Context Free Languages, Context Sensitive Languages, Turing Machine, Recursive and Recursively Enumerable Languages.

1)
S->AB
A->BB| a
B-> AB|b

Choose an incorrect 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

2) Consider the regular grammar generating the set of all strings ending with ‘00’, with terminals {0,1} and non-terminals {S, A, B}, S being the initial state and B, the final state.

S-> $1S/\ 0A$
$A \rightarrow 0B$
$B \rightarrow 0B/1S/0$

The production missing is

(a) $A \rightarrow 1S$
(b) $B \rightarrow \varepsilon$
(c) $A \rightarrow 1B$
(d) $S \rightarrow 1B$

3) Consider the grammar: S->aSbS/ bSaS/ ε,

The smallest string for which the grammar has two derivation trees:

(a) abab
(b) aabb
(c) bbaa
(d) aaabbb

4) The following CFG, S□ aB/ bA

A->a/ aS/ bAA

B -> b/ bS/ aBB generates strings with

(a) Odd number of a's & odd number of b's
(b) Even number of a's & even number of b's
(c) Equal number of a's & b's
(d) Odd number of a's & even number of b's

5) What type of grammar is this most accurately described as?

S-> b/aD

D-> a/aDD

(a) A regular grammar
(b) CFG
(c) CSG
(d) Type-0

6) $L_1 = \{a^m b^n \mid m+n = \text{Even}\}$ $L_2 = \{a^m b^n \mid m\text{-}n = 4\}$

(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

Solution: Option (a)

7) 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.

Which of the following is true?

(a) Both are Regular
(b) Both are Context-Free
(c) L_1 is regular, L_2 is Context Free
(d) L_1 is CF, L_2 is Regular

8) Suppose a Language L is accepted by Linear Bounded Automata A. Then,

(a) A always halts on all i/p's as L is decidable.
(b) L maybe undecidable as A need not halt on all i/p
(c) L need not be Context-Sensitive Language

(d) None of the above

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

(a) All co-finite languages 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 of above

10) Suppose L is a context-Free Language. Then L

(a) is necessarily context-free
(b) is necessarily non-context free
(c) is necessarily context-sensitive
(d) is necessarily Recursive

11) Let G be grammar in CNF. Let $w_1, w_2 \in L(G)$ 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 derivations of w_1 will be shorter than any derivation of w_2
(d) None

12) 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

Solution: Option (c)

2. Consider R = (a + b)* (aa + bb) (a + b)*

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

13) Consider these 2 statements:

S_1: $L^R = L$, if and only if L is the language of palindromes.
where L^R is obtained by reversing all the strings of L.

S_2: $| L_1 \cdot L_2 | = | L_1 | \times | L_2 |$

Which of the following is

true?

(a) Both are False
(b) Both are True
(c) $S_1 \rightarrow T, S_2 \rightarrow F$
(d) $S_1 \rightarrow F, S_2 \rightarrow T$

14) $L_1 = \{ a^m \mid m \geq 0\}$ $L_2 = \{ b^m \mid m \geq 0\}$

$L_1 \cdot L_2 = ?$

(a) $\{ a^m b^m, m \geq 0\}$
(b) $\{a^m b^n, m, n \geq 0\}$
(c) $\{a^m b^n, m, n \geq 1\}$
(d) None of the above

15) $\Sigma = \{0, 1\}$ $L = \Sigma^*$
$R = \{ O^n 1^n$ such that $n > 1\}$

Languages L U R and R are respectively:

(a) Regular, Regular
(b) Regular, Not Regular
(c) Not Regular, Not Regular
(d) Not Regular, Regular

16) S_1: L is regular. Infinite union of L will also be regular i.e. ($L^0 \cup L^1 \cup L^2 \ldots$) S_2: L is regular. It's subset will also be regular.

(a) Both are true
(b) Both are false
(c) $S_1 \rightarrow T, S_2 \rightarrow F$
(d) $S_1 \rightarrow F, S_2 \rightarrow T$

Solution:

17) 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

18) Consider the following languages: $L_1 = \{a^n b^n \ (n \geq 0)\}$
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 and L_2 is CSL
(d) None

19) The language of primes in unary is:

(a) Regular
(b) CFL
(c) DCFL
(d) Context Sensitive

20) The complement of CFL:

(a) Recursive
(b) Recursive enumerated
(c) Not RE
(d) The empty set

21) Which of the following is a Regular language?

(a) $L_1 = \{wcw^R \mid w \in \{a, b\}^*\}$
(b) $L_2 = \{wcw^R \mid w,c \in \{a, b\}^*\}$
(c) $L_3 = \{ww^Rc \mid w \in \{a, b\}^*\}$
(d) $L_4 = \{cww^R \mid w \in \{a, b\}^*\}$

22) Given that a language $L = L_1 \cup L_2$, where L_1 and L_2 are two other languages. If L is known to be a regular language, then which of the following statements is necessarily TRUE?

(a) If L_1 is regular then L_2 will also be regular
(b) If L_1 is regular and finite then L_2 will be regular
(c) If L_1 is regular and finite the L_2 will also be regular and finite
(d) None of

these

23) Consider the following statements:

S_1: There doesn't exist FA for every CFL.

S_2: Let $\Sigma = \{a, b\}$ and $L = \{a^n w a^n \mid n \geq 1, w \in \Sigma^*\}$. Then L is context free but not regular.

(a) Both are True
(b) Both are False
(c) $S_1 \rightarrow$ True, $S_2 \rightarrow$ False
(d) $S_1 \rightarrow$ False, $S_2 \rightarrow$ True

24) $L = \{a^i b^j c^k d^m\} \mid i+j+k+m$ is multiple of 13} L is ?

(a) Regular
(b) Context-free
(c) Turing-decidable
(d) Turing-Recognizable

25) Language $L = \{a^n b^n w \mid n \geq 0, w \in \{c, d\}^*, |w| = n\}$ is

(a) Regular
(b) DCFL
(c) NCFL
(d) Not context-free

26) 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

27) Which of the following is true for i/p alphabet Σ and tape alphabet Γ of a standard TM?

(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

28) Consider the CFG:

$S \rightarrow aSa \mid bSb \mid a \mid b \mid \in$

Which of following strings is NOT guaranteed by grammar?

(a) aaaa
(b) baba
(c) abba
(d) babaaabab

29) Let L be CFL and M a regular language. Language L ∩ M is always

(a) always regular
(b) never regular
(c) always DCFL
(d) always context free language

30) Which of the following is accepted by NPDA but Not by DPDA?

(a) $\{a^n b^n c^n \mid n \geq 0\}$
(b) $\{a^n b^n \mid n \geq 0\}$
(c) $\{a^n b^m \mid m, n \geq 0\}$
(d) $\{a^l b^m c^n \mid l \neq m \text{ or } m \neq n\}$

31) Consider the CFG below:

$S \rightarrow aSAb \mid \varepsilon$
$A \rightarrow bA \mid \varepsilon$

Grammar generates:

(a) $(a + b)^* \cdot b$
(b) $a^m b^n \mid m \leq n$
(c) $a^m b^n \mid m = n$
(d) $a^* b^*$

32) Consider regular grammar:

$S \rightarrow bS \mid$
$aA \mid \varepsilon$ A
$\rightarrow aS \mid bA$

Myhill-Nerode equivalence classes for language generated by grammar are

(a) $\{w \in (a + b)^* \mid \#_a(w) \text{ is even}\}$ and $\{w \in (a + b)^* \mid \#_a(w) \text{ is odd}\}$

(b) $\{w \in (a + b)^* \mid \#_b (w) \text{ is even}\}$ and $\{w \in (a + b)^* \mid \#_b (w) \text{ is odd}\}$
(c) $\{w \in (a + b)^* \mid \#_a (w) = \#_b (w)\}$ and $\{w \in (a + b)^* \mid \#_a (u) \neq \#_b (w)\}$
(d) $\{\varepsilon\}$, $\{wa \mid w \in (a + b)^*$ and $wb \mid w \in (a + b)^*\}$

33) $L \subseteq \Sigma^*, \Sigma = \{a, b\}$ Which of the following is True?

(a) $L = \{x \mid x$ has equal a's and b's$\}$ is regular
(b) $L = \{a^n b^n \mid n \geq 1\}$ is regular
(c) $L = \{x \mid x$ has more a's than b's$\}$ is regular
(d) $L = \{ a^m b^n, m,n \geq 1\}$ is regular

34) Let $L = \{x \in \{a, b, c\}^* : x$ contains exactly one a and exactly one $b\}$. Which is true?
(a) R. E. = $c^+ a c^+ b c^+ + c^+ b c^+ a c^+$
(b) R.E. = $c^* a c^* b c^* + c^* b c^* a c^*$
(c) Both (a) and (b)
(d) R.E. not possible as L is context-free

35) If L is Turing-recognizable. Then

(a) L and $\bar{L}$ must be decidable.

(b) L must be decidable but $\bar{L}$ need not be.

(c) Either L is decidable or $\bar{L}$ is not Turing recognizable.

(d) None of above.

36) S_1: $L \leq_m \{0^n 1^n \mid n \geq 0\}$ then L is decidable.

S_2: if L is R.E. and $L' \subseteq L$ then L' is recursively enumerable because enumerator for L also enumerates L'.

(a) Both are True
(b) Both are False
(c) $S_1 \rightarrow T, S_2 \rightarrow F$
(d) $S_1 \rightarrow F, S_2 \rightarrow T$

37) Which of the following CFG is not producing the same language as others?

(a) $S \rightarrow aS \mid bS \mid a \mid b \mid \varepsilon$
(b) $S \rightarrow Sa \mid Sb \mid a \mid b \mid \varepsilon$
(c) $S \rightarrow a \mid b \mid SS \mid \varepsilon$
(d) $S \rightarrow aS$
$\mid b\ A\ A$
$\rightarrow bA \mid$
ε

38) $L_1 = \{a^m b^n c^p \mid m \geq n \text{ or } n = p\}$ $L_2 = \{a^m b^n c^p \mid m \geq n \text{ and } n = p\}$

(a) Both are NCFL's
(b) L_1 is DCFL and L_2 is NCFL
(c) L_1 is NCFL and L_2 is not context-free
(d) Both are not context-free

39) Consider the following Grammar:

$$S \rightarrow aS \mid Sb \mid SS \mid \varepsilon$$

I. G is ambiguous
II. Language is a*b*
III. G can be accepted by DPDA
IV. r = (a+b)*

Which are true?
(a) i, ii, iii only
(b) i, iii only
(c) iii, iv only
(d) i, iii, iv only

40) $L_1 = \{ca^n b^n\} \cup \{da^n b^{2n}\}$ $L_2 = \{a^n b^n c\} \cup \{a^n b^{2n} d\}$

(a) Both are DCFL's
(b) Both are NCFL's
(c) L_1 is DCFL, L_2 is NCFL
(d) L_1 is NCFL, L_2 is DCFL

41) Consider this language $L = \{a^n b c^m \mid n > 1, m \leq n\}$ over $\Sigma = \{a, b, c\}$, the L is

(a) Not decidable
(b) Language is unambiguous
(c) Language is NCFL
(d) Language is DCFL
(e) Both (b) and (d)

42) Let A and B be disjoint, R.E. languages. Let $\overline{A \cup B}$ also be recursive enumerable. What can you say about A and B?

(a) Neither A nor B is decidable is possible
(b) At least one among A and B is decidable
(c) Both A and B are decidable
(d) None of above

43)

1. Following language:

$L = \{a^n b^n c^n d^n, n \geq 1\}$ is

(a) CFL but nor regular
(b) CSL but not CFL
(c) Regular
(d) Type 0 language but not Type 1

44) onsider these languages:

$L_1 = \{S \in (0 + 1)^* \mid n_0(S) + n_1(S) \leq 4\}$ $L_2 = \{S \in (0 + 1)^* \mid n_0(S) - n_1(S) \leq 4\}$

(a) Both are regular
(b) Both are non-regular
(c) L_1 is regular but L_2 is not
(d) L_1 is not regular but L_2 is regular

45) Which of the following is True for any Language L?

(a) $L^* = \bigcup^{\infty} L^i$
(b) $L^* = L^+ \cup \{\varepsilon\}$
(c) $L^* = L^+$
(d) $L^* = L^+ \cap \{\varepsilon\}$

46) Concept of Grammar is used in which part of compiler?

(a) Lexical analysis
(b) Parser
(c) Code generation
(d) Code optimization

47) Consider the Language:

$L = \{a^n b^n c^k,\ n,k \geq 1\} \cup \{a^n b^k c^k,\ n,k \geq 1\}$

Which is True?
(a) All the Grammars generating L will be ambiguous.
(b) There exists a G which is unambiguous.
(c) Language L is unambiguous
(d) None of the above

~~48~~) Let R be Regular set. Let S be set consisting of all strings in R which are identical with their own reverses. What can you say about S?

(a) S is regular
(b) S is non-regular
(c) S may or may not be regular
(d) None of the above

~~49~~) uppose L is a context-free language over $\Sigma = \{a\}$ i.e. only one alphabet. What can you say about L?

(a) L is always regular
(b) L need not be regular
(c) L is always DCFL
(d) L is always NCFL

~~50~~) Let L be a Context Free Language. Even(L) is the set of all strings w in L such that |w| is even. What can you say about Even(L)?
(a) It will be regular
(b) It will be context-free
(c) It is not decidable
(d) None of the above

51) Consider this grammar:

$$S \rightarrow bF,\ \ S \rightarrow aS,\ F \rightarrow \varepsilon\ ,\ F \rightarrow bF \mid aF$$

Regular Expression for this grammar is?

(a) (a + b)* b (a + b)*
(b) a*b(a + b)*

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

(d) All of the above

52) Let L be a regular language. Consider $L' = \{xy : x \in L \text{ and } y \notin L\}$

L' is

(a) Always regular

(b) Need not be regular

(c) Context-free

(d) Depends on L

53) Consider two statements:

S_1: Every regular language has regular proper subset.
S_2: If L_1 and L_2 are non-regular, then $L_1 \cup L_2$ is also not-regular.

(a) Both are True

(b) Both are False

(c) $S_1 \rightarrow$ True, $S_2 \rightarrow$ False

(d) $S_1 \rightarrow$ False, $S_2 \rightarrow$ True

54) $L_1 = \{a^m b^n c^{\max(m,n)} : m,n > 1\}$
$L_2 = \{a^{2n}, n > 1\} \cup \{a^m, m>1\}$

(a) Both are regular

(b) Only L_2 is regular

(c) Only L_1 is regular

(d) None of the above

55) Consider this Context-Free Grammar:

$$S \rightarrow aSa \mid bSb \mid aSb \mid bSa \mid \varepsilon$$

(a) L(G) is regular

(b) L(G) is DCFL

(c) L(G) is NCFL

(d) L(G) is ambiguous

56) Ambiguous grammar is NOT accepted by

(a) Regular language

(b) DCFL

(c) CFL

(d) Recursive language

57) $L = \{0^{n+m}\ 1^{n+m}\ 0^m \mid n, m \geq 0\}$

The above language is

(a) CFL but not regular
(b) CSL but not CFL
(c) RE but not CSL
(d) none of the above

58) $L_1 = \{(xy)^m\ (yz)^m, m \geq 1\}$
$L_2 = \{a^m b^n c^k \mid m > n$ or $m < n\}$ Which of the following is True?

(a) L_1 is CFL, L_2 is DCFL
(b) L_1 is DCFL, L_2 is CFL
(c) Both L_1, L_2 are CFLs
(d) Both L_1, L_2 are DCFLs

59) $L = \{x^a y^a : a \geq 1\}$

I. L^3 is context free.
II. $\lceil \sqrt{L}\ \rceil$ is not context free. Which of the following is correct?

(a) I only
(b) II only
(c) Both I and II
(d) None of the above

60) Consider the following statements.

(i) Kleen closure of an empty language is non-empty.
(ii) Some infinite languages are regular.
(iii) $L = \{a^P / P$ is a prime number$\}$ is a regular language.

(a) Only (i) is true
(b) Only (ii) & (iii) are true
(c) Only (i) & (ii) are true
(d) All are true

Solution: Option (c)

61) Consider the following grammar which of the following is/are ambiguous?

(i) $S \rightarrow y \mid Sxs$
(ii) $S \rightarrow E \mid Exs$ and $E \rightarrow y$
(iii) $S \rightarrow Sxy \mid y$

(a) i only
(b) ii only
(c) iii only
(d) None of these

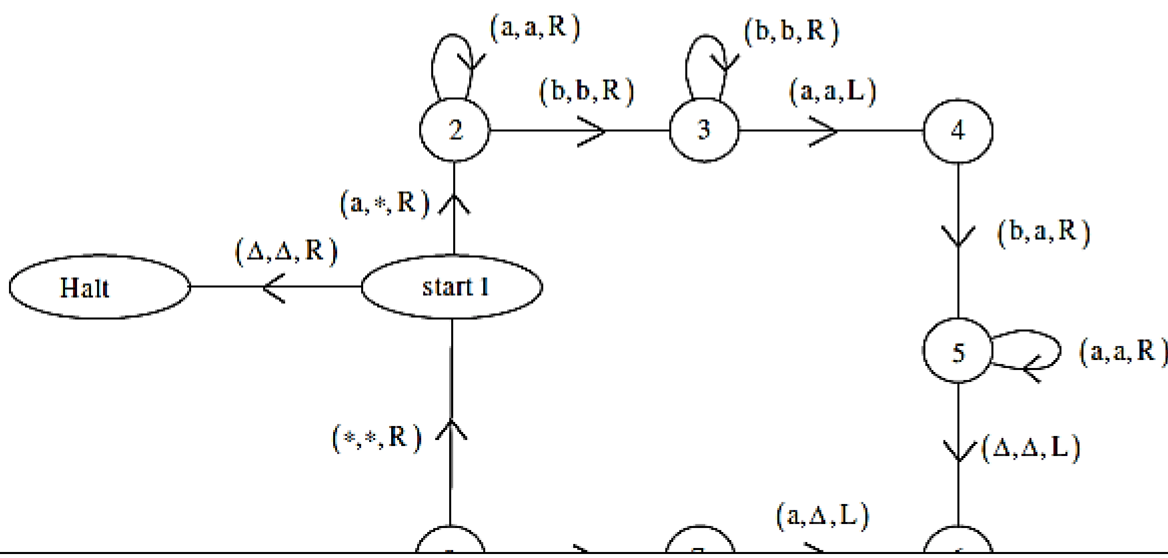
62) Which of the following is not decidable problem?

(a) A sting is generated by C.N.F or Not?
(b) A given non-terminal A in a given grammar CFG is ever used in the generation of word
(c) Given context-free Grammar generates an infinite language or a finite language
(d) None of

the above

63) Consider the following T.M.

{Note Σ ={a,b}
$\lceil$ = {*,a,b}
Δ = empty cells of Tape.



Which of the following string does not accepted by T.M. ?

(i) aabbaa
(ii) ∈
(iii) aabb

(a) i & ii
(b) ii, iii and iv
(c) iii and iv
(d) iv only

64) Consider the PDA $M = \{\{q_0, q_1\}, \{0,1\}\}, \{0,1, z_0\}, \{q_0, z_0, q_F\}$

$\delta = \{((q_0, 0, z_0), (q_0, 0z_0)), ((q_0, 0,0), (q_0, 00))\ ((q_0, 1,0), (q_0, 10))$

$((q_0, 1,1), (q_0, 11), (q_0, 0,1), (q_1, \in))$

$((q_1, 0,1), (q_1, t)), ((q_1, 0,0), (q_1, \in))$

$((q_1, \in, z_0), (q_F, \in))$

The language corresponding to above PDA is

(a) $L = \{0^n1^n0^n/n \geq 1\}$
(b) $L = \{0^n1^n0^{m+n}/n \geq 1\}$
(c) $L = \{0^n1^{n+m}0^m/m, n \geq 1\}$
(d) $L = \{0^n1^n0^m/m, n \geq 1\}$

65) 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+n
(iii) Acceptance of language $L = \{W/W \notin (a, b)^*\}$
(iv) Acceptance of language $L = \{a^nb^nc^nd^ne^n/n \geq 1\}$

(a) i and ii
(b) iii and iv
(c) iii only
(d) None of these

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66) Which of the following is a context free language

(i) $L = \{a^mb^mc^k: n = m \text{ or } n \leq k\}$
(ii) $L = \{a^nb^nc^n \mid n \geq 0\}$
(iii) $L = \{a^nb^mc^k : n = m \text{ or } m \neq k\}$

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

(a) iv only
(b) i, ii & iv only
(c) ii & iii only
(d) iv & iii only

67) Let $\Sigma = \{a, b\}$ and $L = \{a^n w a^n : n \geq 1, w \in \Sigma^*\}$ consider the following statement

(i) L has regular expression $a * (a + b) * a *$
(ii) L is Non-Regular language
(iii) L has CFG $S \rightarrow aSa \mid aS \mid bS \mid aa$ where S is variable
(iv) L has CFG $S \rightarrow aSa \mid axa$ where S, X are variable $X \rightarrow aX \mid bX \mid \lambda$

Which of the following is/are true?

(a) i only
(b) ii and iii only
(c) i and iv only
(d) iv only

68) Based on the accepting power, which of the following is true?

(a) Type 0 $\subset$ Type 1 $\subset$ Type 2 $\subset$ Type 3

(b) Type 0 $\subset$ Type 2 $\subset$ Type 1 $\subset$ Type 3

(c) Type 0 $\supset$ Type 1 $\supset$ Type 2 $\supset$ Type 3

(d) Type 0 $\supset$ Type 2 $\supset$ Type 1 $\supset$ Type 3

69) Which of the following is true?

(i) Automata is a recognizing device or an accepting device.
(ii) Grammar is a generating device.

(a) only (i) (b) only (ii)
(c) both (i) & (ii) (d) none of these

70) Expressive power of automata is the number of languages accepted by the automata. What is the expressive power of Finite Automata (FA), Push Down Automata (PDA), Linear Bounded Automata (LBA) and Turing Machine (TM), respectively.

(a) FA – 1, PDA – 1, LBA – 1, TM – 1

(b) FA – 1, PDA – 2, LBA – 3, TM – 4

(c) FA – 4, PDA – 3, LBA – 2, TM – 1 (

d) FA – 1, PDA – 4, LBA – 3, TM – 2

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71) Which of the following is/are true about expressive power of automata?

(i) E(DFA) = E(NFA)
(ii) E(DPDA) ≠ E(NPDA)
(iii) E(DTM) = E(NTM)

(a) Only (i) & (iii) (b) Only (i) & (ii)
(c) Only (ii) & (iii) (d) All are true

72) For which of the following language L, modes can be constructed in both deterministic and non-deterministic mode to accept L?

(i) Regular Language
(ii) Context Free Language
(iii) Recursive Enumerable Language

(a) Only (i) & (ii) (b) Only (i) & (iii)
(c) Only (ii) & (iii) (d) All of the above

73) Which of the following statements is false?

(a) DFA & NFA are of same capability (b) DPDA & NPDA are of same capability (c) DTM & NTM are of same capability (d) None

74) Which of the following statements is wrong?

(a) PDA is more powerful than FA

(b) TM is more powerful than PDA
(c) FA+3 Stacks is more powerful than FA+2 Stacks
(d) None

75) Consider the language $L_1 = \{a^p \cdot b^q \cdot c^r \mid p, q, r > 0\}$ and $L_2 = \{a^p \cdot b^q \cdot c^r \mid p, q, r \geq 0 \text{ and } p = r\}$, then which of the following statements are true.

(1) $L_1 \cup L_2$ is a context free language
(2) $L_1 \cap L_2$ is a context free language
(3) $L_1 - L_2$ is not regular
(4) L_1 and L_2 both are regular languages

(a) Only 1 and 2 statements are true (b) Only 3 and 4 statements are true (c) Only 1, 2, 3 statements are true (d) Only 1, 2, 4 statements are true

76) Below is the grammar then find the language generated by given grammar

S → ABC Xb → bx
AB → aAx |bAy | ∊ Ya → ay
C → ∊ Yb → by
XC → BaC aB → Ba
YC → BbC bB → Bb
Xa → aX

(a) $L = \{w \mid w \in (a, b)^*, \text{ and } x_a(w) = x_b(w)\}$
(b) $L = \{w \mid w \subseteq (a, b)^+, \text{ and w is a palandrom string}$
(c) $L = \{w \mid w \subseteq (a, b)^*, \text{ and } w = xx, \text{ where } X = (a, b)^*\}$
(d) None of the above

77) A PDA behaves like an FSA when the number of auxiliary memory it has, is _____

78) The statement "A Turing machine can't solve halting problem" is

(a) True (b) False

(c) Still an open question (d) False when P!= NP

79) Consider PDA = M = ({q_0, q_1}, {a, b}, {a, z_0}, δ, q_0, z_0, φ) which accepts by empty stack

δ: (q_0, a, z_0) = (q_0, az_0)
(q_0, a, a) = (q_0, aa)
(q_0, b, a) = (q_1, a)

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(q_1, b, a) = (q_1, a)
(q_1, a, a) = (q_1, ∈)
(q_1, ∈, z_0) = (q_1, ∈)

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

(s1) aaa
(s2) aabbaa
(s3) aba
(s4) aaab

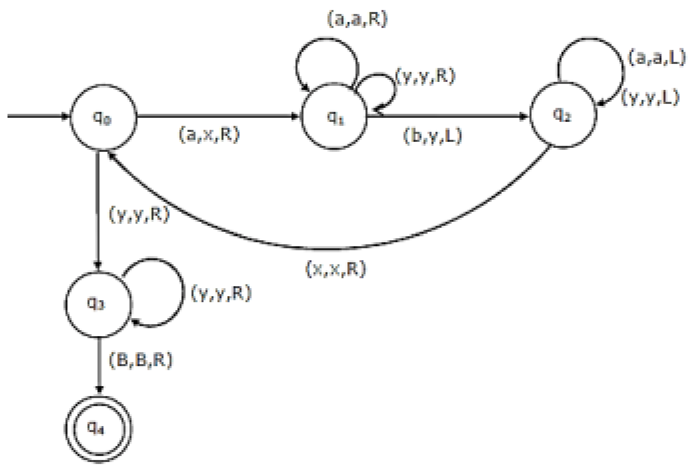
(a) Only s2, s3 and s4 (b) Only s1
(c) Only s2 and s3 (d) Only s2

80) Which of the following is true for the following grammar?

E → E + E
E → E * E
E → id

(a) * has precedence over + (b) + has precedence over * (c) Both are of same precedence (d) None of these

81) The transition diagram for Turing machine is given below:



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

(a) aabbb (b) aabb
(c) abbb (d) None of these

82) 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) Finiteness of CFL is decidable
(d) Is $L_1 \cap L_2 = \phi$ is decidable for CSL's

83) Consider three decision problems P_1, P_2 and P_3. It is known that P_1 is decidable and P_2 is undecidable. Which one of the following is true?

(a) P_3 is decidable if P_1 isreducible to P_3
(b) P_3 is undecidable if P_3 isreducible to P_2
(c) P_3 is undecidable if P_2 isreducible to P_3
(d) P_3 is decidable if P_3 isreducible to P_2's complement

84) Consider the following grammar:

$S \to Aa \mid b$
$A \to Ac \mid Sd \mid c$

The resulting grammar after eliminating left recursion is
(a)
$A \to SdA' \mid CA'$ $A' \to cA' \mid \epsilon$
$S \to Aa \mid b$
(b)
$A \to bdA' \mid cA'$
$A' \to cA' \mid adA' \mid bA' \mid \epsilon$

(c)
$A \to bdA' \mid cA'$ $A' \to cA' \mid adA' \mid \epsilon$
(d) None of these

85) Consider the following languages:

$L_{ne} = \{\langle M \rangle \mid L(M) \neq \phi\}$
$L_e = \{\langle M \rangle \mid L(M) = \phi\}$

where $\langle M \rangle$ denotes encoding of a Turning machine

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

86) etermine the minimum height of parse tree in CNF for terminal string of length w, which is constructed by using CFG G

(a) $\log_2|w| + 1$ (b) $\log_2|w|$

(c) $\log_2|w| - 1$ (d) None of these

87) Let G and G_1 be a CFG with productions

G: $S \to S + S \mid S*S \mid (S) \mid a$
G_1: $S \to S + T \mid T$
$T \to T*F \mid F$
$F \to (S) \mid a$

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

88) The intersection of a CFL and a regular language

(a) Need not be regular (b) Need not be context free (c) Is always regular (d)

Is always CFL

89) Let $\Sigma = \{a, b\}$ and let L = {w | w contains an equal number of occurrences of substrings "ab" and "ba"}. Thus aba ∈ L since "aba" contain one occurrence of "ab" and one occurrence of "ba" but abab ∉ L. Then which of the following is true?

(a) L is regular (b) L is a DCFL but not regular (c) L is a CFL but not regular (d)

L is recursive but not a CFL **Solution:** Option (a)

90) $L_1 = \{a^n b^n a^m / n, m = 1,2,3, \dots\}$
$L_2 = \{a^n b^m a^m / n, m = 1,2,3, \dots\}$
$L_3 = \{a^n b^n a^n / n = 1,2,3, \dots\}$

Which of the following is true?

(a) $L_3 = L_1 \cap L_2$

(b) L_1 is context free language (CFL) but L_2 and L_3 are not CFL's

(c) L_1 and L_2 are not CFL's but L_3 is a CFL

(d) Both (a) and (b)

91) Which one of the following is a DCFL?

(a) $L = \{a^n b^n c^n | \ n > 1000\}$ (b) L = set of all balanced parenthesis (c) $L = \{WW^R | \ W \in$

$\{a, b\}^*\}$ (d) All of these

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