Automata

13. The number of states in a minimal deterministic finite automaton corresponding to the language L = { a^n | n≥4 } is
    (A) 3 (B) 4
    (C) 5 (D) 6
    Answer: C

14. Regular expression for the language L = { w ∈ {0, 1}* | w has no pair of consecutive zeros} is
    (A) (1 + 010)*
    (B) (01 + 10)*
    (C) (1 + 010)* (0 + λ)
    (D) (1 + 01)* (0 + λ)
    Answer: D

15. Consider the following two languages:
    $L_1 = \{a^n b^l a^k \mid n + l + k > 5\}$
    $L_2 = \{a^n b^l a^k \mid n > 5, l > 3, k \leq l\}$
    Which of the following is true?
    (A) L_1 is regular language and L_2 is not regular language.
    (B) Both L_1 and L_2 are regular languages.
    (C) Both L_1 and L_2 are not regular languages.
    (D) L_1 is not regular language and L_2 is regular language.

21. Given the production rules of a grammar G1 as
    $S_1 \rightarrow AB \mid aaB$
    $A \rightarrow a \mid Aa$
    $B \rightarrow b$
    and the production rules of a grammar G2 as
    $S_2 \rightarrow aS_2bS_2 \mid bS_2aS_2 \mid \lambda$
    Which of the following is correct statement?
    (A) G1 is ambiguous and G2 is not ambiguous.
    (B) G1 is ambiguous and G2 is ambiguous.
    (C) G1 is not ambiguous and G2 is ambiguous.
    (D) G1 is not ambiguous and G2 is not ambiguous.
    Answer: B

22. Given a grammar : $S_1 \rightarrow Sc$, $S \rightarrow SA|A$, $A \rightarrow aSb|ab$, there is a rightmost derivation $S_1 \Rightarrow Sc \Rightarrow SAC \Rightarrow SaSbc$. Thus, SaSbc is a right sentential form, and its handle is
    (A) SaS (B) be
    (C) Sbe (D) aSb
    Answer: D

23. The equivalent production rules corresponding to the production rules
    $S \rightarrow S\alpha1|S\alpha2|\beta1|\beta2$ is
    (A) $S \rightarrow \beta1 \mid \beta2$, $A \rightarrow \alpha1A \mid \alpha2A \mid \lambda$
    (B) $S \rightarrow \beta1 \mid \beta2 \mid \beta1A \mid \beta2A$,
    $A \rightarrow \alpha1A \mid \alpha2A$
    (C) $S \rightarrow \beta1 \mid \beta2$, $A \rightarrow \alpha1A \mid \alpha2A$
    (D) $S \rightarrow \beta1 \mid \beta2 \mid \beta1A \mid \beta2A$,
    $A \rightarrow \alpha1A \mid \alpha2A \mid \lambda$

Answer: D

24. Given a Non-deterministic Finite Automation (NFA) with states p and r as initial and final states respectively transition table as given below

	a	b
p	-	q
q	r	s
r	r	s
s	r	s

The minimum number of states required in Deterministic Finite Automation (DFA) equivalent to NFA is

(A) 5 (B) 4
(C) 3 (D) 2

Answer: C

44. Let L be a set accepted by a nondeterministic finite automaton. The number of states in non-deterministic finite automaton is |Q|. The maximum number of states in equivalent finite automaton that accepts L is

(A) |Q| (B) 2|Q|
(C) $2^{|Q|}-1$ (D) $2^{|Q|}$

Answer: D

3. "My Lafter Machin (MLM) recognizes the following strings :

(i) a
(ii) aba
(iii) abaabaaba
(iv) abaabaabaabaabaabaabaabaaba

Using this as an information, how would you compare the following regular expressions?

(i) $(aba)^{3x}$
(ii) a.(baa)3^{x}–1. ba
(iii) ab.(aab).$^{3x-1}$.a
(A) (ii) and (iii) are same, (i) is different.
(B) (ii) and (iii) are not same.
(C) (i), (ii) and (iii) are different.
(D) (i), (ii) and (iii) are same.

Answer: D

5. In a MIU puzzle, either of the letters M, I or U could go as a start symbol. Production rules are given below :

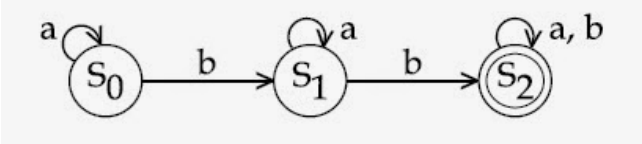
R1 : U→IU

R2 : M.x→M.x.x where $\cdot$ is string concatenation operator. Given this, which of the following holds for

(i) MIUIUIUIUIU
(ii) MIUIUIUIUIUIUIUIU
(A) Either (i) or (ii) but not both of these are valid words.
(B) Both (i) and (ii) are valid words and they take identical number of transformations for the production.
(C) Both (i) and (ii) are valid words but they involve different number of transformations in the production.
(D) None of these

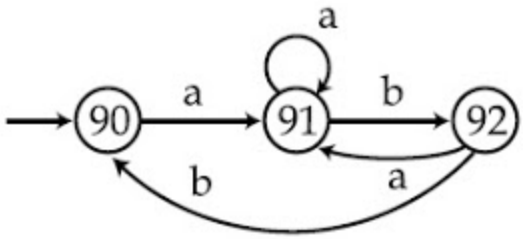
Answer: C

5. Consider a Moore Machine M whose digraph is:



Then L(M), the language accepted by the machine M, is the set of all strings having:
(A) two or more b's
(B) three or more b's
(C) two or more a's
(D) three or more a's
Answer: A

1. The following deterministic finite automata recognizes:



(A) Set of all strings containing 'ab'
(B) Set of all strings containing 'aab'
(C) Set of all strings ending in 'abab'
(D) None of the above
Answer: D

4. The regular expression given below describes:
r=(1+01)*(0+λ)
(A) Set of all string not containing '11'
(B) Set of all string not containing '00'
(C) Set of all string containing '01'
(D) Set of all string ending in '0'
Answer: D

5. Which of the following language is regular?
(A) L={$a^n b^n$|n≥1}
(B) L={$a^n b^m c^n d^m$|n,m≥1}
(C) L={$a^n b^m$|n,m≥1}
(D) L={$a^n b^m c^n$|n,m≥1}
Answer: C

1. Which of the regular expressions corresponds to this grammar ?
S → AB / AS, A → a / aA, B → b
(A) aa*b+ (B) aa*b
(C) (ab)* (D) a(ab)*
Answer: B

1. Which of the following strings is in the language defined by grammar S→0A, A→1A/0A/1
(A) 01100
(B) 00101

(C) 10011
(D) 11111
Answer: B

1. Which of the following is not true?
(A) Power of deterministic automata is equivalent to power of non-deterministic automata.
(B) Power of deterministic pushdown automata is equivalent to power of non-deterministic pushdown automata.
(C) Power of deterministic Turing machine is equivalent to power of non-deterministic Turing machine.
(D) All the above
Answer: B

2. Identify the language which is not context - free.
(A) L = {ωωR|ωϵ{0,1}*}
(B) L = {$a^n b^n$|n≥0}
(C) L = {ωω|ωϵ{0,1}*}
(D) L = {$a^n b^m c^m d^n$ | n, m≥0 }
Answer: B

3. The context-free languages are closed for:
(i) Intersection (ii) Union
(iii) Complementation (iv) Kleene Star
then
(A) (i) and (iv) (B) (i) and (iii)
(C) (ii) and (iv) (D) (ii) and (iii)
Answer: C

4. Which sentence can be generated by S→d/bA, A→d/ccA:
(A) bccddd (B) aabccd
(C) ababccd (D) abbbd
Answer: A

5. Regular expression a+b denotes the set:
(A) {a} (B) {ϵ, a, b}
(C) {a, b} (D) None of these
Answer: C

19. Which of the following are not regular?
(A) Strings of even number of a's.
(B) Strings of a's, whose length is a prime number.
(C) Set of all palindromes made up of a's and b's.
(D) Strings of a's whose length is a perfect square.
(1) (A) and (B) only
(2) (A), (B) and (C) only
(3) (B), (C) and (D) only
(4) (B) and (D) only
Answer: 3

20. Consider the languages $L_1 = \phi$, and $L_2 = \{1\}$. Which one of the following represents $L_1^* \cup L_2^* L_1^*$?
(1) {ε}
(2) {ε,1}

(3) ϕ
(4) 1

22. The regular grammar for the language $L = \{a^n b^m \mid n + m \text{ is even}\}$ is given by
(A) $S \rightarrow S_1 \mid S_2$
$S_1 \rightarrow a\ S_1 \mid A_1$
$A_1 \rightarrow b\ A_1 \mid \lambda$
$S_2 \rightarrow aaS_2 \mid A_2$
$A_2 \rightarrow b\ A_2 \mid \lambda$
(B) $S \rightarrow S_1 \mid S_2$
$S_1 \rightarrow a\ S_1 \mid a\ A_1$
$S_2 \rightarrow aa\ S_2 \mid A_2$
$A_1 \rightarrow bA_1 \mid \lambda$
$A_2 \rightarrow bA_2 \mid \lambda$
(C) $S \rightarrow S_1 \mid S_2$
$S_1 \rightarrow aaa\ S_1 \mid aA_1$
$S_2 \rightarrow aaS_2 \mid A_2$
$A_1 \rightarrow bA_1 \mid \lambda$
$A_2 \rightarrow bA_2 \mid \lambda$
(D) $S \rightarrow S_1 \mid S_2$
$S_1 \rightarrow aa\ S_1 \mid A_1$
$S_2 \rightarrow aaS_2 \mid aA_2$
$A_1 \rightarrow bbA_1 \mid \lambda$
$A_2 \rightarrow bbA_2 \mid b$
Answer: D

23. Let $\Sigma = \{a, b\}$ and language $L = \{aa, bb\}$. Then, the complement of L is
(A) $\{\lambda, a, b, ab, ba\} \cup \{w \in \{a, b\}^* \mid |w| > 3\}$
(B) $\{a, b, ab, ba\} \cup \{w \in \{a, b\}^* \mid |w| \geq 3\}$
(C) $\{w \in \{a, b\}^* \mid |w| > 3\} \cup \{a, b, ab, ba\}$
(D) $\{\lambda, a, b, ab, ba\} \cup \{w \in \{a, b\}^* \mid |w| \geq 3\}$
Answer: D

24. Consider the following identities for regular expressions :
(a) $(r + s)^* = (s + r)^*$
(b) $(r^*)^* = r^*$
(c) $(r^*\ s^*)^* = (r + s)^*$
Which of the above identities are true ?
(A) (a) and (b) only (B) (b) and (c) only
(C) (c) and (a) only (D) (a), (b) and (c)
Answer: D

22. The symmetric difference of two sets S_1 and S_2 is defined as
$S_1 \Theta S_2 = \{x \mid x \epsilon S_1$ or $x \epsilon S_2$, but x is not in both S_1 and $S_2\}$
The nor of two languages is defined as
nor $(L_1, L_2) = \{w \mid w \notin L_1$ and $w \mid w \notin L_2\}$
Which of the following is correct?
(A) The family of regular languages is closed under symmetric difference but not closed under nor.

(B) The family of regular languages is closed under nor but not closed under symmetric difference.
(C) The family of regular languages are closed under both symmetric difference and nor.
(D) The family of regular languages are not closed under both symmetric difference and nor.
Answer: C

23. The regular expression for the complement of the language L = {anbm|n≥4, m≤3} is:
(A) (λ + a + aa + aaa)b* + a*bbbb* + (a + b)*ba(a + b)*
(B) (λ + a + aa + aaa)b* + a*bbbbb* + (a + b)*ab(a + b)*
(C) (λ + a + aa + aaa) + a*bbbbb* + (a + b)*ab(a + b)*
(D) (λ + a + aa + aaa)b* + a*bbbbb* + (a + b)*ba(a + b)*
Answer: D

24. Consider the following two languages:
$L_1 = \{0^i1^j \mid gcd(i,j)=1\}$
L_2 is any subset of 0*.
Which of the following is correct?
(A) L_1 is regular and L_2* is not regular
(B) L_1 is not regular and L_2* is regular
(C) Both L_1 and L_2* are regular languages
(D) Both L_1 and L_2* are not regular languages
Answer: B

55. Let L be the language generated by regular expression 0*10* and accepted by the deterministic finite automata M. Consider the relation RM defined by M. As all states are reachable from the start state, R_M has ..... equivalence classes.
(A) 2 (B) 4
(C) 5 (D) 6
Answer: D

56. Let $L = \{0^n1^n \mid n\geq 0\}$ be a context free language.
Which of the following is correct?
(A) L' is context free and L^k is not context free for any k≥1
(B) L' is not context free and L^k is context free for any k≥1
(C) Both L' and L^k is for any k≥1 are context free.
(D) Both L' and L^k is for any k≥1 are not context free.
Answer: C

57. Given a Turing Machine
$M = (\{q_0,q_1,q_2,q_3\}, \{a,b\}, \{a,b,B\}, \delta, B, \{q_3\})$
Where δ is a transition function defined as
$\delta(q_0,a) = (q_1,a,R)$
$\delta(q_1,b) = (q_2,b,R)$
$\delta(q_2,a) = (q_2,a,R)$
$\delta(q_2,b) = (q_3,b,R)$
The language L(M) accepted by the Turing Machine is given as:
(A) aa*b (B) abab
(C) aba*b (D) aba*
Answer: C

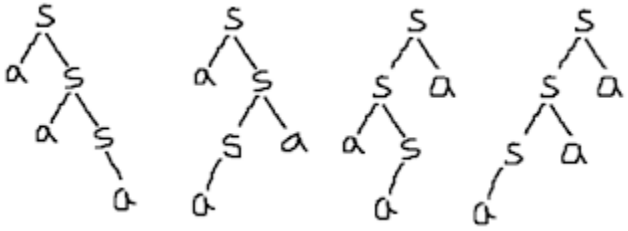
22. The family of context sensitive languages is ..... under union and ..... under reversal.
(A) closed, not closed (B) not closed, not closed
(C) closed, closed (D) not closed, closed
Answer: C

23. Match the following :

List - I	List - II
(a) $\{a^n b^n \mid n > 0\}$ is a deterministic context free language	(i) but not recursive language
(b) The complement of $\{a^n b^n a^n \mid n > 0\}$ is a context free language	(ii) but not context free language
(c) $\{a^n b^n a^n\}$ is context sensitive language	(iii) but can not be accepted by a deterministic pushdown automation
	(iv) but not regular

(a) (b) (c) (d)
(A) (i) (ii) (iii) (iv)
(B) (i) (ii) (iv) (iii)
(C) (iv) (iii) (ii) (i)
(D) (iv) (iii) (i) (ii)
Answer: Marks to all

24. The language of all non-null strings of a's can be defined by a context free grammar as follow :
S→a S|S a| a
The word a^3 can be generated by ..... different trees.
(A) Two (B) Three
(C) Four (D) Five
Answer: C
Explanation:



26. The context free grammar given by
S→XYX
X→aX|bX|λ
Y→bbb
generates the language which is defined by regular expression:
(A) (a+b)*bbb (B) abbb(a+b)*
(C) (a+b)*(bbb)(a+b)* (D) (a+b)(bbb)(a+b)*
Answer: C

27. There are exactly ..... different finite automata with three states x, y and z over the alphabet {a, b} where x is always the start state.
(A) 64 (B) 256

(C) 1024 (D) 5832

Answer: D

28. Given the following two languages :

$L_1=\{a^nba^n|n>0\}$

$L_2=\{a^nba^nb^{n+1}|n>0\}$

Which of the following is correct?

(A) L_1 is context free language and L_2 is not context free language

(B) L_1 is not context free language and L_2 is context free language

(C) Both L_1 and L_2 are context free languages

(D) Both L_1 and L_2 are not context free languages

Answer: A

19. Minimal deterministic finite automaton for the language $L=\{ 0^n \mid n\geq 0, n\neq 4 \}$ will have:

(A) 1 final state among 5 states

(B) 4 final states among 5 states

(C) 1 final state among 6 states

(D) 5 final states among 6 states

Answer: D

20. The regular expression corresponding to the language L where

$L=\{x\in\{0,1\}^* \mid x$ ends with 1 and does not contain substring 00 $\}$ is:

(A) (1 + 01)* (10 + 01) (B) (1 + 01)* 01

(C) (1 + 01)* (1 + 01) (D) (10 + 01)* 01

Answer: C

21. The transition function for the language $L = \{w|n_a(w)$ and $n_b(w)$ are both odd$\}$ is given by:

$\delta(q_0, a)=q_1$; $\delta(q_0, b)=q_2$

$\delta(q_1, a)=q_0$; $\delta(q_1, b)=q_3$

$\delta(q_2, a)=q_3$; $\delta(q_2, b)=q_0$

$\delta(q_3, a)=q_2$; $\delta(q_3, b)=q_1$

the initial and final states of the automata are:

(A) q_0 and q_0 respectively (B) q_0 and q_1 respectively

(C) q_0 and q_2 respectively (D) q_0 and q_3 respectively

Answer: D

61. A context free grammar for $L=\{w|n_0(w)>n_1(w)\}$ is given by:

(A) $S\rightarrow 0|0S|1SS$ (B) $S\rightarrow 0S|1S|0SS|1SS|0|1$

(C) $S\rightarrow 0|0S|1SS|S1S|SS1$ (D) $S\rightarrow 0S|1S|0|1$

Answer: C

62. Given the following two statements:

S_1: If L_1 and L_2 are recursively enumerable languages over $\sum$, then $L_1 \cup L_2$ and $L_1 \cap L_2$ are also recursively enumerable.

S_2: The set of recursively enumerable languages is countable.

Which of the following is correct?

(A) S_1 is correct and S_2 is not correct

(B) S_1 is not correct and S_2 is correct

(C) Both S_1 and S_2 are not correct

(D) Both S_1 and S_2 are correct

Answer: D

63. Given the following grammars:

G_1: S→AB|aaB
A→aA|ϵ
B→bB|ϵ
G_2: S→A|B
A→aAb|ab
B→abB|ϵ
Which of the following is correct?
(A) G_1 is ambiguous and G_2 is unambiguous grammars
(B) G_1 is unambiguous and G_2 is ambiguous grammars
(C) Both G_1 and G_2 are ambiguous grammars
(D) Both G_1 and G_2 are unambiguous grammars
Answer: C

22. The pushdown automation M = ({q0, q1, q2}, {a, b}, {0, 1}, □, q0, 0, {q0}) with
□ (q0, a, 0) = {(q1, 10)}
□ (q1, a, 1) = {(q1, 11)}
□ (q1, b, 1) = {(q2, □)}
□ (q2, b, 1) = {(q2, □)}
□ (q2, □, 0) = {(q0, □)}
Accepts the language
(A) $L = \{a^n b^m \mid n, m \geq 0\}$ (B) $L = \{a^n b^n \mid n \geq 0\}$
(C) $L = \{a^n b^m \mid n, m > 0\}$ (D) $L = \{a^n b^n \mid n > 0\}$
Answer: B

23. Given two languages :
$L1 = \{(ab)^n a^k \mid n > k, k \geq 0\}$
$L2 = \{a^n b^m \mid n$ □ $m\}$
Using pumping lemma for regular language, it can be shown that
(A) L1 is regular and L2 is not regular.
(B) L1 is not regular and L2 is regular.
(C) L1 is regular and L2 is regular.
(D) L1 is not regular and L2 is not regular.
Answer: D

24. Regular expression for the complement of language $L = \{a^n b^m \mid n \geq 4, m \leq 3\}$ is
(A) (a + b)* ba(a + b)*
(B) a* bbbbb*
(C) (□ + a + aa + aaa)b* + (a + b)* ba(a + b)*
(D) None of the above
Answer: D

61. Given the recursively enumerable language (L_{RE}), the context sensitive language (L_{CS}), the recursive language (L_{REC}), the context free language (L_{CF}) and deterministic context free language (L_{DCF}). The relationship between these families is given by
(A) L_{CF} □ L_{DCF} □ L_{CS} □ L_{RE} □ L_{REC}
(B) L_{CF} □ L_{DCF} □ L_{CS} □ L_{REC} □ L_{RE}
(C) L_{DCF} □ L_{CF} □ L_{CS} □ L_{RE} □ L_{REC}
(D) L_{DCF} □ L_{CF} □ L_{CS} □ L_{REC} □ L_{RE}
Answer: D

62. Match the following :

List – I	**List – II**
a. Context free grammar	i. Linear bounded automaton
b. Regular grammar	ii. Pushdown automaton
c. Context sensitive grammar	iii. Turing machine
d. Unrestricted grammar	iv. Deterministic finite automaton

Codes :

	a	b	c	d
(A)	ii	iv	iii	i
(B)	ii	iv	i	iii
(C)	iv	i	ii	iii
(D)	i	iv	iii	ii

Answer: B

63. According to pumping lemma for context free languages :

Let L be an infinite context free language, then there exists some positive integer m such that any w □ L with |w|□m can be decomposed as w = u v *x* y z

(A) with | v*x*y | □ m such that $uv^i xy^i$ z□L for all i = 0, 1, 2

(B) with | v*x*y | □ m, and | vy | □ 1, such that $uv^i xy^i$ z□L for all i = 0, 1, 2, …….

(C) with | v*x*y | □ m, and | vy | □ 1, such that $uv^i xy^i$ z□L for all i = 0, 1, 2, …….

(D) with | v*x*y | □ m, and | vy | □ 1, such that $uv^i xy^i$ z□L for all i = 0, 1, 2, …….

Answer: B

73. Given the following two grammars :

G1 : S □□AB | aaB

A □□a | Aa

B □□b

G2 : S □□a S b S | b S a S | □

Which statement is correct?

(A) G1 is unambiguous and G2 is unambiguous.

(B) G1 is unambiguous and G2 is ambiguous.

(C) G1 is ambiguous and G2 is unambiguous.

(D) G1 is ambiguous and G2 is ambiguous.

Answer: D

74. Match the following :

List – I	**List – II**
a. Chomsky Normal form	i. S □□b S S | a S | c
b. Greibach Normal form	ii. S □□a S b | ab
c. S-grammar	iii. S □□AS | a A □□SA | b
d. LL grammar	iv. S □□a B S B B □□b

Codes :

a	b	c	d

(A) iv iii i ii
(B) iv iii ii i
(C) iii iv i ii
(D) iii iv ii i
Answer: C

75. Given the following two languages :
L1 = $\{a^n b^n \mid n \geq 1\}$ □□{a}
L2 = $\{w C w^R \mid w$ □□{a, b}*}
Which statement is correct?
(A) Both L1 and L2 are not deterministic.
(B) L1 is not deterministic and L2 is deterministic.
(C) L1 is deterministic and L2 is not deterministic.
(D) Both L1 and L2 are deterministic.
Answer: D

15. Let L be any language. Define even (W) as the strings obtained by extracting from W the letters in the even-numbered positions and even(L) = {even (W) | W □□L}. We define another language Chop (L) by removing the two leftmost symbols of every string in L given by Chop(L) = {W | □□W □□L, with | □□| = 2}. If L is regular language then
(A) even(L) is regular and Chop(L) is not regular.
(B) Both even(L) and Chop(L) are regular.
(C) even(L) is not regular and Chop(L) is regular.
(D) Both even(L) and Chop(L) are not regular.
Answer: B

21. Given the following statements:
S_1 : The grammars S→asb | bsa | ss | a and S→asb | bsa | a are not equivalent.
S_2: The grammars S→ss | sss | asb | bsa | λ and S→ss | asb | bsa | λ are equivalent.
Which of the following is true?
(A) S_1 is correct and S_2 is not correct.
(B) Both S_1 and S_2 are correct
(C) S_1 is not correct and S_2 is correct
(D) Both S_1 and S_2 are not correct.
Answer: A

40. Pumping lemma of the context-free languages states:
Let L be an infinite context free language. Then there exists some positive integer m such that wϵL with |w|≥m can be decomposed as w=uv xy Z with |vxy| ..... and |vy| ..... such that $uv^{z'}xy^{z'}$, ZϵL for all z' = 0,1, 2,...
(A) ≤m, ≤1
(B) ≤m, ≥1
(C) ≥m, ≤1
(D) ≥m, ≥1
Answer: B

41. The Greibach normal form grammar for the language $L=\{a^n b^{n+1} \mid n \geq 0\}$ is
(A) S→a SB, B→bB|λ
(B) S→a SB, B→bB|b
(C) S→a SB|b, B→b
(D) S→a Sb|b

Answer: C

42. Given the following statements:

S_1: Every context-sensitive language L is recursive.

S_2: There exists a recursive language that is not context sensitive.

Which statement is correct?

(A) S_1 is not correct and S_2 is not correct.

(B) S_1 is not correct and S_2 is correct.

(C) S_1 is correct and S_2 is not correct.

(D) S_1 is correct and S_2 is correct.

Answer: D

16. Assume, L is regular language. Let statements S_1 and S_2 be defined as :

S1 : SQRT(L) = { x| for some y with $|y| = |x|^2$, xy ∈L}

S2 : LOG(L) = { x| for some y with $|y| = 2^{|x|}$, xy ∈ L}

Which of the following is true?

(A) S_1 is correct and S_2 is not correct.

(B) Both S_1 and S_2 are correct.

(C) Both S_1 and S_2 are not correct.

(D) S_1 is not correct and S_2 is correct.

Answer: B

17. A regular grammar for the language L = $\{a^n b^m \mid$ n is even and m is even$\}$is given by

(A) $S \rightarrow aSb \mid S_1$; $S_1 \rightarrow bS_1a \mid \lambda$

(B) $S \rightarrow aaS \mid S_1$; $S_1 \rightarrow bSb \mid \lambda$

(C) $S \rightarrow aSb \mid S_1$; $S_1 \rightarrow S_1ab \mid \lambda$

(D) $S \rightarrow aaS \mid S_1$; $S_1 \rightarrow bbS_1 \mid \lambda$

Answer: D

18. Given the following productions of a grammar :

$S \rightarrow aA \mid aBB$;

$A \rightarrow aaA \mid \lambda$;

$B \rightarrow bB \mid bbC$;

$C \rightarrow B$

Which of the following is true?

(A) The language corresponding to the given grammar is a set of even number of a's.

(B) The language corresponding to the given grammar is a set of odd number of a's.

(C) The language corresponding to the given grammar is a set of even number of a's followed by odd number of b's.

(D) The language corresponding to the given grammar is a set of odd number of a's followed by even number of b's.

Answer: B

19. The language accepted by the nondeterministic pushdown automaton

M= ($\{q_0, q_1, q_2\}$, {a, b}, {a, b, z}, δ, q_0, z, $\{q_2\}$) with transitions

$\delta(q_0, a, z) = \{(q_1, a), (q_2, \lambda)\}$;

$\delta(q_1, b, a) = \{(q_1, b)\}$

$\delta(q_1, b, b) = \{(q_1, b)\}$, $\delta(q_1, a, b) = \{(q_2, \lambda)\}$

is

(A) L(abb*a)

(B) {a} U L(abb*a)

(C) L(ab*a)
(D) {a} U L(ab*a)
Answer: B

20. The language L = $\{a^n b^n a^m b^m \mid n \geq 0, m \geq 0\}$ is
(A) Context free but not linear
(B) Context free and linear
(C) Not Context free and not linear
(D) Not Context free but linear

16. Assume, L is regular language. Let statements S_1 and S_2 be defined as :
S1 : SQRT(L) = { x| for some y with $|y| = |x|^2$, xy ∈L}
S2 : LOG(L) = { x| for some y with $|y| = 2^{|x|}$, xy ∈ L}
Which of the following is true?
(A) S_1 is correct and S_2 is not correct.
(B) Both S_1 and S_2 are correct.
(C) Both S_1 and S_2 are not correct.
(D) S_1 is not correct and S_2 is correct.
Answer: B

17. A regular grammar for the language L = $\{a^n b^m \mid$ n is even and m is even$\}$is given by
(A) $S \rightarrow aSb \mid S_1$; $S_1 \rightarrow bS_1a \mid \lambda$
(B) $S \rightarrow aaS \mid S_1$; $S_1 \rightarrow bSb \mid \lambda$
(C) $S \rightarrow aSb \mid S_1$; $S_1 \rightarrow S_1ab \mid \lambda$
(D) $S \rightarrow aaS \mid S_1$; $S_1 \rightarrow bbS_1 \mid \lambda$
Answer: D

18. Given the following productions of a grammar :
$S \rightarrow aA \mid aBB$;
$A \rightarrow aaA \mid \lambda$;
$B \rightarrow bB \mid bbC$;
$C \rightarrow B$
Which of the following is true?
(A) The language corresponding to the given grammar is a set of even number of a's.
(B) The language corresponding to the given grammar is a set of odd number of a's.
(C) The language corresponding to the given grammar is a set of even number of a's followed by odd number of b's.
(D) The language corresponding to the given grammar is a set of odd number of a's followed by even number of b's.
Answer: B

19. The language accepted by the nondeterministic pushdown automaton
M= ($\{q_0, q_1, q_2\}$, {a, b}, {a, b, z}, δ, q_0, z, $\{q_2\}$) with transitions
$\delta(q_0 a, z) = \{(q_1 a), (q_2 \lambda)\}$;
$\delta(q_1, b, a) = \{(q_1, b)\}$
$\delta(q_1, b, b) = \{(q_1 b)\}$, $\delta(q_1, a, b) = \{(q_2, \lambda)\}$
is
(A) L(abb*a)
(B) {a} U L(abb*a)
(C) L(ab*a)
(D) {a} U L(ab*a)

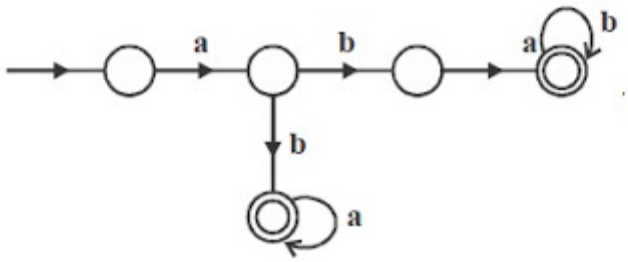
Answer: B

20. The language $L = \{a^n b^n a^m b^m \mid n \geq 0, m \geq 0\}$ is
(A) Context free but not linear
(B) Context free and linear
(C) Not Context free and not linear
(D) Not Context free but linear
Answer: A

21. Assume statements S_1 and S_2 defined as :
S_1 : L_2-L_1 is recursive enumerable where L_1 and L_2 are recursive and recursive enumerable respectively.
S_2 : The set of all Turing machines is countable.
Which of the following is true?
(A) S_1 is correct and S_2 is not correct.
(B) Both S_1 and S_2 are correct.
(C) Both S_1 and S_2 are not correct.
(D) S_1 is not correct and S_2 is correct.
Answer: B

22. Non-deterministic pushdown automaton that accepts the language generated by the grammar: $S \rightarrow aSS \mid ab$ is
(A) $\delta(q_0, \lambda, z) = \{ (q_1, z)\}$;
$\delta(q_0, a, S) = \{ (q_1, SS)\}, (q_1, B) \}$
$\delta(q_0, b, B) = \{ (q_1, \lambda)\}$,
$\delta(q_1, \lambda, z) = \{ (q_f, \lambda)\}$
(B) $\delta(q_0, \lambda, z) = \{ (q_1, Sz)\}$;
$\delta(q_0, a, S) = \{ (q_1, SS)\}, (q_1, B) \}$
$\delta(q_0, b, B) = \{ (q_1, \lambda)\}$,
$\delta(q_1, \lambda, z) = \{ (q_f, \lambda)\}$
(C) $\delta(q_0, \lambda, z) = \{ (q_1, Sz)\}$;
$\delta(q_0, a, S) = \{ (q_1, S)\}, (q_1, B) \}$
$\delta(q_0, b, \lambda) = \{ (q_1, B)\}$,
$\delta(q_1, \lambda, z) = \{ (q_f, \lambda)\}$
(D) $\delta(q_0, \lambda, z) = \{ (q_1, z)\}$;
$\delta(q_0, a, S) = \{ (q_1, SS)\}, (q_1, B) \}$
$\delta(q_0, b, \lambda) = \{ (q_1, B)\}$,
$\delta(q_1, \lambda, z) = \{ (q_f, \lambda)\}$
Answer: B

47. The minimum number of states of the non-deterministic finite automation which accepts the language
$\{abab^n | n \geq 0\} U \{aba^n | n \geq 0\}$ is
(A) 3
(B) 4
(C) 5
(D) 6
Answer: C
Explanation:



50. Which of the following definitions generates the same Language as L, where $L=\{WW^R|W\epsilon\{a,b\}^*\}$
    (A) S→asb|bsa|ϵ
    (B) S→asa|bsb|ϵ
    (C) S→asb|bsa|asa|bsb|ϵ
    (D) S→asb|bsa|asa|bsb
    Answer: B

20. Given L1 = L(a*baa*) and L2 = L(ab*)
    The regular expression corresponding to language L3 = L1/L2 (right quotient) is given by
    (A) a*b (B) a*baa*
    (C) a*ba* (D) None of the above
    Answer: C

18. Given the following expressions of a grammar
    E→E*F/F+E/F
    F→F–F/id
    Which of the following is true ?
    (A) * has higher precedence than +
    (B) – has higher precedence than *
    (C) + and – have same precedence
    (D) + has higher precedence than *
    Answer: B

40. Consider the following statements :
    I. Recursive languages are closed under complementation.
    II. Recursively enumerable languages are closed under union.
    III. Recursively enumerable languages are closed under complementation.
    Which of the above statements are true ?
    (A) I only (B) I and II
    (C) I and III (D) II and III
    Answer: B

4. The logic of pumping lemma is a good example of:
    (A) pigeon hole principle
    (B) recursion
    (C) divide and conquer technique
    (D) iteration
    Answer: A

3. A context free grammar is:
(A) type 0 (B) type 1
(C) type 2 (D) type 3

Answer: C

36. The grammar with production rules $S \rightarrow aSb \mid SS \mid \lambda$ generates language L given by:

(A) $L = \{w \in \{a, b\}^* \mid n_a(w) = n_b(w)$ and $n_a(v) \geq n_b(v)$ where v is any prefix of w$\}$

(B) $L = \{w \in \{a, b\}^* \mid n_a(w) = n_b(w)$ and $n_a(v) \leq n_b(v)$ where v is any prefix of w$\}$

(C) $L = \{w \in \{a, b\}^* \mid n_a(w) \neq n_b(w)$ and $n_a(v) \geq n_b(v)$ where v is any prefix of w$\}$

(D) $L = \{w \in \{a, b\}^* \mid n_a(w) \neq n_b(w)$ and $n_a(v) \leq n_b(v)$ where v is any prefix of w$\}$

Answer: A

37. A pushdown automation $M = (Q, \Sigma, \Gamma, \delta, q_0, z, F)$ is set to be deterministic subject to which of the following condition(s), for every $q \in Q$, $a \in \Sigma \cup \{\lambda\}$ and $b \in \Gamma$

(s1) $\delta(q, a, b)$ contains at most one element

(s2) if $\delta(q, \lambda, b)$ is not empty then $\delta(q, c, b)$ must be empty for every $c \in \Sigma$

(A) only s1

(B) only s2

(C) both s1 and s2

(D) neither s1 nor s2

Answer: C

38. For every context free grammar (G) there exists an algorithm that passes any $w \in L(G)$ in number of steps proportional to

(A) $\ln|w|$

(B) $|w|$

(C) $|w|^2$

(D) $|w|^3$

Answer: D

39. Match the following:

List - I

a. Context sensitive language

b. Regular grammar

c. Context free grammar

d. Unrestricted grammar

List - II

i. Deterministic finite automation

ii. Recursive enumerable

iii. Recursive language

iv. Pushdown automation

Codes:

	a	b	c	d
(A)	ii	i	iv	iii
(B)	iii	iv	i	ii
(C)	iii	i	iv	ii
(D)	ii	iv	i	iii

Answer: C

40. The statements s1 and s2 are given as:

s1: Context sensitive languages are closed under intersection, concatenation, substitution and inverse homomorphism.

s2: Context free languages are closed under complementation, substitution and homomorphism.

Which of the following is correct statement?

(A) Both s1 and s2 are correct.
(B) s1 is correct and s2 is not correct.
(C) s1 is not correct and s2 is correct.
(D) Both s1 and s2 are not correct.
Answer: B

21. Given the following statements :
(A) A class of languages that is closed under union and complementation has to be closed under intersection.
(B) A class of languages that is closed under union and intersection has to be closed under complementation.
Which of the following options is correct?
(1) Both (A) and (B) are false.
(2) Both (A) and (B) are true.
(3) (A) is true, (B) is false.
(4) (A) is false, (B) is true.
Answer: 3

62. Which of the following pairs have different expressive power?
(1) Single-tape-turing machine and multi-dimensional turing machine.
(2) Multi-tape turing machine and multi-dimensional turing machine.
(3) Deterministic push down automata and non-deterministic pushdown automata.
(4) Deterministic finite automata and Non-deterministic finite automata.
Answer: 3

63. Which of the following statements is false?
(1) Every context-sensitive language is recursive.
(2) The set of all languages that are not recursively enumerable is countable.
(3) The family of recursively enumerable languages is closed under union.
(4) The families of recursively enumerable and recursive languages are closed under reversal.
Answer: 2

36. The grammar with production rules $S \rightarrow aSb \mid SS \mid \lambda$ generates language L given by:
(A) $L = \{w \in \{a, b\}^* \mid n_a(w) = n_b(w)$ and $n_a(v) \geq n_b(v)$ where v is any prefix of w$\}$
(B) $L = \{w \in \{a, b\}^* \mid n_a(w) = n_b(w)$ and $n_a(v) \leq n_b(v)$ where v is any prefix of w$\}$
(C) $L = \{w \in \{a, b\}^* \mid n_a(w) \neq n_b(w)$ and $n_a(v) \geq n_b(v)$ where v is any prefix of w$\}$
(D) $L = \{w \in \{a, b\}^* \mid n_a(w) \neq n_b(w)$ and $n_a(v) \leq n_b(v)$ where v is any prefix of w$\}$
Answer: A

37. A pushdown automation $M = (Q, \Sigma, \Gamma, \delta, q_0, z, F)$ is set to be deterministic subject to which of the following condition(s), for every $q \in Q$, $a \in \Sigma \cup \{\lambda\}$ and $b \in \Gamma$
(s1) $\delta(q, a, b)$ contains at most one element
(s2) if $\delta(q, \lambda, b)$ is not empty then $\delta(q, c, b)$ must be empty for every $c \in \Sigma$
(A) only s1
(B) only s2
(C) both s1 and s2
(D) neither s1 nor s2
Answer: C

38. For every context free grammar (G) there exists an algorithm that passes any $w \in L(G)$ in number of steps proportional to
(A) $\ln|w|$

(B) |w|
(C) $|w|^2$
(D) $|w|^3$
Answer: D

39. Match the following:

List - I

a. Context sensitive language
b. Regular grammar
c. Context free grammar
d. Unrestricted grammar

List - II

i. Deterministic finite automation
ii. Recursive enumerable
iii. Recursive language
iv. Pushdown automation

Codes:

	a	b	c	d
(A)	ii	i	iv	iii
(B)	iii	iv	i	ii
(C)	iii	i	iv	ii
(D)	ii	iv	i	iii

Answer: C

40. The statements s1 and s2 are given as:
s1: Context sensitive languages are closed under intersection, concatenation, substitution and inverse homomorphism.
s2: Context free languages are closed under complementation, substitution and homomorphism.
Which of the following is correct statement?
(A) Both s1 and s2 are correct.
(B) s1 is correct and s2 is not correct.
(C) s1 is not correct and s2 is correct.
(D) Both s1 and s2 are not correct.
Answer: B

55. Given the following two languages:
$L_1 = \{uww^Rn \mid u, v, w \in \{a, b\}^+\}$
$L_2 = \{uww^Rn \mid u, v, w \in \{a, b\}^+, |u| \geq |v|\}$
Which of the following is correct ?
(A) L_1 is regular language and L_2 is not regular language.
(B) L_1 is not regular language and L_2 is regular language.
(C) Both L_1 and L_2 are regular languages.
(D) Both L_1 and L_2 are not regular languages.
Answer: A

53. If the parse tree of a word w generated by a Chomsky normal form grammar has no path of length greater than i, then the word w is of length
(A) no greater than 2^{i+1}
(B) no greater than 2^i
(C) no greater than 2^{i-1}

(D) no greater than i

Answer: C

42. The grammar 'G1' S→OSO|ISI|0|1|ϵ and the grammar 'G2' is S→aS|aSb|X, X→Xa|a.

Which is the correct statement?

(A) G1 is ambiguous, G2 is unambiguous

(B) G1 is unambiguous, G2 is ambiguous

(C) Both G1 and G2 are ambiguous

(D) Both G1 and G2 are unambiguous

Answer: B

45. Which of the following regular expression identities are true?

(A) (r+s)*=r*s*

(B) (r+s)*=r*+s*

(C) (r+s)*=(r*s*)*

(D) r*s*=r*+s*

Answer: C

38. Which is not the correct statement?

(A) The class of regular sets is closed under homomorphisms.

(B) The class of regular sets is not closed under inverse homomorphisms.

(C) The class of regular sets is closed under quotient.

(D) The class of regular sets is closed under substitution.

Answer: B

57. Given the following statements :

(i) Recursive enumerable sets are closed under complementation.

(ii) Recursive sets are closed under complementation.

Which is/are the correct statements?

(A) only (i)

(B) only (ii)

(C) both (i) and (ii)

(D) neither (i) nor (ii)

Answer: B

16. Given the following statements :

(i) The power of deterministic finite state machine and nondeterministic finite state machine are same.

(ii) The power of deterministic pushdown automaton and nondeterministic pushdown automaton are same.

Which of the above is the correct statement(s)?

(A) Both (i) and (ii)

(B) Only (i)

(C) Only (ii)

(D) Neither (i) nor (ii)

Answer: B

25. Which is not the correct statement(s)?

(i) Every context sensitive language is recursive.

(ii) There is a recursive language that is not context sensitive.

(A) (i) is true, (ii) is false.

(B) (i) is true and (ii) is true.
(C) (i) is false, (ii) is false.
(D) (i) is false and (ii) is true.
Answer: B

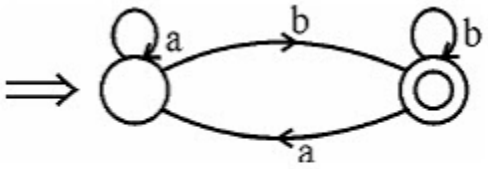
28. Which one of the following is not a Greibach Normal form grammar?
(i) S□a|bA|aA|bB
A□a
B□b
(ii) S□a|aA|AB
A□a
B□b
(iii) S□a|A|aA
A□a
(A) (i) and (ii)
(B) (i) and (iii)
(C) (ii) and (iii)
(D) (i), (ii) and (iii)
Answer: C

32. The equivalent grammar corresponding to the grammar G : S□aA, A□BB, B□aBb|□is
(A) S□aA, A□BB, B□aBb
(B) S□a|aA, A□BB, B□aBb|ab
(C) S□a|aA, A□BB|B, B□aBb
(D) S□a|aA, A□BB|B, B□aBb|ab
Answer: D

35. Consider the regular expression (a + b) (a + b) … (a + b) (n-times). The minimum number of states in finite automaton that recognizes the language represented by this regular expression contains
(A) n states
(B) n + 1 states
(C) n + 2 states
(D) 2^n states
Answer: B

39. The following CFG
S□aB|bA, A□a|as|bAA, B□b|bs|aBB
generates strings of terminals that have
(A) odd number of a's and odd number of b's
(B) even number of a's and even number of b's
(C) equal number of a's and b's
(D) not equal number of a's and b's
Answer: C

43. The regular expression for the following DFA



is
(A) ab*(b + aa*b)*
(B) a*b(b + aa*b)*
(C) a*b(b* + aa*b)
(D) a*b(b * + aa*b)*
Answer: D

52. Match the following :

List - I
(i) Regular Grammar
(ii) Context free Grammar
(iii) Unrestricted Grammar
(iv) Context Sensitive Grammar

List - I
(a) Pushdown automaton
(b) Linear bounded automaton
(c) Deterministic finite automaton
(d) Turing machine

(i) (ii) (iii) (iv)
(A) (c) (a) (b) (d)
(B) (c) (a) (d) (b)
(C) (c) (b) (a) (d)
(D) (c) (b) (d) (a)
Answer: B

34. Which of the following statements is/ are TRUE?
(a) The grammar S → SS a is ambiguous. (Where S is the start symbol)
(b) The grammar S → 0S1 | 01S | ϵ is ambiguous. (The special symbol ϵ represents the empty string) (Where S is the start symbol)
(c) The grammar (Where S is the start symbol)
S → T/U
T → x S y | xy | ϵ
U → yT
generates a language consisting of the string yxxyy.
(1) Only (a) and (b) are TRUE.
(2) Only (a) and (c) are TRUE.
(3) Only (b) and (c) are TRUE.
(4) All of (a), (b) and (c) are TRUE.
Answer: 4

31. Which of the following strings would match the regular expression: p+[3-5]*[xyz]?
I. p443y
Il. p6y

III. 3xyz
IV. p35z
V. p353535x
Vl. ppp5
(1) I, III and Vl only
(2) IV, V and VI only
(3) II, IV and V only
(4) I, IV and V only
Answer: 4

20. Given L1 = L(a*baa*) and L2 = L(ab*)
The regular expression corresponding to language L3 = L1/L2 (right quotient) is given by
(A) a*b (B) a*baa*
(C) a*ba* (D) None of the above
Answer: C

73. Consider a language A defined over the alphabet ∑={0, 1} as A = $\{0^{[n/2]}\ 1^{n}: n >= 0\}$.
The expression [n/2] means the floor of n/2, or what you get by rounding n/2 down to the nearest integer.
Which of the following is not an example of a string in A ?
(A) 011 (B) 0111
(C) 0011 (D) 001111
Answer: C