EPT-TEST-29(TOC)
Total Questions: 22
Time: 60 minutes

Q1. Membership problem is decidable on (MSQ)

a. **Regular language**
b. **Context-free language**
c. **Context-sensitive language**
d. **Deterministic context-free language.**

Q2. Consider the following statements:

S1: Recursive language is also called decidable language.

S2: Recursively Enumerable languages are also called semi-decidable languages.

S3: Partially decidable and semi-decidable both are the same.

Number of correct statement(s) is/are_____

(NAT Type)

Q3. Number of states in minimal DFA that accept all the strings of a's and b's where "each string starting with a and ending with b" —---- (NAT Type)

Q4. Number of states in minimal DFA that accepts all the strings over ∑ = {a, b} where "each string starting and ending with the same symbol"---—----

(NAT Type)

Q5. Which of the following regular expressions does not generate a substring containing "baa"?

a) a*(ba)*
b) a*b*(ba)*a
c) (ab*+a)*(ab)*b*a*
d) (bba* +b)*a

Q6. Number of 3-state DFA with designated(Fix) initial state that can be constructed over ∑ = {a, b}.

—---- (NAT Type)

Q7. Which of the following is correct?

Let r_1 = (a*b)* and r_2 = (a + b*)*

a) $L(r_1) = L(r_2)$

b) $L(r_1) \subset L(r_2)$
c) $L(r_1) \supset L(r_2)$
d) None of these

Q8. CFL's are decidable on:

a. Membership problem only
b. Emptiness problem only
c. Finiteness Problem only
d. All the above

Q9. **Which of the following are equivalent?**

1. (ab)*b 2. a(bb)*

3. a(ba)* 4. (ab)*a

A) 1 and 3 only
B) 1 and 4 only
C) 3 and 4 only
D) 2 and only

Q10. Which of these are equivalent?

I) ∈ + r + rrr*

II) ∈ + rr*

III) r*

A)I and III only

B)II and III only

C)All are equal

D)None of these

Q11. Which one of the following languages over the alphabet {0, 1} is described by the regular expression (O + 1)* 0(0 + 1)*0(0 + 1)*?

a) **The set of all strings containing the substring 00**
b) **The set of all strings containing at most two 0's**
c) **The set of all strings containing at least two 0's**
d) **The set of all strings that begin and end with either 0 or 1**

12. Which of the following problems is undecidable?

a) Deciding if a given context-free grammar is ambiguous.
b) Deciding if a given string is generated by a given context-free grammar.
c) Deciding if the language generated by a given context-free grammar is empty.
d) Deciding if the language generated by a given context-free grammar is finite.

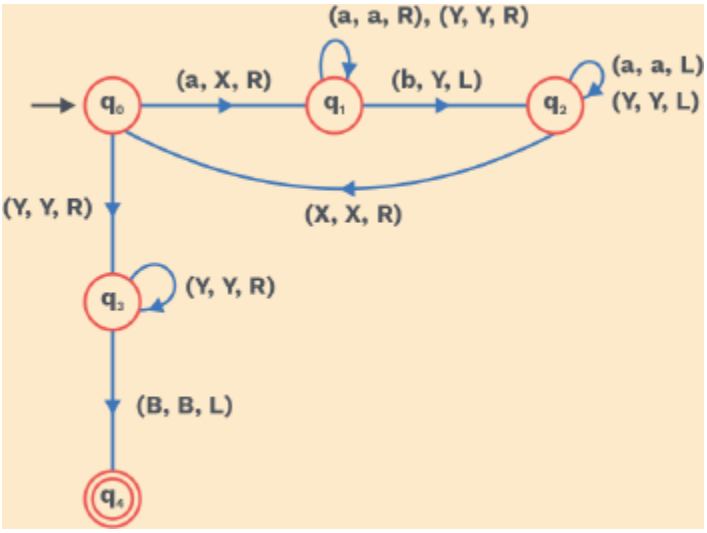
13. If L_1 and L_2 are context-free languages and R is a regular set, one of the languages below is not necessarily a context-free language?

a) $L_1.L_2$
b) $L_1 \cap L_2$
c) $L_1 \cap R$
d) $L_1 \cup L_2$

14. Given a set S = set of all strings over {a, b} is

a) Countable
b) Uncountable
c) Finite
d) Neither countable nor uncountable

15. The transition diagram for the Turing machine is given below

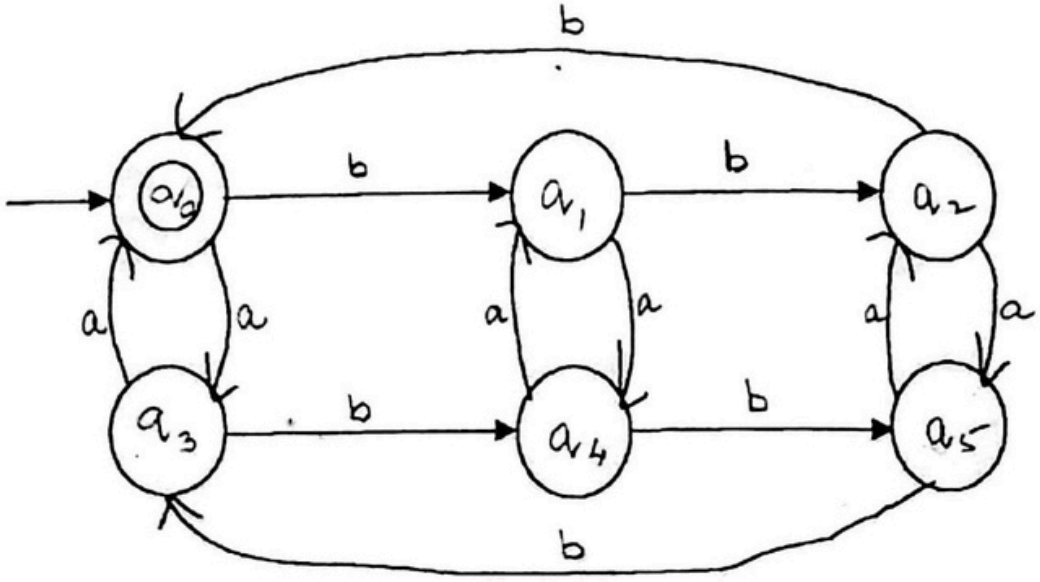


Which one of the following strings is accepted by the above TM?

a) ab
b) aab
c) abb
d) None of the above

Q16.

Consider the finite automata m



(a) a's divisible by 3 and b's divisible by 2
(b) a's divisible by 2 and b's divisible by 3
(c) a's divisible by 3 and b's divisible by 3
(d) None

Q17. Consider the given statements:

S1: Let L_1 be a recursive language then its complement $\overline{L1}$ is also a recursive language.

S2: Let L_2 be a recursively enumerable language then its complement $\overline{L2}$ is also a recursively enumerable language.

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

a) **S1**
b) **S2**
c) **S1 & S2**
d) **None of the above**

Q18. Consider the following language,

L_1 = Recursive enumerable language,

L_2 = Recursive language

L_3 = Context free language

Now, Let L=($\overline{L2} \cap$L1)−L3 ,L is

a) **L is CFL**
b) **L is recursive**
c) **L is REL**
d) **L is not REL**

Q19. What is the highest type number that can be assigned to the following grammar?

$S \rightarrow S_1B$

$S_1 \rightarrow aS_1b$

$bB \rightarrow bbbB$

$aS_1b \rightarrow aa$

$B \rightarrow \in$

a) Type 0
b) Type 1
c) Type 2
d) Type 3

Q20. Consider the given statements:

S1: Let L_1 be recursive and L_2 be recursively enumerable, then $L_2 - L_1$ is necessarily recursively enumerable.

S2: Let L_1 be recursive and L_2 be recursively enumerable, then $L_1 - L_2$ is necessarily recursively enumerable.

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

a) S1
b) S2
c) S1 & S2

d) None of the above

Q21. A Turing machine has _____ number of states.

a) Finite
b) Infinite
c) May be finite
d) None of the mentioned

Q22. **A context-free grammar is ambiguous if:**

a) The grammar contains useless non-terminals
b) It produces more than one parse tree for some sentences.
c) Some productions have two non-terminals side by side on the right-hand side.
d) None of the above

ANSWERS

A1. **a, b, c, d**

Explanation:

The membership problem is decidable for all languages except recursively enumerable languages because all the machines always halt except the Turing machine.

A2. 3

All the statements are correct.

Recursive language is called decidable language because, for the recursive language, we have halting Turing Machines.

For a recursively enumerable language, we have a Turing machine and the Turing machine may or may not halt, but TM always halts for strings belonging to the language.

Hence, Recursively enumerable languages are semi-decidable.

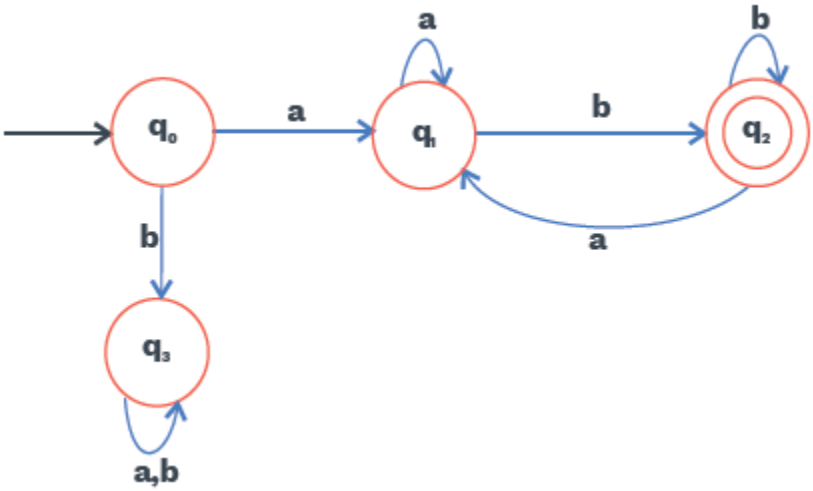
Partially decidable and semi-decidable means the same only.

A3. 4

Explanation:

L = {ab, aab, abb, aaab, abab, aabb, …….}

DFA:

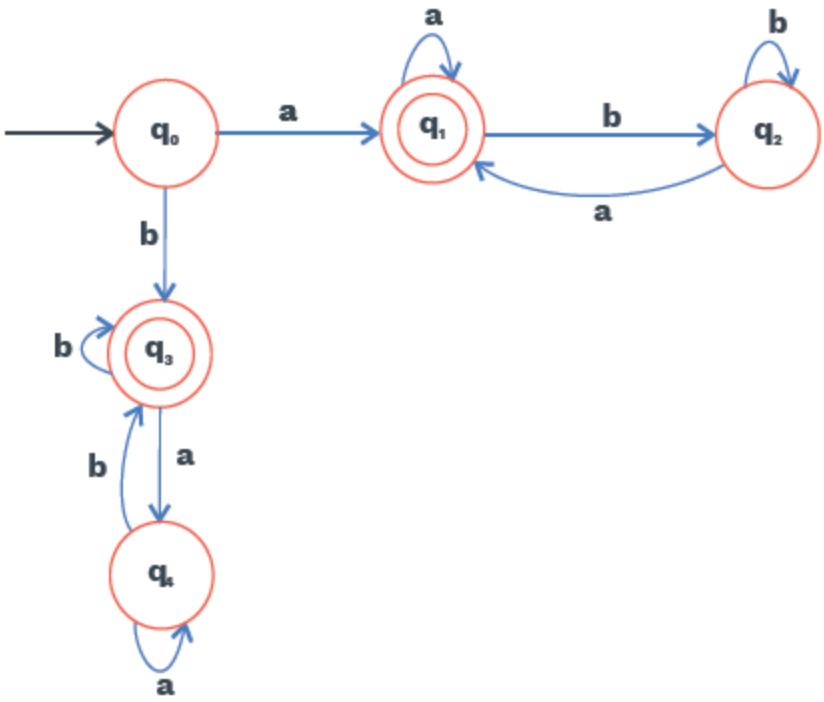


A4. 5

Explanation:

Sol:L = {a, b, aaa, bbb, aba, bab, ……}

DFA:



A5. **(a)**

Explanation:

a) a*(ba)* = {∈, a, ba,aba,baba,……}

It cannot generate a string containing ‘baa’ as a substring.

b) a*b*(ba)* a = {a, aa, ba, baa, ……}

It can generate a string containing ‘baa’ as a substring.

c) (ab*+ a)* (ab)* b*a* = {∈, a, b, aa, bb, ab, ba, baa, abba, …..}

It can generate a string containing ‘baa’ as a substring.

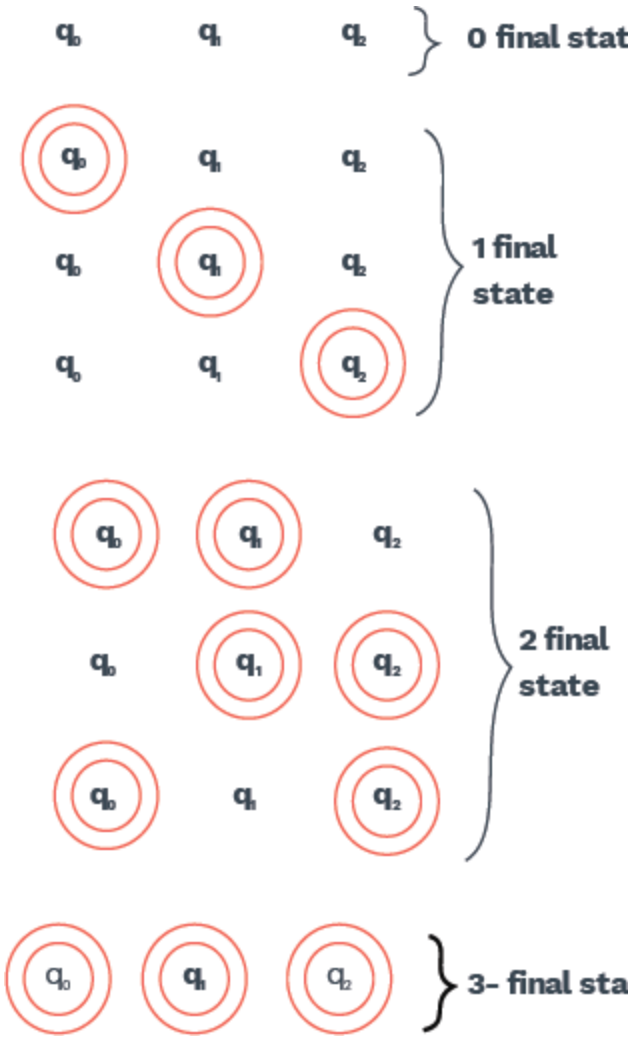
d) (bba*+ b)* a = {a, ba, bba, bbaa, …….}

It can also generate a string containing ‘baa’ as a substring.

A6. **5832**

Explanation:

The final state can be:



Total possibility = $2^3 = 8$

Possibility

δ	a	b
→ q_0	$q_0/q_1/q_2$	$q_0/q_1/q_2$
q_1	$q_0/q_1/q_2$	$q_0/q_1/q_2$
q_2	$q_0/q_1/q_2$	$q_0/q_1/q_2$

Total number of ways to construct 3-state DFA with a designated initial state over $\sum = \{a, b\} = 2^3 * 3^6 = 8 * 9^3 = 5832$

A7. **(b)**

Explanation:

$r_1 = (a*b)*$ and $r_2 = (a+b*)*$

$L(r_1) = \{\in, b, ab, aab, \ldots\ldots\}$

$L(r_2) = \{\in, a, b, aa, ab, ba, bb, aab, \ldots\ldots\ldots\ldots\}$

So, $L(r_1) \subset L(r_2)$

A8. d)

CFLs are decidable on membership problems, emptiness problem, finiteness problem because we have an algorithm for all the problems.

For Push-down automata CYK is an algorithm for membership problems.

For the emptiness problem, the algorithm is the simplification of CFG.

The Dependency tree lets us know whether the grammar is finite or not. Hence,

d) is the correct option.

A9. C

A10. C

A11. C

A12. A

A13. B

A14. A

A15. A

Explanation: It is accepting L = $\{a^n b^n \mid n \geq 1\}$.

So, (a) is the correct option.

A16. B

A17. A

A18. **C**

Explanation:

L=($\overline{L2}$∩L1)−L3

=($\overline{Rec}$∩REL)−CFL

=(Rec∩REL)−CFL

=REL∩$\overline{CFL}$

=REL∩CSL

=REL.

[Here, Rec means recursive language,

REL means recursively enumerable language,

CFL means context-free language,

CSL means context-sensitive language]

A19. A

The given grammar is in the form of u → v

where u belongs to $(V+T)^{+}$ v belongs to $(V+T)^{*}$

here, V is set of non-terminals and T is set of terminals

Hence, it is unrestricted grammar or type-0 grammar.

A20. **A**

A21. A

Explanation: In the definition of Turing machine, ‘Q’ represents the “Set of a finite number of states”.

A22. B