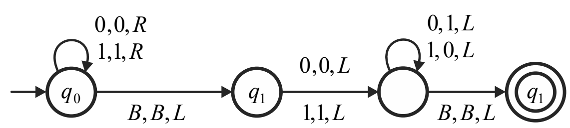
Q.18



The DFA above accepts :

(A) The set of all strings containing two consecutive 1's
(B) $(0+1)*$
(C) Set of all strings not containing two consecutive 1's
(D) Set of all strings containing two consecutive 0's

Q.19



Consider TM :

If input strings 1000, what will be the output?

(A) 1100 (B) 1000
(C) 0111 (D) None

Q.20 Give the strongest correct statement about finite language over finite Σ?

(A) It could be undecidable
(B) It is Turing-recognizable
(C) It is CSL
(D) It is regular language.

Q.21 Let n_1 be the number of states in Minimal NFA of a partial language and n_2 be the DFA. Relation?

(A) $n_1 \geq n_2$ (B) $n_1 \leq n_2$

(C) $n_1 < n_2$ (D) $n_2 > n_1$

Q.22 S_1 : L is Regular, infinite union of L will also be regular

i.e. $(L^0 \cup L' \cup L^2 \ldots)$

S_2 : L is Regular, It's subset will also be regular.

(A) Both are true

(B) Both are false

(C) $S_1 \to \text{T}, S_2 \to \text{F}$

(D) $S_1 \to \text{F}, S_2 \to \text{T}$

Q.23 Consider $r = (11+111)^*$ over $\Sigma = \{0,1\}$. Number of states in Minimal NFA is X and in Minimal DFA is Y then X+Y=?

Q.24 Consider 2 Scenarios :

C_1 : For DFA $(\phi, \Sigma, \delta, q_0, F)$

if $F = \phi$, then $L = \Sigma^*$

C_2 : For NFA $(\phi, \Sigma, \delta, q_0, F)$

if $F = \phi$, then $L = \Sigma^*$

Where, $F =$ Final states set

$\phi =$ Total states set

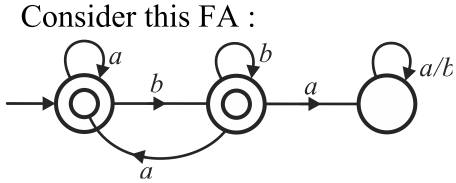
(A) Both are true

(B) Both are False

(C) C_1 is true, C_2 is false

(D) C_1 is false, C_2 is true

Q.25 Consider this FA :



How many strings will be there in the complement of the language accepted by this FA?

(A) Infinite (B) 2

(C) 3 (D) 0

Q.26 In programming language, and identifier has to be a letter followed by any number of letters or digits. If L and D denotes the sets of letter and digits respectively, examine the correct expressions?

(A) $(L \cup D)^*$ (B) $(L \cdot D)^*$

(C) $L \cdot (L \cup D)^*$ (D) $L \cdot (L \cdot D)^*$

Q.27 Total number of DFA possible with 2 states $q_0 \to$ start and non-final, $q_1 \to$ final over $\Sigma = \{a, b\}$ is

(A) 16 (B) 32

(C) 48 (D) 64

Q.28 $\Sigma = \{0,1\}, L = \Sigma^*, R = \{0^n 1^n \mid n \geq 1\}$

Language $L \cup R$ and R are respectively.

(A) Regular, Regular

(B) Regular, Not Regular

(C) Not Regular, No Regular

(D) Not Regular, Regular

Q.29 $L_1 = \{a^m \mid m \geq 0\}, L_2 = \{b^m \mid m \geq 0\}$

$L_1 \cdot L_2 = ?$

(A) $\{a^m b^m \mid m \geq 0\}$

(B) $\{a^m b^n \mid m, n \geq 0\}$

(C) $\{a^m b^n \mid m, n \geq 1\}$

(D) None

Q.30 Consider these statements:

S_1 : If a language is finite, it has to be non-Regular

S_2 : Let L be any language.

$(\overline{L})^* \neq (\overline{L^*})$

(A) Both are True

(B) Both are False

(C) $S_1 \to$ True, $S_2 \to$ False

(D) $S_1 \to$ False, $S_2 \to$ True

Q.31 Which of the following are not equivalent to expression $(a+b+c)^*$?

(A) $(a^*+b^*+c^*)^*$ (B) $((ab)^*+c^*)^*$

(C) $(a^*b^*c^*)^*$ (D) $(a^*b^*+c^*)^*$

Q.32 $M=(K,\Sigma,\delta,S,F)$ be a FA.

$K=\{A,B\}$ $F=\{B\}$

$\delta(A,a)=A$ $\delta(B,a)=B$

$\delta(A,b)=B$ $\delta(B,b)=A$

A Grammar (V,Σ,P,S) is used to generate language accepted by M. Which set of rules will make $L(G)=L(H)$?

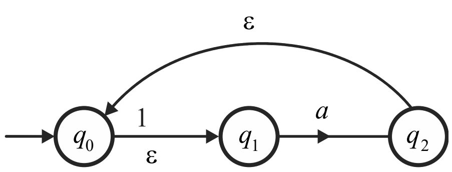
(A) $\begin{Bmatrix} A\to aB, A\to bA, B\to bA, \\ B\to aA, B\to \varepsilon \end{Bmatrix}$

(B) $\begin{Bmatrix} A\to aA, A\to bB, B\to aB, \\ B\to bA, B\to \varepsilon \end{Bmatrix}$

(C) $\begin{Bmatrix} A\to bB, A\to aB, B\to aA, \\ B\to bA, B\to \varepsilon \end{Bmatrix}$

(D) $\begin{Bmatrix} A\to aA, A\to bA, B\to aB, \\ B\to bA, B\to \varepsilon \end{Bmatrix}$

Q.33 Consider NFA :



What will be $\delta^*(q_0,a)$?

(A) $\{q_0,q_1,q_2\}$ (B) $\{q_1,q_2\}$

(C) $\{q_0,q_1\}$ (D) None

Q.34 $L_1=\{a^m b^n \mid m+n=\text{Even}\}$

$L_2=\{a^m b^n \mid m-n=4\}$

(A) L_1 is Regular, L_2 is Not Regular

(B) Both are Regular

(C) Both are non-Regular

(D) L_2 is Regular, L_1 is Not Regular

Q.35 Let r be any Regular expression :

$S_1 \to r+\phi=r=\phi+r$

$S_2 \to r+\varepsilon=r=\varepsilon+r$

(A) Both are true

(B) Both are false

(C) $S_1 \to \text{T}, S_2 \to \text{F}$

(D) $S_1 \to \text{F}, S_2 \to \text{T}$

Q.36 $L_1 =$ Set of all strings having equal number of 00 and 11.

$L_2 =$ Set of all strings having equal number of 01 and 10.

(A) Both are regular

(B) Both are Context-free

(C) L_1 is regular, L_2 is CFL

(D) L_1 is CFL, L_2 is Regular

Q.37 Suppose a language L is accepted by LBA then,

(A) A always halts on all input's as L is decidable

(B) L may be undecidable as A need not half on all input.

(C) L need not be context-sensitive language

(D) None

Q.38 Suppose there exist a NPDA of language L. Then

(A) There always exist a DPDA for L

(B) There doesn't exist a DPDA for L

(C) There may or may not exist a DPDA for L

(D) None

Q.39 $L\subseteq\Sigma^*$ is said to be co-finite *iff* their complement is finite. What can you say?

(A) All co-finite language are regular

(B) There exist a co-finite language which is not context free

(C) There exist a co-finite language which is not decidable.

(D) None

Q.40 Suppose L is a CFL, then $\overline{L}$

(A) is necessarily context-free
(B) is necessarily non-context free
(C) is necessarily context-sensitive but nor recursive
(D) is necessarily Recursive.

Q.41 Let G be grammar in CNF. Let $W_1W_2 \in L(G)$ such that $|W_1| < |W_2|$

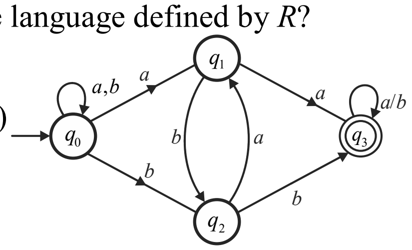
(A) Any derivation of W_1 has exactly same number of steps as any derivation of W_2
(B) Some derivation of W_2 may be shorter than of steps as any derivation of W_1
(C) All derivation of W_1 will be shorter than any derivation of W_2
(D) None

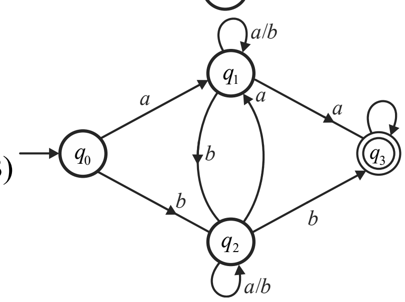
Q.42 Consider an ambiguous grammar G and its disambiguated version D. Let the language recognized by them are $L(G)$ and $L(D)$ respectively. Which one is true?

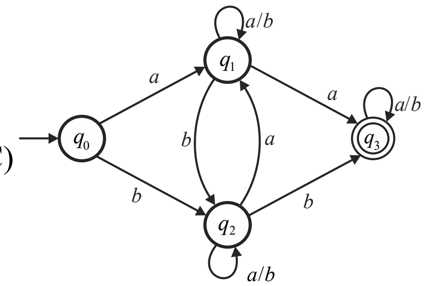
(A) $L(D) < L(G)$ (B) $L(G) < L(D)$
(C) $L(D) = L(G)$ (D) $L(D)$ is empty

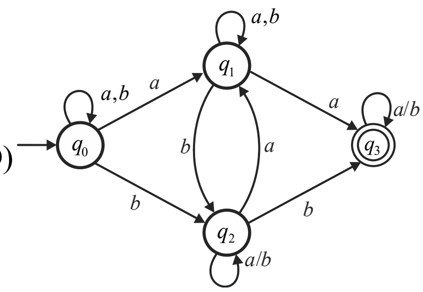
Q.43 Consider $R = (a+b)^*(aa+bb)(a+b)^*$

Which of the following NFA recognizes the language defined by R?

(A)


(B)


(C)


(D)


Q.44 For $n \geq 0, L_n = \{a^i b^k \mid i \geq n, 0 < k < i\}$

(A) L_n is regular, independent of value of n
(B) L_n is not regular, independent of value of n
(C) L_n is regular only for small value of n
(D) None of above

Q.45 Let L_1 be an infinite regular language. Let L_2 be an infinite set such that $L_2 \subset L_1$.

(A) L_2 is definitely regular because L_1 is Regular.
(B) L_2 is Never regular because L_2 is infinite.
(C) L_2 may or may not be regular
(D) None of above

Q.46 Consider $L_1 \cdot L_2 \subseteq \Sigma^*$ such that L_1 and $L_1 \cup L_2$ are Regular.

(A) L_2 is definitely Regular
(B) L_2 may not be regular.
(C) L_2 is context free
(D) None of above

Q.47 W^R denotes the Reverse of W. For $L \subseteq \Sigma^*, L^R = \{W^R \mid W \in L\}$

Suppose L^R is not regular. Then,

(A) L is definitely regular

(B) L may or may not be regular

(C) L is definitely not regular

(D) None of above

Q.48 Consider these 2 statements :

$S_1 : a^* \cdot \phi = a^*$

$S_2 : \phi^k = \phi$

(A) Both are False

(B) Both are True

(C) $S_1 \to \text{T}, S_2 \to \text{F}$

(D) $S_1 \to \text{F}, S_2 \to \text{T}$

Q.49 Statement I : L_i be regular language $i = 1, 2, \ldots \infty$

Language $n_{i=1}^{\infty} L_i$ is regular i.e. infinite intersection

Statement II :

$L = \{WX \mid W \in \Sigma^*, |W| = |X|\}$ is regular.

(A) Both are True

(B) Both are False

(C) $S_1 \to \text{True}, S_2 \to \text{False}$

(D) $S_1 \to \text{False}, S_2 \to \text{True}$

Q.50 Let the class of languages accepted by finite state machine be L_1 and the class of Languages represented by regular expression be L_2 then.

(A) $L_1 < L_2$ (B) $L_1 \geq L_2$

(C) $L_1 \cup L_2 = \Sigma^*$ (D) $L_1 = L_2$

Q.51 Regular Grammar is/are : **[MSQ]**

(A) CFL (B) CSG

(C) Type-0 (D) none

Q.52 Which of the following is/are True? **[MSQ]**

(A) $(01)^*0^* = 0(10)^*$

(B) $(01)^*0 = 0(10)^*$

(C) $(0+1)^*(0+1)^* \mid (0+1)^* = (0+1)^*01(0+1)^*$

(D) $(0+1)^*01(0+1)^* + 1^*0^* = (0+1)^*$

Q.53 FSM with output capability can be used to add two given integer in binary representation. This is

(A) True

(B) False

(C) May be True

(D) None of the above

Q.54 Number of states require to simulate a computer with memory capable of storing ‘3’ words each of length ‘8’

(A) $3^{(2*8)}$ (B) $3^{(3*8)}$

(C) $3^{(3+8)}$ (D) None

Q.55 How many DFA’S exits with 3 states over input alphabet $\Sigma = \{0,1\}$?

(A) 16 (B) 26

(C) 32 (D) 5832

Q.56 Regular expression for all strings starts with *ab* and ends with *bba* is

(A) aba^*b^*bba

(B) $ab(ab)^*bba$

(C) $ab(a+b)^*bba$

(D) All of the above

Q.57 String W is accepted by finite automata if (A is the acceptance state)

(A) $\delta^*(Q, W) \in A$

(B) $\delta(Q, W) \in A$

(C) $\delta^*(Q_0, W) \in A$

(D) $\delta(Q_0, W) \in A$

Q.58 $\delta^*(q, Ya)$ is equivalent to

(A) $\delta((q,Y),a)$

(B) $\delta(\delta^*(q,Y),a)$

(C) $\delta(q,Ya)$

(D) independent from δ rotation

Q.59 Extended transition function is

(A) $Q\times\Sigma^*\to Q$

(B) $Q\times\Sigma\to Q$

(C) $Q^*\times\Sigma^*\to\Sigma$

(D) $Q\times\Sigma\to\Sigma$

Q.60 Definite $init(L) =$ {Set of all prefixes of L}

Let, $L=\left\{\begin{matrix} W/W \text{ has equal number} \\ \text{of 0's and 1's}\end{matrix}\right\}$

$init(L)$ is

(A) all binary strings with unequal number of 0's and 1's

(B) all binary strings with ε-string.

(C) all binary strings with exactly one more 0 than the number of 1's or one more 1 than number of 0's

(D) None of above

Q.61 Consider regular grammar :

$S\to bS\,|\,aA\,|\,\varepsilon$

$A\to aS\,|\,bA$

Myhill-Nerode equivalence classes for language generated by grammar are

(A) $\{W\in(a+b)^*\,|\,\#_a(W) \text{ is even}\}$

(B) $\{W\in(a+b)^*\,|\,\#_b(W) \text{ is even}\}$ and $\{W\in(a+b)^*\,|\,\#_b(W) \text{ is odd}\}$

(C) $\{W\in(a+b)^*\,|\,\#_a(W)=\#_b(W)\}$ and $\{W\in(a+b)^*\,|\,\#_a(W)\neq\#_b(W)\}$

(D) $\{\varepsilon\},\left\{\begin{matrix} Wa\,|\,W\in(a+b)^* \\ \text{and } W_b\,|\,W\in(a+b)^*\end{matrix}\right\}$

Q.62 Consider the CFG below :

$S\to aSAb\,|\,\varepsilon$

$A\to bA\,|\,\varepsilon$

Grammar Generates

(A) $(a+b)^*b$

(B) $a^m b^n\,|\,m\le n$

(C) $a^m b^n\,|\,m=n$

(D) a^*b^*

Q.63 Which of the following statements about regular language is true? **[MSQ]**

(A) Every language has a regular subset

(B) Every language has a regular superset

(C) Every subset of regular language is regular

(D) Every subset of finite language is regular

Q.64 Which of the following is accepted by NPDA but not by DPDA?

(A) $\{a^n b^n c^n\,|\,n\ge 0\}$

(B) $\{a^n b^n\,|\,n\ge 0\}$

(C) $\{a^n b^m\,|\,m,n\ge 0\}$

(D) $\{a^i b^j c^k\,|\,i\neq j \text{ or } j\neq k\}$

Q.65 Let L be CFL and M be a Regular language. Language $L\cap M$ is always

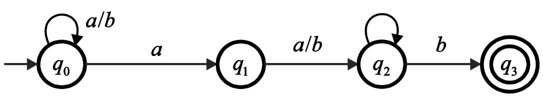
(A) always Regular

(B) never regular

(C) always DCFL

(D) always CFL

Q.66 R.E but describing this below NFA?



(A) $(a+b)^*a(a+b)b$

(B) $(a+b)^*a(a+b)b$

(C) $(a+b)^*a(a+b)b(a+b)^*$

(D) $(a+b)^*$

Q.67 Consider of CFG

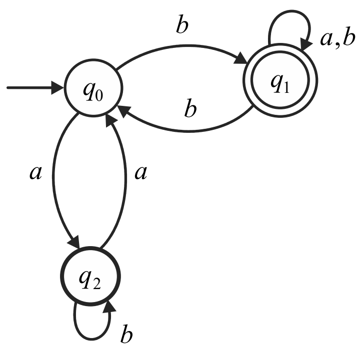
$S \to aSa \mid bSb \mid a \mid b \mid \varepsilon$

Which of the following strings is NOT generated by grammar?

(A) *aaaa* (B) *baba*

(C) *abba* (D) *baba abab*

Q.68



Consider $u = abbaba$

$v = bab$

$w = aabb$

(A) It accepts u, v but not w

(B) It accepts all

(C) It rejects all

(D) It rejects u only

Q.69 If L_1 and L_2 are Turing-Recognizable then $L_1 \cup L_2$ will be

(A) Decidable

(B) Turing recognizable but may not be decidable

(C) May not be Turing recognizable

(D) None of above

Q.70 Which of the following is true for input alphabet Σ and tape alphabet Γ of a standard T_M ?

(A) It is possible for Σ and Γ to be equal.

(B) Γ is always a strict superset of Σ

(C) It is possible for Σ and Γ to be disjoint.

(D) None

Q.71 Language

$L = \begin{Bmatrix} a^n b^n W \mid n \geq 0, \\ W \in \{c, d\}^*, |W| = \text{constant} \end{Bmatrix}$ is

(A) Regular

(B) DCFL

(C) CFL

(D) Non Context-free

Q.72 $L = \begin{Bmatrix} a^i b^j c^k d^m \mid i + j + \\ k + m \text{ is multiple of } 13 \end{Bmatrix}$ L is?

(A) Regular

(B) Context-free

(C) Turing-decidable

(D) Turing Recognizable

Q.73 S_1 : A non-deterministic T_m can decide language that a standard T_m cannot decide.

S_2 : L be a Context free language. $\bar{L}$ is turing-decidable.

(A) Both are True

(B) Both are False

(C) $S_1 \to \text{True}, S_2 \to \text{False}$

(D) $S_1 \to \text{False}, S_2 \to \text{True}$

Q.74 $\gamma_1 = (01+1)^*(\varepsilon + 0)$

$\gamma_2 = (0+\varepsilon)(10+1)^*$

(A) Both represent same language.

(B) r_1 represent strings with no consecutive 00 and

r_2 represent strings with no consecutive 11.

(C) r_1 represents strings with no consecutive 11 and

r_2 represents strings with no consecutive 00

(D) None of above

Q.75 Consider this

$S_1 : r_1 = (\varepsilon + a + b)^{100}$ represents strings of length strictly less than 100.

$S_2 : r_2 = (00+11+01+10)^{*}(0+1)$ represents all odd length strings.

(A) Both are True

(B) Both are False

(C) $S_1 \rightarrow \text{True}, S_2 \rightarrow \text{False}$

(D) $S_1 \rightarrow \text{False}, S_2 \rightarrow \text{True}$

Q.76 Consider this R.E $= (0+1)*(00+11)$

What will be the number of states in minimal DFA and NFA?

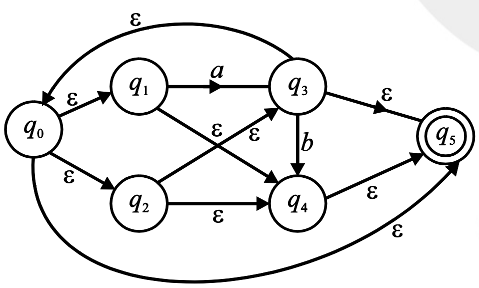
(A) DFA-5, NFA-5

(B) DFA-5, NFA-4

(C) DFA-4, NFA-4

(D) None

Q.77 Consider the following NFA



Find the epsilon closure of state q_2 :

(A) $\{q_4, q_3, q_5\}$ only

(B) $\{q_3, q_4\}$ only

(C) $\{q_0, q_5\}$ only

(D) $\{q_0, q_1, q_2, q_3, q_4, q_5\}$ only

Q.78 Which of the following statements are True?

S_1 : Every Left recursive grammar can be converted to right recursive grammar and vice-versa.

S_2 : All ε-production can be removed from any context free grammar.

S_3 : An Unambiguous Context free grammar always has a unique parse tree for each string of the language generated by it.

(A) Only S_1 and S_2

(B) Only S_1 and S_3

(C) Only S_2 and S_3

(D) S_1, S_2 and S_3

Q.79 If string of length 10 is used to test for membership, then the number of table entries in CYK algorithm is

(A) 50 (B) 55

(C) 45 (D) 99

Q.80 Let $<M>$ be the encoding of Turing machine as a string over $\Sigma = \{0,1\}$, Let

$$L = \left\{ \begin{array}{l} <M> \mid M \text{ is } T_m \\ \text{on input } W \text{ will} \\ \text{visit some state } P \end{array} \right\}.$$

The language L is

(A) Decidable

(B) Undecidable and not even partially decidable.

(C) Undecidable and not even partially decidable

(D) Not a decision problem

Q.81 Let $L \leq_m L'$ denote the language L is mapping reducible (Many to one reducible) to language L'. Which one of the following is true?

(A) If $L \leq_p L'$ and L' semi-decidable then L is semi-decidable

(B) If $L \leq_p L'$ and L is RE then L' is RE.

(C) If $L \leq_p L'$ and L is decidable then L' decidable.

(D) If $L \leq_p L'$ and L is recursive.

Q.82 Let L be the language containing only the string S where

$$S = \begin{cases} 0 & \text{if you will never clear the gate} \\ 1 & \text{if you will clear the gate some day} \end{cases}$$

Which of the following is true? (L' is the complement of language L)

(A) L is decidable

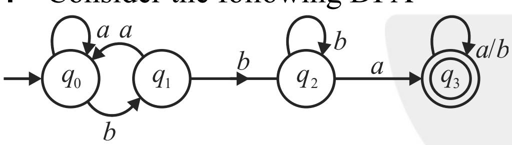
(B) L' is decidable

(C) L and L' both are decidable

(D) L is undecidable

Q.83 If G is a Context free grammar and W is a string of length 10 in $L(G)$. The length of derivation of W in G, if G is in Chomsky normal form is __________.

Q.84 Consider the following DFA



The number of strings upto length 5 where first and last character of string is 'a' are ______.

Q.85 Which of the following is True?

(A) Complement of CSL is CSL

(B) Complement of CFL is CFL

(C) Complement of RE is RE

(D) Complement of non-CFL Can't be CFL

Q.86 Consider the following statements

1. The complement of every Turing recognizable language is Turing recognizable
2. Deciding if a given string is generated by a given Context free grammar is decidable.

Which of the above statements are correct?

(A) Only 1

(B) Both 1 and 2

(C) Only 2

(D) Neither 1 nor 2

Q.87 Consider the following language $L = \{W \in (a+b)^* \mid W$ has atleast as many occurrences of $(bba)'s$ as $(abb)'s\}$. Which of the following is/are true? **[MSQ]**

(A) L is regular

(B) Complement of L is CFL

(C) Complement of L is CSL

(D) Reversal of L is CFL

Q.88 Consider the following Grammar G.

$G:\ S \to XC \mid AY$

$X \to aXb \mid \in$

$C \to cC \mid c$

$A \to aA \mid a$

$Y \to bYc \mid \in$

Which of the following is correct?

(A) G is ambiguous but $L(G)$ is not inherently ambiguous.

(B) G is ambiguous but $L(G)$ is inherently ambiguous.

(C) G is not ambiguous but $L(G)$ is not inherently ambiguous.

(D) None of the above

Q.89 Consider the language

$L_1 = \{0^n 1^n 2^m \mid n, m \geq 0\}$ and

$L_2 = \{0^n 1^m 2^m \mid n, m \geq 0\}$

Which of the following statements is True? (L^c is the complement of L)

(A) $L_1 \cap L_2$ is CSL

(B) $L_1 \cap L_2$ is CFL

(C) $L_1^c \cdot L_2^c$ is CFL

(D) None of these

Q.90 Consider the following context free grammar G :

$G:\ R \to XRX \mid S$

$S \to aAb \mid bAa$

$A \to XAX \mid X \mid \varepsilon$

$X \to a \mid b$

Which of the following correctly describes the above grammar G?

(A) $L(G)$ contain all strings over 'a' and 'b' that are palindrome only.

(B) $L(G)$ contain all strings will equal number 'a' and 'b' only.

(C) $L(G)$ contain all strings will equal number of 'a' and but different of 'b' only.

(D) None of the above.

Q.91 Let $L_1 = a^*b^*$ and $L_2 = \{ab\}$, $L_3 =$ Prefix $(L_1^* \cap L_2)$, where prefix $(L) = \{U \mid uv \in L \text{ for any } V\}$.

The number of strings in L_3 is ______.

Q.92 Which of the following does not perform with the help of Turing machine?

(i) Addition of two Numbers i.e., $f(m,n) = m+n$

(ii) Multiplication of two Numbers i.e., $f(m,n) = m \times n$

(iii) Acceptance of language $L = \{W/W \in (a,b)^*\}$

(iv) Acceptance of language $L = \{a^n b^n c^n d^n e^n \mid n \geq 1\}$

(A) i and ii

(B) iii and iv

(C) iii only

(D) None of these.

Q.93 Which one of the following is a DCFL?

(A) $L = \{a^n b^n c^n \mid n > 1000\}$

(B) $L =$ Set of all balanced parenthesis

(C) $L = \{WW^R \mid W \in (a,b)^*\}$

(D) All of these

Q.94 Let G and G_1 be a CFG with productions

$G:\ S \to S+S \mid S*S \mid (S) \mid a$

$G_1:\ S \to S + \mathrm{T} \mid \mathrm{T}$

$\mathrm{T} \to \mathrm{T} * \mathrm{F} \mid \mathrm{F}$

$\mathrm{F} \to (S) \mid a$

Then which of the following is true?

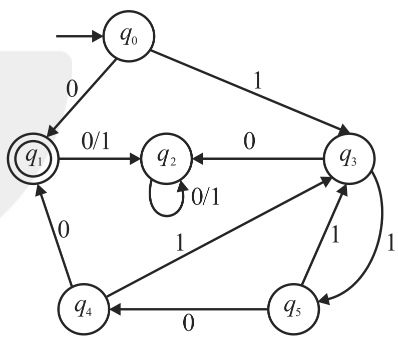
(A) $L(G) \neq L(G_1)$

(B) $L(G_1) \subseteq L(G)$

(C) $L(G) \subset L(G_1)$

(D) $L(G) = L(G_1)$

Q.95 Which of the following language is accepted by the following finite automata?



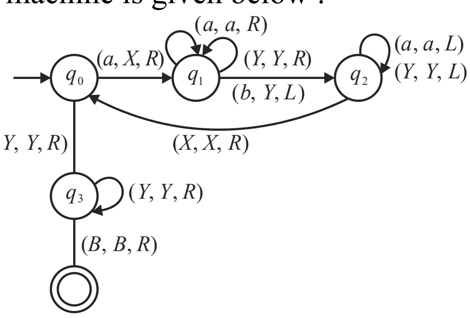
(A) $(110)^*01$

(B) $0 + (1(11)^*10)^+0$

(C) $0 + (1(11)^*101)^+0$

(D) $(11+10)^*01$

Q.96 The transition diagram for Turing machine is given below :



Which of one of the following strings is accepted by the above TM?

(A) $aabbb$

(B) $aabb$

(C) $abbb$

(D) None

Q.97 Which of the following is TRUE?

(A) The equality problem $(L_1 = L_2)$ of CFLs is decidable

(B) The emptiness of CSL'S is decidable

(C) The Finiteness of CFL is decidable

(D) IS $L_1 \cap L_2 = \phi$ is decidable for CSL's.

Q.98 Consider the following languages :

$L_{ne} = \{< M >| L(M) \neq \phi\}$

$L_e = \{< M >| L(M) = \phi\}$

Where $< M >$ denotes encoding of a *TM M*. Then which one of the following is TRUE?

(A) L_{ne} is r.e. but not recursive and L_e is not r.e.

(B) Both are not r.e.

(C) both are recursive

(D) L_e is r.e. but not recursive and L_{ne} is not r.e.

Q.99 Finite automata can be used in

(A) Lexical Analysis

(B) Syntax Analysis

(C) Semantic Analysis

(D) None of these

Q.100 Let $L = \{ab, aa, baa\}$

Which of the following are not in L^*?

(A) *abaabaaaa*

(B) *aaaabaaaa*

(C) *baaaaabaa*

(D) *baaaabaaababa*

Q.101 The minimum number of states are required for Turing machine as unary to binary conversion is

(A) 7 (B) 5

(C) 3 (D) 9

Q.102 Consider the following languages

(I) $[a^m b^n c^p d^q \mid m + p = n + q$ where $m, n, p, q \geq 0]$

(II) $[a^m b^n c^p d^q \mid m = n$ and $p = q$ where $m, n, p, q \geq 0]$

(III) $[a^m b^n c^p d^q \mid m = n = p$ and $p \neq q$ where $m, n, p, q \geq 0]$

(IV) $[a^m b^n c^p d^q \mid m.n = p + q$ where $m, n, p, q \geq 0]$

Which of the above language are context free?

(A) I & IV only (B) I & II only

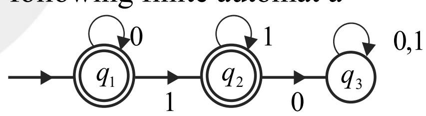
(C) II & III only (D) II & IV only

Q.103 For $\Sigma = [a, b]$, find the minimum number of states are is DFA for all strings in which 3rd symbol from right hand side is

(A) 6 (B) 7

(C) 9 (D) 8

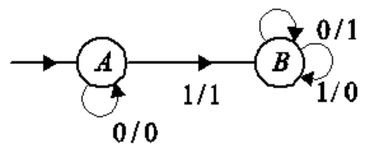
Q.104 Find the regular expression for the following finite automat a

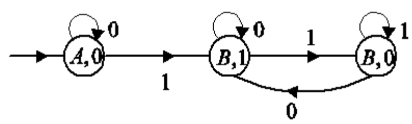


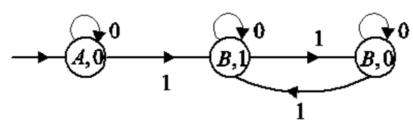
(A) 0^+1^* (B) 0^*

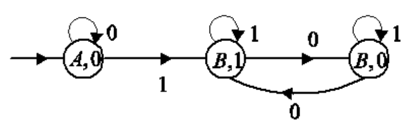
(C) 1^* (D) 0^*1^*

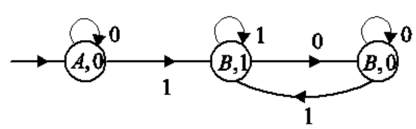
Q.105 Mealy to Moore equivalent circuit



(A)


(B)


(C)


(D)


Answers Theory of Computation

1.	2	2.	5	3.	1	4.	5	5.	D
6.	A,C,D	7.	C	8.	A	9.	1	10.	A,C
11.	A	12.	A	13.	C	14.	B	15.	B
16.	B	17.	C	18.	B	19.	B	20.	D
21.	B	22.	B	23.	7	24.	C	25.	D
26.	C	27.	A	28.	B	29.	B	30	D
31.	B	32.	B	33.	A	34.	A	35.	C
36.	B	37.	A	38.	C	39.	A	40	D
41.	C	42.	C	43.	A	44.	B	45.	C
46.	B	47.	C	48.	A	49.	D	50.	D
51.	A,B,C	52.	B,D	53.	A	54.	B	55.	D
56.	C	57.	C	58.	B	59.	A	60.	B
61.	A	62.	B	63.	A,B,D	64.	D	65.	D
66.	A	67.	B	68.	B	69.	B	70.	B
71.	B	72.	C	73.	D	74.	A	75.	F
76.	B	77.	D	78.	B	79.	B	80.	B
81.	A	82.	C	83.	19	84.	6	85.	A
86.	C	87.	A,B,C,D	88.	B	89.	A	90.	D
91.	3	92.	C	93.	B	94.	D	95.	B
96.	B	97.	C	98.	A	99.	A	100.	D
101.	C	102.	A	103.	D	104.	D	105.	A

Explanations **Theory of Computation**

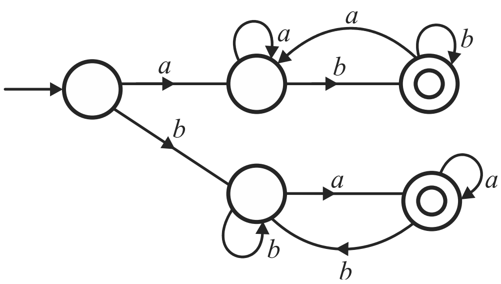
1. **2**

Trivial substring of any string always 2, ε and string itself.

Hence, the correct answer is 2.

2. **5**

$$L = \{ab, ba, \ldots\}$$



Hence, the correct answer is 5.

3. **11**

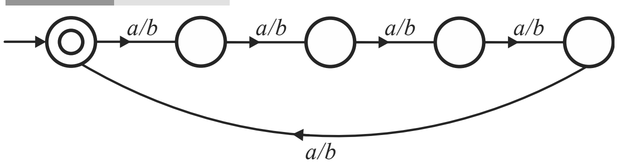
Number of substrings $= \dfrac{n(n+1)}{2} + 1$

[Where n is the length of substring]

$$= \frac{4 \times 5}{2} + 1 = 11$$

Hence, the correct answer is 11.

4. **5**



Hence, the correct answer is 5.

5. **(D)**

When we convert NFA with N states into DFA then DFA have maximum 2^N states.

Hence, the correct option is (D).

6. **(A,C,D)**

A. $S \to AB$
$\to BBB$
$\to ABBB$
$\to aBBB$
$\to aABBB$
$\to aabbb$

B. $S \to AB$
$\to aB$
$\to aAB$
$\to aBBB$
$\to abBB$
$\to abABB$
$\to abaBB$
$\to ababAB$
$\to ababab$

C. $S \to AB$
BBB
$ABBB$
$abbb$

Hence, the correct option are (A,C,D).

7. **(C)**

A, B and D Generate the same language.

Hence, the correct option is (C).

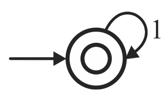
8. **(A)**

The complementation of CFL is not always CFL, but it must be recursive language

Hence, the correct option is (A).

9. **1**

$$L = \{\varepsilon, 1, 11, 111, 1111, \ldots\}$$



Hence, the correct answer is 1.

10. **(A,C)**

$L_1 = \{a^n b^n \mid n \geq 0\}$ this is $DCFL$ we can construct $DPDA$ for this.

$$L_2 = \underbrace{\{a^m b^m \mid m \neq n\}}_{DCFL} \cup \underbrace{(a+b)^* ba(a+b)^*}_{RL}$$

$$= DCFL$$

Hence, the correct option are (A,C).

11. **(A)**

Given language is finite and every finite language is regular.

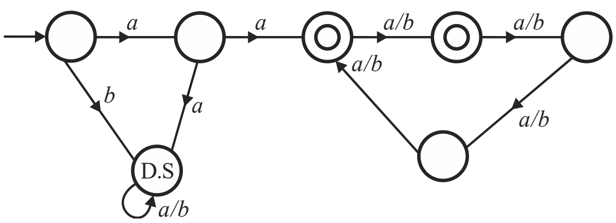
Hence, the correct option is (A).

12.	(A)

$x \bmod n$, if $n =$ even and $n = 2^m$ then number of states in $NDFA\ = m+1$

Hence, the correct option is (C).

13.	(C)



Hence, the correct option is (B).

14.	(B)

$2^n \times 2^{n \times m}$ number of DFA possible with n states and m input alphabet

$$= 2^4 * 4^{4\times 2} = 2^4 \times 2^{16} = 2^{20}$$

Hence, the correct option is (B).

15.	(B)

Hence, the correct option is (B).

16.	(B)

Type-3

$A \to aB \mid a$ where $a \in T*$

or

$A \to Ba \mid a \qquad A_1B \in V$

Type-2

$A \to \alpha,$ where $\alpha \in (V+T)*$

$A \in V$

Type-1

$\alpha \to \beta \quad \alpha \in (V+T)*\forall(V+T)*$

and

$|\alpha| \le |\beta| \qquad \beta \in (V+T)*$

Type-0

$\alpha \to \beta$

$\alpha \in (V+T)*\forall(V+T)*$

$\beta \in (V+T)*$

Hence, the correct option is (B).

17.	(C)

Complement of NFA does not exist.

Hence, the correct option is (C).

18.	(B)

A. False it accepts ε.

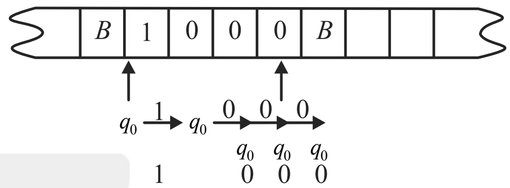
B. True

C. False it accepts $\varepsilon, 0, 1$

D. False it accepts $\varepsilon, 0, 1$

Hence, the correct option is (B).

19.	(B)



Hence, the correct option is (B).

20.	(D)

Finite language always regular.

Hence, the correct option is (D).

21.	(B)

When we create NFA with N state into DFA then DFA have $\le 2^N$ states.

Hence, the correct option is (B).

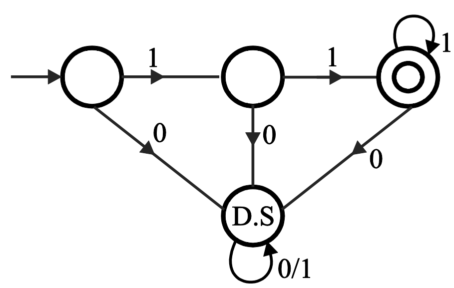
22.	(B)

Regular languages are not closed under infinite union and subset operations.

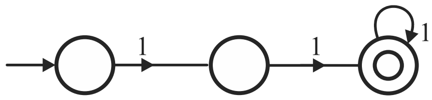
Hence, the correct option is (B).

23.	7

DFA

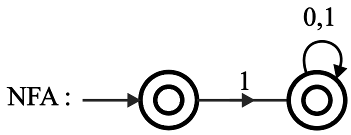


NFA



Hence, the correct answer is 7.

24. (C)



$L(NFA) \neq \sum^*$

Hence, the correct option is (C).

25. (D)

$L(FA) = (a+b)^*$

$\bar{L} = *\{\,\}$

Hence, the correct option is (D).

26. (C)

R.E $= L \cdot (L+D)^*$

Hence, the correct option is (A).

27. (A)

16 DFA'S are possible

	0	1
$\rightarrow q_0$	2	2
(q_1)	2	2

Total $= 2 \times 2 \times 2 \times 2 = 16$

Hence, the correct option is (A).

28. (B)

$L \cup R \rightarrow$ Regular

$L \rightarrow$ CFL

Hence, the correct option is (B).

29. (B)

$L_1 = \{a^m \mid m > 0\}$

$L_2 = \{b^m \mid m > 0\}$

In individually they both have power terms is m, but if we concatenate it. i.e.,

$L_1.L_2 = \{a^m b^n \mid m, n \geq 0\}$

Because they both languages have not any type of relation is given so in this case, they both power terms must be different

Hence, the correct option is (B).

30. (D)

Infinite can also be regular $\rightarrow a^*$

$(\bar{L})^*$ will surely contain ε

but $(\overline{L^*})$ will not contain ε

So, they are not equal.

Hence, the correct option is (D).

31. (B)

Option (A): $(a^* + b^* + c^*)^*$

According to regular expression closure identities.

It can also generates all possible combination of a, b & c including ε

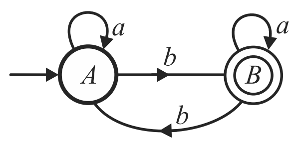
Option (B): $((ab)^* + c^*)^*$

It cannot generate only a's combination b's combination

Option C & D, can also generate all possible combination of a, b & c including ε.

Hence, the correct option is (B).

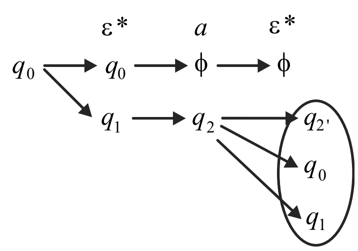
32. (B)



Hence, the correct option is (B).

33. (A)

$\delta^*(q_0, a) =$



Hence, the correct option is (A).

34. **(A)**

$$R = (aa)^*(bb)^* + a(aa)^*b(bb)^* = L_1$$

L_2 involves infinite counting so not regular

Hence, the correct option is (A).

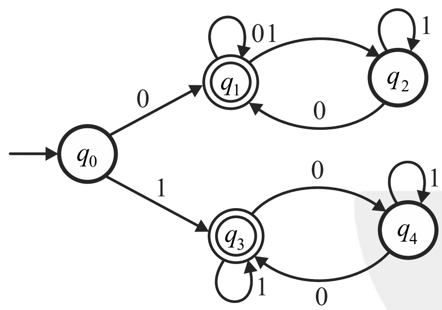
35. **(C)**

r may not contain ε, So $r + \varepsilon \neq r$

Hence, the correct option is (C).

36. **(B)**

L_2 is important and specific case.



Hence, the correct option is (B).

37. **(A)**

All CSL'S are decidable.

Hence, the correct option is (A).

38. **(C)**

If DPDA is possible for L, surely NPDA can also be made.

Hence, the correct option is (C).

39. **(A)**

If complement is finite $\rightarrow L^c$ is Regular So, L has to be Regular.

Hence, the correct option is (A).

40. **(D)**

Using closure properties.

Hence, the correct option is (D).

41. **(C)**

Derivation always required $2n-1$ steps in CNF.

$n =$ Length of string.

Hence, the correct option is (C).

42. **(C)**

Both grammar Generate same language

Hence, the correct option is (C).

43. **(A)**

44. **(B)**

b is depending on a and number of $a's$ are unbounded.

Hence, the correct option is (B).

45. **(C)**

Take $L_1 = (a+b)^*$

L_2 can be 0^n1^n

Hence, the correct option is (C).

46. **(B)**

Take $L_1 = (a+b)^*, L_2$ could be either regular or non-regular.

Hence, the correct option is (B).

47. **(C)**

If L^R is Regular, L has to be regular.

Hence, the correct option is (C).

48. **(A)**

$$\phi^k = \varepsilon$$

$$a^k \cdot \phi = \phi$$

Hence, the correct option is (A).

49. **(D)**

For S_1, take

All non-primer I am taking

After taking their intersection, U will get like this.

$$L = \{a^p \mid p \text{ is prime}\} \text{ i.e. not regular.}$$

For S_2 : L is nothing but language of even length strings.

$$\text{R.E} = (00+01+10+11)^*$$

So, L is regular.

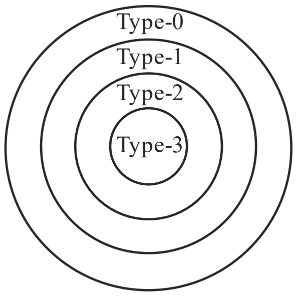
Hence, the correct option is (D).

50. **(D)**

Finite state machine and Regular expression have same power to express a language.

Hence, the correct option is (D).

51. **(A,B,C)**



Hence, the correct option are (A,B,C).

52. **(B,D)**

53. **(A)**

Use them as a flip flop output.

Hence, the correct option is (A).

54. **(B)**

Here each state in a FSM can store one bit. So we need to find the number of bits required in this case. Consider the M words as segments of memory and each word is divided into n bits. So, the total number of bits are $m*n$. and each bit can be in two states. Hence the answer is 2^{m*n}.

Hence, the correct option is (B).

55. **(D)**

Number of DFA'S $= 2^3 * 3^{3\times 2} = 5832$

Hence, the correct option is (D).

56. **(C)**

Starts with ab then any number of a or b and ends with bba.

Hence, the correct option is (C).

57. **(C)**

If automata starts with starting state and after finite moves if reaches to final step then it called accepted.

Hence, the correct option is (C).

58. **(B)**

First it parse Y string after that it parse a.

Hence, the correct option is (B).

59. **(A)**

This takes single state and string of input to produce a state.

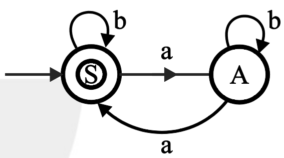
Hence, the correct option is (A).

60. **(B)**

$$init(L) = (a+b)^*$$

Hence, the correct option is (B).

61. **(A)**



Myhill-Nerode equivalence classes are actually the number of states in FA

Hence, the correct option is (A).

62. **(B)**

Verify using aab. It is getting rejected.

Hence, the correct option is (B).

63. **(A,B,D)**

A. True if $L = (a+b)^*$

$L_1 = \phi$

$L_1 \subset (a+b)^*$

B. True if $L =$ any language over $\Sigma = \{a,b\}$

$L_1 = (a+b)^* -$ Regular

$L_1 \supset L$

C. False if $L = (a+b)^*$

$L_1 = a^n b^n |_{n\geq 0}$ not regular & $L_1 \subset L$

D. True every finite language is regular.

Hence, the correct option are (A,B,D).

64. (D)

(a) is CSL

b and c are accepted by DPDA.

Hence, the correct option is (D).

65. (D)

According to closure property.

Hence, the correct option is (D).

66. (A)

(b) is not because aab is rejected.

Hence, the correct option is (A).

67. (B)

Language of palindromes it is.

Hence, the correct option is (B).

68. (B)

69. (B)

We can build a T_m for union but decidability may not always be guaranted.

Hence, the correct option is (B).

70. (B)

Γ always contains members of $\sum$ and special Block

Symbol also, which is not in $\sum$.

Hence, the correct option is (B).

71. (B)

Not possible to check for W as stack will be empty after checking for a and b.

Hence, the correct option is (B).

72. (C)

We just had 13 states to remainders $(0,1,\ldots 12)$.

We start by state with 0 remainder and as we visit new character, we change state to next remainder.

Hence, the correct option is (C).

73. (D)

S_1 : NTM $\cong$ DTM

$S_2 : \bar{L}$ is Recursive.

Hence, the correct option is (D).

74. (A)

Both are regular expression represents strings with no consecutive zeroes.

Hence, the correct option is (A).

75. (D)

$S_1 \rightarrow$ F

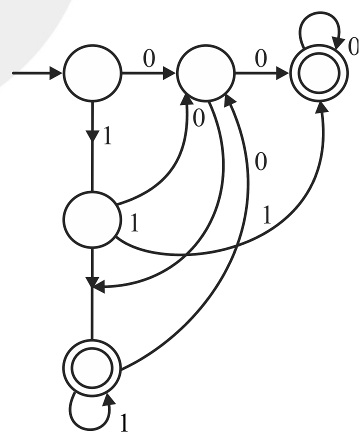
$S_2 \rightarrow$ T

r_1 represents strings of length at most 100.

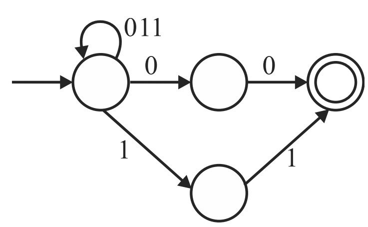
Hence, the correct option is (D).

76. (B)

DFA



NFA



Hence, the correct option is (B).

77. (D)

Null closure of any state are those state which are reachable only by ε-transition, i.e, here q_2 to q_3 and q_4 by ε-transition. From q_3 we can reach q_0 and q_5 and from q_0 to q_1 by using ε-transition.

So ε-closure of q_2 is $\{q_0, q_1, q_2, q_3, q_4, q_5\}$

Hence, the correct option is (D).

78. (B)

Explanation : Statement S_1 and S_3 are True.

S_2 is false because all ε-production can be removed from grammar only when the language do not contain ε-string but if language contain ε-string then removal of the Null production is not possible.

Hence, the correct option is (B).

79. (B)

By theorem if n is the length of string to test for membership, then the number of table entries in CYK algorithm is $\frac{n(n+1)}{2}$

So, $\frac{10\times 11}{2} = 55$

Hence, the correct option is (B).

80. (B)

Language L is state entry problem, halting problem of Turing machine can be reduced to state entry problem.

Hence, the correct option is (B).

81. (A)

$L \leq_p L'$. Since L' is semi-decidable then L is semi-decidable is one way theorem.

Hence, the correct option is (A).

82. (C)

The language L is one of the two languages $\{0\}$, $\{1\}$.

In either case the language is finite only. Hence L is decidable. Since complement of decidable is decidable only.

So L and L' both are decidable.

Hence, the correct option is (C).

83. 19

$|W| = n$ then number of length of derivation of W in $G = 2n-1 = 2\times 10-1 = 19$

Hence, the correct answer is 6.

84. 6

String of one length $= 0 \rightarrow$ Not possible

String of two length $= 0 \rightarrow$ Not possible

String of three length $= bba$ — (1 string)

String of four length $= abba$ — (1 string)

String of five length $= abbba,\ abbaa,$

$abbab, aabba$ (4 strings)

Total 6 strings possible.

Hence, the correct answer is 6.

85. (A)

CSL closed under complement so complement of CSL is CSL RE and CFL are not closed under complement.

Complement of non-CFL can be CFL i.e.

$\{WW = \text{CSL}\}, \text{Complemen} = \text{CFL}$

Hence, the correct option is (A).

86. (C)

1. Turing recognizable language are RE language which are not closed under complementation. So statement is false.

2. Second statement is True.

Hence, the correct option is (C).

87. (A,B,C,D)

There is no need to keep the number of $bba's$ in the memory because whenever two $abb's$ comes together (adjacent), then one $bba's$ always come between them, so language L is regular. Since Regular language is closed under complement reversal and regular language are subset of CSL and CFL.

Hence, the correct option are (A,B,C,D).

88. **(B)**

The grammar generates the following language.

$L(G) = \{a^n b^n c^m \mid n, m \geq 0\} \cup \{a^n b^m c^m \mid n, m \geq 0\}$

Hence, the correct option is (B).

89. **(A)**

The intersection of L_1 and L_2 is given by $L_1 \cap L_2 = \{0^n 1^n 2^n \mid n \geq 0\}$ which is well known CSL.

Hence, the correct option is (A).

90. **(D)**

Sometimes it generates equal number of a & b, but that is not true for all cases, sometimes number of a's and b's are not equal and also it cannot generate palindrome.

So, the correct option is D.

Hence, the correct option is (D).

91. **3**

$$L_1 = a^*b^* \;\Rightarrow\; L_1^* = (a^*b^*)^* = (a+b)^*$$

$$L_2 = \{ab\}$$

$$L_1^* \cap L_2 = (a+b)^* \cap \{ab\} = \{ab\}$$

$$L_3 = \text{Prefix}\,(L_1^* \cap L_2) = \{\varepsilon, a, ab\}$$

Hence, the correct answer is 3.

92. **(C)**

$$L = \{W/W/(a,b)^*\}$$

We can't identify the boundary of language so cannot be accepted by T.M.

93. **(B)**

Option (A) is not CFL

Option (C) is NCFL

Option (B) is DCFL

Hence, the correct option is (B).

94. **(D)**

G_1 is the unambiguous expression of G.

Hence, the correct option is (D).

95. **(B)**

In the given DFA, state q_2 is the dead state. We obtain the following Regular Expression $0 + (1(11)^*10)^+0$ after removing the dead state.

Hence, the correct option is (B).

96. **(B)**

According to the given Turing machine diagram, we can clearly say that machine only accepts the language those number of a's are followed by same number of b's

So, **option (A)** - False because number of a's are not followed by same number of b's

Option (B) -Ture because number of a's are followed by same number of b's

Option (C)- False because number of a's are not followed by same number of b's

Option (D)- False because option B is correct

Hence, the correct option is (B).

97. **(C)**

According to Decidability Table.

Hence, the correct option is (C).

98. **(A)**

L_{ne} is r.e., since we can accept M, if M accepts a string.

Hence, the correct option is (A).

99. **(A)**

Finite automata is used during Lexical Analysis to recognize tokens.

Hence, the correct option is (A).

100. **(D)**

Option A (True)

{ab} {aa} {baa} {aa}

these all are L so it is generated

Option B (True)

{aa} {aa} {baa} {aa}

these all are L so it is also generated

Option C (True)

{baa} {aa} {ab} {aa}

these all are L so it is also generated

Option D (False)

{baa} {aa} {baa} {ab} {ab} a

but last term a is not in L so it cannot generated

Hence, the correct option is (D).

101. C

In unary

1–1

2–11

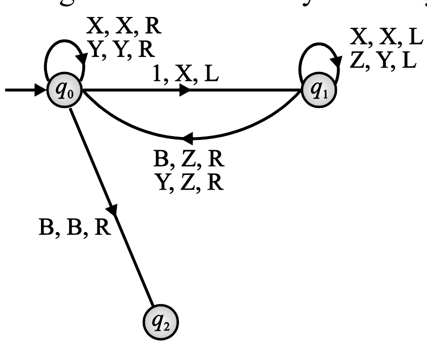
3–111

4–1111

5–11111

But in binary $0-Y, 1-Z$ according to the weight $[2^0, 2^1 --\text{etc}]$

So the turing machine for unary to binary is



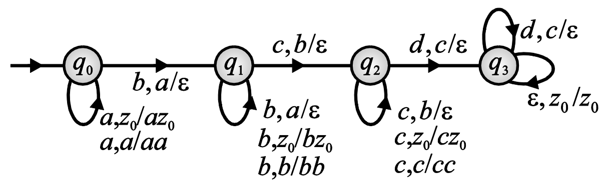
Here no final state so here minimum 3 states are required

102. A

If language is context free then we can construct a PDA pushdown automata

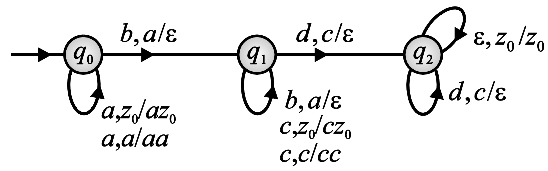
Option I: PUSH all a If b comes then pop all a and if a is finished and top symbol of stack is Z_0 then we push b

If c comes and top of the symbol is b then pop all b and is b is finished and top symbol of stack is Z_0 then we push C if d comes then pop all the c and if input symbol is ε and top symbol of the stack is Z_0 then it reaches to the final state



Option II :

Push all a, If b comes pop all a, push all c If d comes pop all c



Option II is the correct option.

Option III is similar like $a^n b^n c^n$ we have only one memory clement so it is not a context free language so option III is incorrect option

Option IV $a^m b^n c^p d^q \mid m.n = p + q$

So we have only a memory (stack) so it is impossible to multiply two variable power & store it, so it is not a context free language so option IV is incorrect option. So option I and II are correct options.

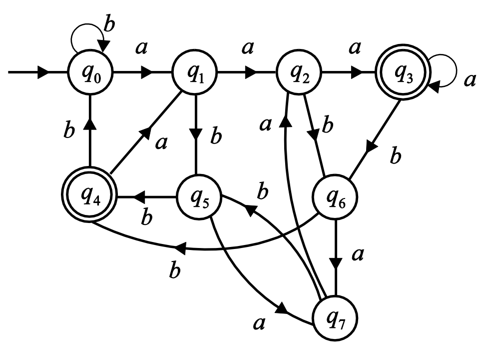
Hence, the correct option is (A).

103. D

According to question 3rd last symbol must be a.

So, its equivalent regular expression are

$$= (a + b) * a (a + b)(a + b)$$



So the minimum number of states are 8 so the correct answer is D.

104. **D**

Equation according to the diagram

$$q_1 = \varepsilon + q_1.0 \qquad \ldots(i)$$

$$q_2 = q_1.1 + q_2.1 \qquad \ldots(ii)$$

$$q_3 = q_2.0 + q_3.0 + q_3.1 \qquad \ldots(iii)$$

When we have more than one final state than we add both final state Regular expression, first we find these two are separately

For equation (i)

$$q_1 = \varepsilon + q_1.0$$

Using Arden's theorem if $R = Q + RP$ where P does not contain ε and only one input state than it has a unique solution i.e.,

$$R = QP^*$$

So, $q_1 = \varepsilon.0^*$

$$\Sigma.R^* = R^*$$

[Regular expression identities]

$$q_1 = 0^* \qquad \ldots(iv)$$

Now we find q_2

$$q_2 = q_1.1 + q_2.1$$

Using equation 4 $[q_1 = 0^*]$

So $q_2 = 0^*.1 + q_2.1$

Using Arden's method

$$q_2 = 0^*.1.1^* \qquad \ldots(v)$$

Union of both final state

$$R.E. = 0^* + 0^*.1.1^*$$

$$R.E. = 0^*[\varepsilon + 1.1^*]$$

$$\varepsilon + R.R^* = R^*$$

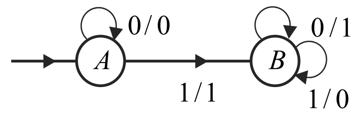
[using regular expression (RE) Identities]

$$R.E. = 0^*.1^*$$

Hence, the correct option is (D).

105. **A**

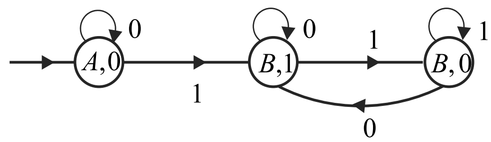
Mealy circuit is



Make state transition table

State	Inputs	
	0	1
A	(A, 0)	(B,1)
B	(B, 1)	(B,0)

Draw its equivalent more machine



So the option A is the correct option.

❖❖❖❖