1. All the regular languages can have one or more of the following descriptions:
   i) DFA ii) NFA iii) e-NFA iv) Regular Expressions
   Which of the following are correct?
   a) i, ii, iv
   b) i, ii, iii
   c) i, iv
   d) i, ii, iii, iv. ANS:-D
2. Which of the technique can be used to prove that a language is non regular?
   a) Ardens theorem
   b) Pumping Lemma
   c) Ogden's Lemma
   d) None of the mentioned ANS:-B
3. Which of the following language regular?
   a) $\{a^ib^i|i>=0\}$
   b) $\{a^ib^i|0<i<5\}$
   c) $\{a^ib^i|i>=1\}$
   d) None of the mentioned ANS:-B
4. Which of the following are non regular?
   a) The set of strings in {a,b}* with an even number of b's
   b) The set of strings in {a, b, c}* where there is no c anywhere to the left of a
   c) The set of strings in {0, 1}* that encode, in binary, an integer w that is a multiple of 3. Interpret the empty strings e as the number 0.
   d) None of the mentioned, ANS:-d
5. If L is DFA-regular, L' is
   a) Non regular
   b) DFA-regular
   c) Non-finite
   d) None of the mentioned ANS:-B
6. Which of the following options is incorrect?
   a) A language L is regular if and only if ~L has finite number of equivalent classes.
   b) Let L be a regular language. If ~L has k equivalent classes, then any DFA that recognizes L must have atmost k states.
   c) A language L is NFA-regular if and only if it is DFA-regular.
   d) None of the mentioned ANS:- B
7. Myphill Nerode does the following:
   a) Minimization of DFA
   b) Tells us exactly when a language is regular
   c) Both (a) and (b)
   d) None of the mentioned ANS:-C
8. Which of the following are related to tree automaton?
   a) Myphill Nerode Theorem
   b) State machine

c) Courcelle’s Theorem
d) All of the mentioned ANS:-D

9. Given languages:
i) {$a^n b^n | n>=0$}
ii) $^n$ $^n$
iii) {w∈{a,b}∗| #a(w)=#b(w)}, # represents occurrences
Which of the following is/are non regular?
a) i, iii
b) i
c) iii
d) i, ii, iii Ans;-D

10.. How many languages are over the alphabet R?
a) countably infinite
b) countably finite
c) uncountable finite
d) uncountable infinite ans D

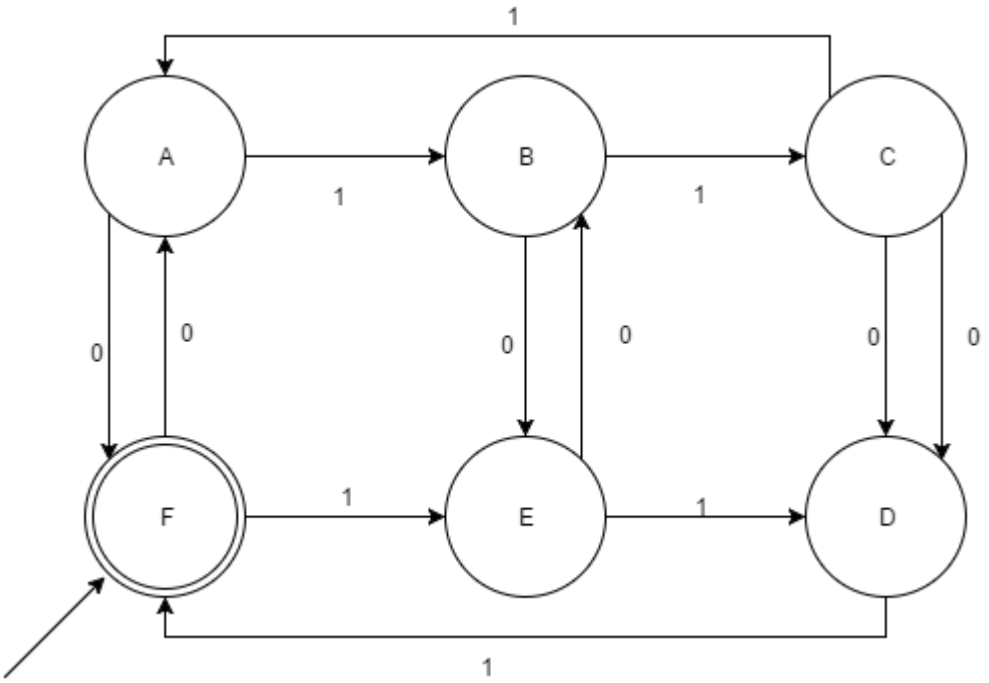
11. According to the 5-tuple representation i.e. FA= {Q, ∑, δ, q, F}
Statement 1: q ϵ Q’; Statement 2: FϵQ
a) Statement 1 is true, Statement 2 is false
b) Statement 1 is false, Statement 2 is true
c) Statement 1 is false, Statement 2 may be true
d) Statement 1 may be true, Statement 2 is false
View Answer :b

12. 3. δˆ tells us the best:
a) how the DFA S behaves on a word u
b) the state is the dumping state
c) the final state has been reached
d) Kleene operation is performed on the set
View Answer:a

13. 4. Which of the following option is correct?
A= {{abc, aaba}. {ε, a, bb}}
a) abcbb ₵ A
b) ε₵A
c) ε may not belong to A
d) abca ₵ A
View Answer:b
t

14. For a DFA accepting binary numbers whose decimal equivalent is divisible by 4, what are all the possible remainders?
a) 0
b) 0,2
c) 0,2,4
d) 0,1,2,3
View Answer :d

15. 6. Which of the following x is accepted by the given DFA (x is a binary string ∑= {0,1})?




a) divisible by 3
b) divisible by 2
c) divisible by 2 and 3
d) divisible by 3 and 2 Ans:d

16. 7. Given:
    L1= {xϵ ∑*|x contains even no's of 0's}
    L2= {xϵ ∑*|x contains odd no's of 1's}
    No of final states in Language L1 U L2?
    a) 1
    b) 2
    c) 3
    d) 4
    View Answer:c
17. 8. The maximum number of transition which can be performed over a state in a DFA?
    ∑= {a, b, c}
    a) 1
    b) 2
    c) 3
    d) 4
    View Answer:c
18. 9. The maximum sum of in degree and out degree over a state in a DFA can be determined as:
    ∑= {a, b, c, d}
    a) 4+4
    b) 4+16
    c) 4+0
    d) depends on the Language
    View Answer:d
19. 10. The sum of minimum and maximum number of final states for a DFA n states is equal to:

a) n+1
b) n
c) n-1
d) n+2
View Answer:a

20. 1. There are _____ tuples in finite state machine.
a) 4
b) 5
c) 6
d) unlimited
View Answer:b

21. 2. Transition function maps.
a) Σ * Q -> Σ
b) Q * Q -> Σ
c) Σ * Σ -> Q
d) Q * Σ -> Q
View Answer:d

22. 3. Number of states require to accept string ends with 10.
a) 3
b) 2
c) 1
d) can't be represented.
View Answer:a

23. 4. Extended transition function is .
a) Q * Σ* -> Q
b) Q * Σ -> Q
c) Q* * Σ* -> Σ
d) Q * Σ -> Σ
View Answer:a

24. 5. δ*(q,ya) is equivalent to .
a) δ((q,y),a)
b) δ(δ*(q,y),a)
c) δ(q,ya)
d) independent from δ notation
View Answer:b

25. advertisement

26. 6. String X is accepted by finite automata if .
a) δ*(q,x) E A
b) δ(q,x) E A
c) δ*(Q0,x) E A
d) δ(Q0,x) E A
View Answer:c

27. 7. Languages of a automata is
a) If it is accepted by automata
b) If it halts
c) If automata touch final state in its life time
d) All language are language of automata
View Answer:a

28. 8. Language of finite automata is.
    a) Type 0
    b) Type 1
    c) Type 2
    d) Type 3
    View Answer:d
29. 9. Finite automata requires minimum _____ number of stacks.
    a) 1
    b) 0
    c) 2
    d) None of the mentioned
    View Answer:b
30. 10. Number of final state require to accept Φ in minimal finite automata.
    a) 1
    b) 2
    c) 3
    d) None of the mentioned
    View Answer:d
31. 11. 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 mentioned
    View Answer:c
32. 12. How many DFA's exits with two states over input alphabet {0,1} ?
    a) 16
    b) 26
    c) 32
    d) 64
    View Answer:d
33. 13. The basic limitation of finite automata is that
    a) It can't remember arbitrary large amount of information.
    b) It sometimes recognize grammar that are not regular.
    c) It sometimes fails to recognize regular grammar.
    d) All of the mentioned
    View Answer:a
34. 14. Number of states require to simulate a computer with memory capable of storing '3' words each of length '8'.
    a) $3 * 2^8$
    b) $2^{(3*8)}$
    c) $2^{(3+8)}$
    d) None of the mentioned
    View Answer:b
35. 15. 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 mentioned

View Answer:a

36. 1. A push down automaton employs _____ data structure.
    a) Queue
    b) Linked List
    c) Hash Table
    d) Stack

    View Answer:d
37. 2. State true or false:
    Statement: The operations of PDA never work on elements, other than the top.
    a) true
    b) false

    View Answer:a
38. 3. Which of the following allows stacked values to be sub-stacks rather than just finite symbols?
    a) Push Down Automaton
    b) Turing Machine
    c) Nested Stack Automaton
    d) None of the mentioned

    View Answer:c
39. 4. A non deterministic two way, nested stack automaton has n-tuple definition. State the value of n.
    a) 5
    b) 8
    c) 4
    d) 10

    View Answer:d
40. 5. Push down automata accepts _____ languages.
    a) Type 3
    b) Type 2
    c) Type 1
    d) Type 0

    View Answer:b
41. 6. The class of languages not accepted by non deterministic, nonerasing stack automata is _____
    a) NSPACE(n2)
    b) NL
    c) CSL
    d) All of the mentioned

    View Answer:d
42. 7. A push down automaton with only symbol allowed on the stack along with fixed symbol.
    a) Embedded PDA
    b) Nested Stack automata
    c) DPDA
    d) Counter Automaton

    View Answer:d

43. 8. Which of the operations are eligible in PDA?
    a) Push
    b) Delete
    c) Insert
    d) Pop
    View Answer:a,d
44. 9. A string is accepted by a PDA when
    a) Stack is empty
    b) Acceptance state
    c) Both (a) and (b)
    d) None of the mentioned
    View Answer:c
45. 10. The following move of a PDA is on the basis of:
    a) Present state
    b) Input Symbol
    c) Both (a) and (b)
    d) None of the mentioned
    View Answer:c

1. If two sets, R and T has no elements in common i.e. RÇT=Æ, then the sets are called
a) Complement
b) Union
c) Disjoint
d) Connected
View Answer
Answer: c
Explanation: Two sets are called disjoint if they have no elements in common i.e. RÇT=Æ.

2. Which among the following is not a part of the Context free grammar tuple?
a) End symbol
b) Start symbol
c) Variable
d) Production
View Answer
Answer: a
Explanation: The tuple definition of context free grammar is: (V, T, P, S) where V=set of variables, T=set of terminals, P=production, S= Starting Variable.

3. A context free grammar is a _____
a) English grammar
b) Regular grammar
c) Context sensitive grammar
d) None of the mentioned
View Answer
Answer: c
Explanation: Context free grammar is the set which belongs to the set of context free grammar. Similarly, Regular grammar is a set which belongs to the the set of Context free grammar.

4. The closure property of context free grammar includes :
a) Kleene
b) Concatenation
c) Union
d) All of the mentioned
View Answer
Answer: d
Explanation: Context free grammars are closed under kleene operation, union and concatenation too.

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5. Which of the following automata takes stack as auxiliary storage?
a) Finite automata
b) Push down automata
c) Turing machine
d) All of the mentioned
View Answer
Answer: b
Explanation: Pushdown Automaton uses stack as an auxiliary storage for its operations. Turing machines use Queue for the same.

6. Which of the following automata takes queue as an auxiliary storage?
a) Finite automata
b) Push down automata
c) Turing machine
d) All of the mentioned
View Answer
Answer: c
Explanation: Pushdown Automaton uses stack as an auxiliary storage for its operations. Turing machines use Queue for the same.

7. A context free grammar can be recognized by
a) Push down automata
b) 2 way linearly bounded automata
c) Both (a) and (b)
d) None of the mentioned
View Answer
Answer: c
Explanation: A linearly bounded automata is a restricted non deterministic turing machine which is capable of accepting ant context free grammar.

8. A null production can be referred to as:
a) String
b) Symbol
c) Word
d) All of the mentioned
View Answer
Answer: a
Explanation: Null production is always taken as a string in computational theory.

9. The context free grammar which generates a Regular Language is termed as:
a) Context Regular Grammar
b) Regular Grammar
c) Context Sensitive Grammar
d) None of the mentioned
View Answer
Answer: b
Explanation: Regular grammar is a subset of Context free grammar. The CFGs which produces a language for which a finite automaton can be created is called Regular grammar.

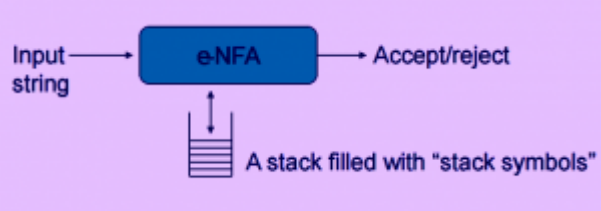
10. NPDA stands for
a) Non-Deterministic Push Down Automata
b) Null-Push Down Automata
c) Nested Push Down Automata
d) All of the mentioned
View Answer
Answer: a
Explanation: NPDA stands for non-deterministic push down automata whereas DPDA stands for deterministic push down automata.

1. The production of the form A->B , where A and B are non terminals is called
a) Null production
b) Unit production
c) Greibach Normal Form
d) Chomsky Normal Form
View Answer
Answer: b
Explanation: A->ε is termed as Null production while A->B is termed as Unit production.

2. Halting states are of two types. They are:
a) Accept and Reject
b) Reject and Allow
c) Start and Reject
d) None of the mentioned
View Answer
Answer: a
Explanation: Halting states are the new tuple members introduced in turing machine and is of two types: Accept Halting State and Reject Halting State.

3. A push down automata can be represented as:
PDA= ε-NFA +[stack] State true or false:
a) true
b) false
View Answer

Answer: a
Explanation:




4. A pushdown automata can be defined as: (Q, ∑, G, q0, z0, A, d)
What does the symbol z0 represents?
a) an element of G
b) initial stack symbol
c) top stack alphabet
d) all of the mentioned
View Answer
Answer: d
Explanation: z0 is the initial stack symbol, is an element of G. Other symbols like d represents the transition function of the machine.



5. Which of the following correctly recognize the symbol '|-' in context to PDA?
a) Moves
b) transition function
c) or/not symbol
d) none of the mentioned
View Answer
Answer: a
Explanation: Using this notation, we can define moves and further acceptance of a string by the machine.

6. Which among the following is true for the given statement?
Statement :If there are strings R and T in a language L so that R is prefix of T and R is not equivalent to T.
a) No DPDA can accept L by empty stack
b) DPDA can accept L by an empty stack
c) L is regular
d) None of the mentioned
View Answer
Answer: a
Explanation: If M is a DPDA accepting L by an empty stsck, R and T are distinct strings in L, and R is a prefix of T, then the sequence of moves M must make in order to accept R leaves the stack empty, since R∈L. But then T cannot be accepted, since M cant move with an empty stack.

7. Which of the following can be accepted by a DPDA?
a) The set of even length palindrome over {a,b}
b) The set of odd length palindrome over {a,b}
c) {$xx^c$| where c stands for the complement,{0,1}}

d) None of the mentioned
View Answer
Answer: d
Explanation: Theorem: The language pal of palindromes over the alphabet {0,1} cannot be accepted by any finite automaton , and it is therefore not regular.

8. For a counter automaton, with the symbols A and Z0, the string on the stack is always in the form of _____
a) A
b) $A^nZ0$, n>=0
c) $Z0A^n$, n>=0
d) None of the mentioned
View Answer
Answer: b
Explanation:The possible change in the stack contents is a change in the number of A's on the stack.

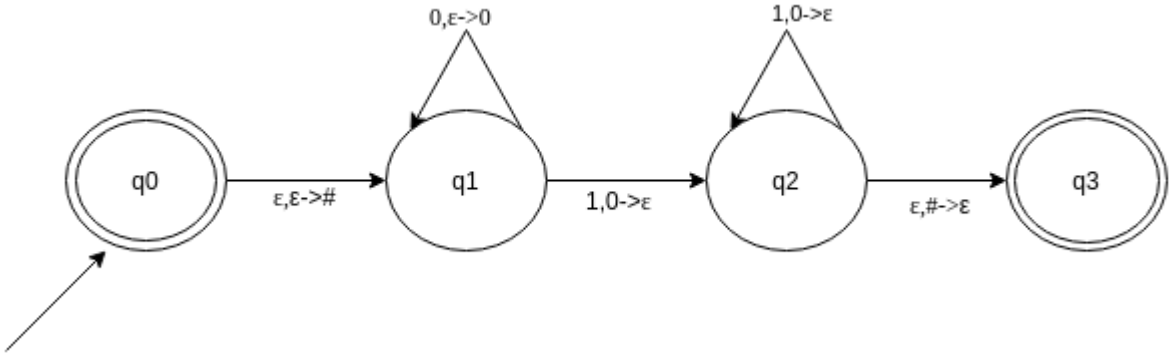
9. State true or false:
Statement: Counter Automaton can exist for the language $L=\{0^i1^i|i>=0\}$
a) true
b) false
View Answer
Answer: a
Explanation: The PDA works as follows. Instead of saving excess 0's or 1's on the stack, we save *'s and use two different states to indicate which symbol there is currently a surplus of. The state q0 is the initial state and the only accepting state.

10. Let ∑={0,1}* and the grammar G be:
S->ε
S->SS
S->0S1|1S0
State which of the following is true for the given
a) Language of all and only Balanced strings
b) It contains equal number of 0's and 1's
c) Ambiguous Grammar
d) All of the mentioned
View Answer
Answer: d

1. The instantaneous PDA is has the following elements
a) State
b) Unconsumed input
c) Stack content
d) All of the mentioned
View Answer
Answer: d
Explanation: The instantaneous description of a PDA is represented by 3 tuple: (q,w,s)
where q is the state, w is the unconsumed input and s is the stack content.

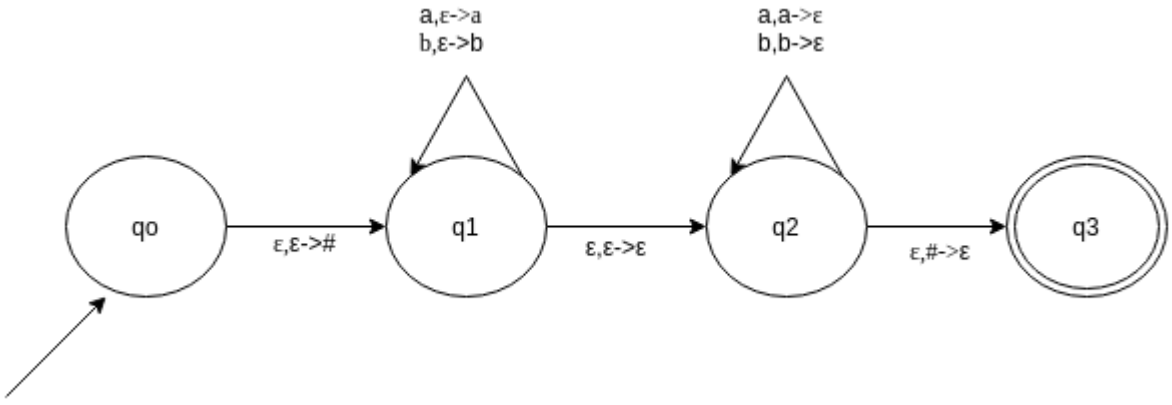
2. The moves in the PDA is technically termed as:
a) Turnstile
b) Shifter
c) Router
d) None of the mentioned
View Answer
Answer: a
Explanation: A turnstile notation is used for connecting pairs od ID's taht represents one or many moves of a PDA.

3. Which of the following option resembles the given PDA?




a) $\{0^n1^n|n>=0\}$
b) $\{0^n1^{2n}|n>=0\}$
c) $\{0^{2n}1^n|n>=0\}$
d) None of the mentioned
View Answer
Answer: a

4. Which of the following correctly resembles the given state diagram?




a) $\{ww^r|w=(a+b)^*\}$
b) ε is called the initial stack symbol
c) Both (a) and (b)
d) None of the mentioned
View Answer
Answer: a
Explanation: Initially we put a special symbol '#' into the empty stack. At state q1, the w is being read. In state q2, each 0 or 1 is popped when it matches the input. If any

other input is given, the PDA will go to a dead state. When we reach that special symbol '#', we go to the accepting state q3.



5. Which of the following assertion is false?
a) If L is a language accepted by PDA1 by final state, there exist a PDA2 that accepts L by empty stack i.e. L=L(PDA1)=L(PDA2)
b) If L is a CFL then there exists a push down automata P accepting CF; ; by empty stack i.e. L=M(P)
c) Let L is a language accepted by PDA1 then there exist a CFG X such that L(X)=M(P)
d) All of the mentioned
View Answer
Answer: d
Explanation:
All the assertions mentioned are theorems or corollary.

6. A push down automata can represented using:
a) Transition graph
b) Transition table
c) ID
d) All of the mentioned
View Answer
Answer: d
Explanation: Yes, a PDA can be represented using a transition diagram, transition table and an instantaneous description.

7. State true or false:
Statement: Every context free grammar can be transformed into an equvalent non deterministic push down automata.
a) true
b) false
View Answer
Answer: a
Explanation: Push down automata is the automaton machine for all the context free grammar or Type 2 languages.

8. Which of the following statement is false?
a) For non deterministic PDA, equivalence is undecidable
b) For deterministic PDA, equivalence is decidable
c) For deterministic PDA, equivalence is undecidable.
d) None of the mentioned
View Answer
Answer: c
Explanation: Geraud proved the equivalence problem decidable for Deterministic PDA .

9. Which of the following are the actions that operates on stack top?
a) Pushing
b) Popping

c) Replacing
d) All of the mentioned
View Answer
Answer: d
Explanation: Push, pop and replace are all the basic and only operations that takes place on stack top.

10. A push down automata is said to be _____ if it has atmost one transition around all configurations.
a) Finite
b) Non regular
c) Non-deterministic
d) Deterministic
View Answer
Answer: d
Explanation: DPDA or Deterministic Push down automata has atmost one transition applicable to each configuration.

1. The transition a Push down automaton makes is additionally dependent upon the:
a) stack
b) input tape
c) terminals
d) none of the mentioned
View Answer
Answer: a
Explanation: A PDA is a finite machine which has an additional stack storage. Its transitions are based not only on input and the correct state but also on the stack.

2. A PDA machine configuration (p, w, y) can be correctly represented as:
a) (current state, unprocessed input, stack content)
b) (unprocessed input, stack content, current state)
c) (current state, stack content, unprocessed input)
d) none of the mentioned
View Answer
Answer: a
Explanation: A machine configuration is an element of K×Σ*×Γ*.
(p,w,γ) = (current state, unprocessed input, stack content).

3. |-* is the _____ closure of |-
a) symmetric and reflexive
b) transitive and reflexive
c) symmetric and transitive
d) none of the mentioned
View Answer
Answer: b
Explanation: A string w is accepted by a PDA if and only if (s,w, e) |-* (f, e, e)

4. With reference of a DPDA, which among the following do we perform from the start state with an empty stack?
a) process the whole string
b) end in final state

c) end with an empty stack
d) all of the mentioned
View Answer
Answer: d
Explanation: The empty stack in the end is our requirement relative to finite state automatons.

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5. A DPDA is a PDA in which:
a) No state p has two outgoing transitions
b) More than one state can have two or more outgoing transitions
c) Atleast one state has more than one transitions
d) None of the mentioned
View Answer
Answer: a
Explanation: A Deterministic Push Down Automata is a Push Down Automata in which no state p has two or more transitions.

6. State true or false:
Statement: For every CFL, G, there exists a PDA M such that L(G) = L(M) and vice versa.
a) true
b) false
View Answer
Answer: a
Explanation: There exists two lemma's such that:
a) Given a grammar G, construct the PDA and show the equivalence
b) Given a PDA, construct a grammar and show the equivalence

7. If the PDA does not stop on an accepting state and the stack is not empty, the string is:
a) rejected
b) goes into loop forever
c) both (a) and (b)
d) none of the mentioned
View Answer
Answer: a
Explanation: To accept a string, PDA needs to halt at an accepting state and with a stack empty, else it is called rejected. Given a PDA M, we can construct a PDA M' that accepts the same language as M, by both acceptance criteria.

8. A language accepted by Deterministic Push down automata is closed under which of the following?
a) Complement
b) Union
c) Both (a) and (b)
d) None of the mentioned
View Answer
Answer: a
Explanation: Deterministic Context free languages(one accepted by PDA by final

state), are drastically different from the context free languages. For example they are closed under complementation and not union.

9. Which of the following is a simulator for non deterministic automata?
a) JFLAP
b) Gedit
c) FAUTO
d) None of the mentioned
View Answer
Answer: a
Explanation: JFLAP is a software for experimenting with formal topics including NFA, NPDA, multi-tape turing machines and L-systems.

10. Finite-state acceptors for the nested words can be:
a) nested word automata
b) push down automata
c) ndfa
d) none of the mentioned
View Answer
Answer: a
Explanation: The linear encodings of languages accepted by finite nested word automata gives the class of ‘visibly pushdown automata’

1. Which of the following is analogous to the following?
:NFA and NPDA
a) Regular language and Context Free language
b) Regular language and Context Sensitive language
c) Context free language and Context Sensitive language
d) None of the mentioned
View Answer
Answer: a
Explanation: All regular languages can be accepted by a non deterministic finite automata and all context free languages can be accepted by a non deterministic push down automata.

2. Let T={p, q, r, s, t}. The number of strings in S* of length 4 such that no symbols can be repeated.
a) 120
b) 625
c) 360
d) 36
View Answer
Answer: b
Explanation: Using the permutation rule, we can calculate that there will be total of 625 permutations on 5 elements taking 4 as the length.

3. Which of the following relates to Chomsky hierarchy?
a) Regular<CFL<CSL<Unrestricted
b) CFL<CSL<Unrestricted<Regular
c) CSL<Unrestricted<CF<Regular

d) None of the mentioned
View Answer
Answer: a
Explanation: The chomsky hierarchy lays down the following order:
Regular<CFL<CSL<Unrestricted

4. A language is accepted by a push down automata if it is:
a) regular
b) context free
c) both (a) and (b)
d) none of the mentioned
View Answer
Answer: c
Explanation: All the regular languages are the subset to context free languages and thus can be accepted using push down automata.



5. Which of the following is an incorrect regular expression identity?
a) R+f=R
b) eR=e
c) Rf=f
d) None of the mentioned
View Answer
Answer: b
Explanation: e is the identity for concatenation. Thus, eR=R.

6. Which of the following strings do not belong the given regular expression?
(a)*(a+cba)
a) aa
b) aaa
c) acba
d) acbacba
View Answer
Answer: d
Explanation: The string acbacba is unacceptable by the regular expression (a)*(a+cba).

7. Which of the following regular expression allows strings on {a,b}* with length n where n is a multiple of 4.
a) (a+b+ab+ba+aa+bb+aba+bab+abab+baba)*
b) (bbbb+aaaa)*
c) ((a+b)(a+b)(a+b)(a+b))*
d) None of the mentioned
View Answer
Answer: c
Explanation: Other mentioned options do not many of the combinations while option c seems most reliable.

8. Which of the following strings is not generated by the given grammar:
S->SaSbS|e

a) aabb
b) abab
c) abaabb
d) None of the mentioned
View Answer
Answer: d
Explanation: All the given options are generated by the given grammar. Using the methods of left and right derivations, it is simpler to look for string which a grammar can generate.

9. abb*c denotes which of the following?
a) {abnc|n=0}
b) {abnc|n=1}
c) {anbc|n=0}
d) {abcn|n>0}
View Answer
Answer: b
Explanation: Here, the first mentioned b is fixed while the other can be zero or can be repeated any number of time.

10. The following denotion belongs to which type of language:
G=(V, T, P, S)
a) Regular grammar
b) Context free grammar
c) Context Sensitive grammar
d) All of the mentioned
View Answer
Answer: b
Explanation: Ant formal grammar is represented using a 4-tuple definition where V= finite set of variables, T= set of terminal characters, P=set of productions and S= Starting Variable with certain conditions based on the type of formal grammar.

1. Context free grammar is called Type 2 grammar because of _____ hierarchy.
a) Greibach
b) Backus
c) Chomsky
d) None of the mentioned
View Answer
Answer: c
Explanation: Chomsky hierarchy decide four type of language :Type 3- Regular Language, Type 2-Context free language, Type 1-Context Sensitive Language, Type 0- Unrestricted or Recursively Ennumerable language.

2. a→b
Restriction: Length of b must be atleast as much length of a.
Which of the following is correct for the given assertion?
a) Greibach Normal form
b) Context Sensitive Language
c) Chomsky Normal form

d) Recursively Ennumerable language
View Answer
Answer: b
Explanation: A context-sensitive grammar (CSG) is a formal grammar in which the left-hand sides and right-hand sides of any production rules may be surrounded by a context of terminal and non terminal symbols. Context-sensitive grammars are more general than context-free grammars, in the sense that there are some languages that cannot be described by context-free grammars, but can be described by CSG.

3. From the definition of context free grammars,
G=(V, T, P, S)
What is the solution of VÇT?
a) Null
b) Not Null
c) Cannot be determined, depends on the language
d) None of the mentioned
View Answer
Answer: a
Explanation: V is the set of non terminal symbols while T is the st of terminal symbols, their intersection would always be null.

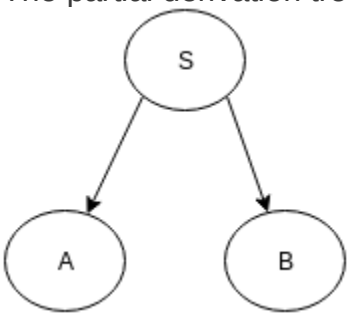
4. If P is the production, for the given statement, state true or false.
P: V->(V∑T)* represents that the left hand side production rule has no right or left context.
a) true
b) false
View Answer
Answer: a
Explanation: Here the production P is from the definition of Context free grammar and thus, has no right or left context.

5. There exists a Context free grammar such that:
X->aX
Which among the following is correct with respect to the given assertion?
a) Left Recursive Grammar
b) Right Recursive Grammar
c) Non Recursive Grammar
d) None of the mentioned
View Answer
Answer: b
Explanation: The grammar with right recursive production is known as Right recursive grammar. Right recursive production is of the form X->aX where a is a terminal and X is a non terminal.



6. If the partial derivation tree contains the root as the starting variable, the form is known as:
a) Chomsky hierarchy
b) Sentential form
c) Root form

d) None of the mentioned
View Answer
Answer: b
Explanation: Example: For any grammar, productions be:
S->AB
A->aaA| ^
B->Bb| ^
The partial derivation tree can be drawn as:




Since it has the root as S, this can be said to be in sentential form.

7. Find a regular expression for a grammar which generates a language which states :
L contains a set of strings starting wth an a and ending with a b, with something in the middle.
a) a(a*Ub*)b
b) a*(aUb)b*
c) a(a*b*)b
d) None of the mentioned
View Answer
Answer: a
Explanation: The grammar for the same language can be stated as :
(1) S → aMb
(2) M → A
(3) M → B
(4) A → e
(5) A → aA
(6) B → e
(7) B → bB

8. Which of the following is the correct representation of grammar for the given regular expression?
a(aUb)*b

a) (1) S → aMb
(2) M → e
(3) M → aM
(4) M → bM

b) (1) S → aMb
(2) M → Mab

(3) M → aM
(4) M → bM

c) (1) S → aMb
(2) M → e
(3) M → aMb
(4) M → bMa

d) None of the mentioned
View Answer
Answer: a
Explanation:
The basic idea of grammar formalisms is to capture the structure of string by
a) using special symbols to stand for substrings of a particular structure
b) using rules to specify how the substrings are combined to form new substrings.

9. A CFG consist of the following elements:
a) a set of terminal symbols
b) a set of non terminal symbols
c) a set of productions
d) all of the mentioned
View Answer
Answer: d
Explanation: A CFG consists of:
a) a set of terminals, which are characters of alphabets that appear in the string generated by the grammar.
b) a set of non terminals, which are placeholders for patterns of terminal symbols that can be generated by the nonterminal symbols.
c) a set of productions, which are set of rules to transit from one state to other forming up the string
d) a start symbol, a special non terminal symbol that appears in the initial string generated in the grammar.

10. A CFG for a program describing strings of letters with the word “main” somewhere in the string:
a) -> m a i n
-> | epsilon
-> A | B | … | Z | a | b … | z

b) –> m a i n
–>
–> A | B | … | Z | a | b … | z

c) –> m a i n
–> | epsilon
–> A | B | … | Z | a | b … | z

d) None of the mentioned
View Answer

Answer: a
Explanation: None.

1. CFGs are more powerful than:
a) DFA
b) NDFA
c) Mealy Machine
d) All of the mentioned
View Answer
Answer: d
Explanation:
Context-free grammars are strictly more powerful than regular expressions:
1) Any language that can be generated using regular expressions can be generated by a context-free grammar.
2) There are languages that can be generated by a context-free grammar that cannot be generated by any regular expression.
As a corollary, CFGs are strictly more powerful than DFAs and NDFAs.

2. State true or false:
S-> 0S1|01
Statement: No regular expression exists for the given grammar.
a) true
b) false
View Answer
Answer: a
Explanation: The grammar generates a language L such that L={$0^n1^n$|n>=1} which is not regular. Thus, no regular expression exists for the same.

3. For the given set of code, the grammar representing real numbers in Pascal has error in one of the six lines. Fetch the error.
(1) ->
(2) -> | epsilon
(3) -> | epsilon
(4) -> ‘E’ | epsilon
(5) -> + | – | epsilon
(6) -> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9
a) 3
b) 4
c) 2
d) No errors
View Answer
Answer: a
Explanation:
–>
–> | epsilon
–> ‘.’ | epsilon
–> ‘E’ | epsilon
–> + | – | epsilon
–> 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

4. Which among the following is incorrect with reference to a derivation tree?
a) Every vertex has a label which is a terminal or a variable.
b) The root has a label which can be a terminal.
c) The label of the internal vertex is a variable.
d) None of the mentioned
View Answer
Answer: b
Explanation: The root or interms of the grammar, starting variable can not be a terminal.



5. Let G=(V, T, P, S)
where a production can be written as:
S->aAS|a
A->SbA|ba|SS
Which of the following string is produced by the grammar?
a) aabbaab
b) aabbaa
c) baabab
d) None of the mentioned
View Answer
Answer: b
Explanation: The step wise grammar translation can be written as:
aAS->aSbaA->aabAS->aabbaa

6. Statement 1: Ambiguity is the property of grammar but not the language.
Statement 2: Same language can have more than one grammar.
Which of the following options are correct with respect to the given statements?
a) Statement 1 is true but statement 2 is false
b) Statement 1 is false but statement 2 is true
c) Both the statements are true
d) Both the statements are false
View Answer
Answer: c
Explanation: One language can more than one grammar. Some can be ambiguous and some cannot.

7. Which of the following are non essential while simplifying a grammar?
a) Removal of useless symbols
b) Removal of unit productions
c) Removal of null production
d) None of the mentioned
View Answer
Answer: d
Explanation: Here are some process used to simplify a CFG but to produce an equivalent grammar:
a) Removal of useless symbols(non terminal) b) Removal of Unit productions and c) Removal of Null productions.

8. Which of the following are context free language?
a) $L=\{a^ib^i|i>=0\}$
b) $L=\{ww^r|$ w is a string and r represents reverse$\}$
c) Both (a) and (b)
d) one of the mentioned
View Answer
Answer: a
Explanation: None.

9. The language $L =\{a^i2b^i|i>=0\}$ is:
a) recursive
b) deterministic CFL
c) regular
d) Two of the mentioned is correct
View Answer
Answer: d
Explanation: The language is recursive and every recursive language is a CFL.

10. L->rLt|tLr|t|r
The given grammar produces a language which is:
a) All palindrome
b) All even palindromes
c) All odd palindromes
d) Strings with same begin and end symbols
View Answer
Answer: c
Explanation: As there exists no production for the palindrome set, even palindromes like abba, aabbaa, baaaaaab, etc will not be generated.

1. A turing machine is a
a) real machine
b) abstract machine
c) hypothetical machine
d) more than one option is correct
View Answer
Answer: d
Explanation: A turing machine is abstract or hypothetical machine thought by mathematician Alan Turing in 1936 capable of simulating any algorithm, however complicated it is.

2. A turing machine operates over:
a) finite memory tape
b) infinite memory tape
c) depends on the algorithm
d) none of the mentioned
View Answer
Answer: b
Explanation: The turing machine operates on an infinite memory tape divided into cells. The machine positions its head over the cell and reads the symbol.

3. Which of the functions are not performed by the turing machine after reading a symbol?
a) writes the symbol
b) moves the tape one cell left/right
c) proceeds with next instruction or halts
d) none of the mentioned
View Answer
Answer: d
Explanation: After the read head reads the symbol from the input tape, it performs the following functions:
a) writes a symbol(some model allow symbol erasure/no writing)
b) moves the tape left or right (some models allows no motion)
c) proceeds with subsequent instruction or goes either into accepting halting state or rejecting halting state.

4. ‘a’ in a-machine is :
a) Alan
b) arbitrary
c) automatic
d) None of the mentioned
View Answer
Answer: c
Explanation: The turing machine was invented by Alan turing in 1936. He named it as a-machine(automatic machine).



5. Which of the problems were not answered when the turing machine was invented?
a) Does a machine exists that can determine whether any arbitrary machine on its tape is circular.
b) Does a machine exists that can determine whether any arbitrary machine on its tape is ever prints a symbol
c) Hilbert Entscheidungs problem
d) None of the mentioned
View Answer
Answer: d
Explanation: Invention of turing machine answered a lot of questions which included problems like decision problem, etc.) . Alan was able to prove the properties of computation using such model.

6. The ability for a system of instructions to simulate a Turing Machine is called _____
a) Turing Completeness
b) Simulation
c) Turing Halting
d) None of the mentioned
View Answer
Answer: a
Explanation: Turing Completeness the ability for a system of instructions to simulate a Turing machine. A programming language that is Turing complete is theoretically

capable of expressing all tasks accomplishable by computers; nearly all programming languages are Turing complete.

7. Turing machine can be represented using the following tools:
a) Transition graph
b) Transition table
c) Queue and Input tape
d) All of the mentioned
View Answer
Answer: d
Explanation: We can represent a turing machine, graphically, tabularly and diagramatically.

8. Which of the following is false for an abstract machine?
a) Turing machine
b) theoretical model of computer
c) assumes a discrete time paradigm
d) all of the mentioned
View Answer
Answer: d
Explanation: A n abstract machine also known as abstract computer, is a theoretical model of computer or hardware system in automata theory. Abstraction in computing process usually assumes a discrete time paradigm.

9. Fill in the blank with the most appropriate option.
Statement: In theory of computation, abstract machines are often used in _____ regarding computability or to analyze the complexity of an algorithm.
a) thought experiments
b) principle
c) hypothesis
d) all of the mentioned
View Answer
Answer: d
Explanation: A thought experiment considers some hypothesis, theory or principle for the purpose of thinking through its consequences.

10. State true or false:
Statement: RAM model allows random access to indexed memory locations.
a) true
b) false
View Answer
Answer: a
Explanation: In computer science, Random access machine is an abstract machine in the general class of register machines. Random access machine should not be confused with Random access memory.

1. A turing machine that is able to simulate other turing machines:
a) Nested Turing machines
b) Universal Turing machine
c) Counter machine

d) None of the mentioned
View Answer
Answer: b
Explanation: A more mathematically oriented definition with the same universal nature was introduced by church and turing together called the Church-Turing thesis(formal theory of computation).

2. Which of the problems are unsolvable?
a) Halting problem
b) Boolean Satisfiability problem
c) Both (a) and (b)
d) None of the mentioned
View Answer
Answer: c
Explanation: Alan turing proved in 1936 that a general algorithm to solve the halting problem for all possible program-input pairs cannot exist.

3. Which of the following a turing machine does not consist of?
a) input tape
b) head
c) state register
d) none of the mentioned
View Answer
Answer: d
Explanation: A state register is one which stores the state of the turing machine, one of the finitely many. Among these is the special start state with which the state register is initialized.

4. The value of n if turing machine is defined using n-tuples:
a) 6
b) 7
c) 8
d) 5
View Answer
Answer: b
Explanation:
The 7-tuple definition of turing machine: (Q, S, G, d, q0, B, F)
where Q= The finite set of states of finite control
S= The finite set of input symbols
G= The complete set of tape symbols
d= The transition function
q0= The start state, a member of Q, in which the finite control is found initially.
B= The blank symbol
F= The set of final or accepting states, a subset of Q.

5. If d is not defined on the current state and the current tape symbol, then the machine _____
a) does not halts
b) halts
c) goes into loop forever

d) none of the mentioned
View Answer
Answer: b
Explanation: If we reach $h_A$ or $h_R$, we say TM halts. Once it has halted, it cannot move further, since d is not defined at any pair ($h_A$,X) or ($h_R$,X) where $h_A$ = accept halting state and $h_R$ = reject halting state.



6. Statement: Instantaneous descriptions can be designed for a Turing machine. State true or false:
a) true
b) false
View Answer
Answer: a
Explanation: Inorder to describe formally what a Turing machine does, we need to develop a notation for configurations or Instantaneous descriptions(ID).

7. Which of the following are the models equivalent to Turing machine?
a) Multi tape turing machine
b) Multi track turing machine
c) Register machine
d) All of the mentioned
View Answer
Answer: d
Explanation: Many machines that might be thought to have more computational capability than a simple UTM can be shown to have no more power. They might compute faster or use less memory but cannot compute more powerfully i.e. more mathematical questions.

8. Which among the following is incorrect for o-machines?
a) Oracle Turing machines
b) Can be used to study decision problems
c) Visualizes Turing machine with a black box which is able to decide cerain decion problems in one operation
d) None of the mentioned
View Answer
Answer: d
Explanation: In automata theory, an o- machine or oracle machine is a abstract machine used to study decision problems. The problem the oracle solves can be of any complexity class. Even undecidable problems like halting problems can be used.

9. RASP stands for:
a) Random access storage program
b) Random access stored program
c) Randomly accessed stored program
d) Random access storage programming
View Answer
Answer: b
Explanation: RASP or Random access stored program is an abstract machine that has instances like modern stored computers.

10. Which of the following is not true about RASP?
a) Binary search can be performed more quickly using RASP than a turing machine
b) Stores its program in memory external to its state machines instructions
c) Has infinite number of distinguishable, unbounded registers
d) Binary search can be performed less quickly using RASP than a turing machine
e) More than two options are incorrect
View Answer
Answer: d
Explanation: In theoretical computer science, the random access stored program( RASP ) machine model is an abstract machine used for the purpose of algorithm development and algorithm complexity theory.

11. State true or false:
Statement: RASP is to RAM like UTM is to turing machine.
a) true
b) false
View Answer
Answer: a
Explanation: The Rasp is a random access machine model that, unlike the RAM has its program in its registers together with its input. The registers are unbounded(infinite in capacity); whether the number of registers is finite is model-specific.

1. The class of recursively ennumerable language is known as:
a) Turing Class
b) Recursive Languages
c) Universal Languages
d) RE
View Answer
Answer: d
Explanation: RE or recursively ennumerable is only called the class of recursively ennumerable language.

2. A language L is said to be Turing decidable if:
a) recursive
b) TM recognizes L
c) TM accepts L
d) None of the mentioned
View Answer
Answer: a,b
Explanation: A language L is recursively ennumerable if there is a turing machine that accepts L, and recursive if there is a TM that recognizes L.(Sometimes these languages are alse called Turing-acceptable and Turing-decidable respectively).

3. Which of the following statements are false?
a) Every recursive language is recursively ennumerable
b) Recursively ennumerable language may not be recursive
c) Recursive languages may not be recursively ennumerable
d) None of the mentioned
View Answer

Answer: c
Explanation: Every recursive language is recursively ennumerable but there exists recursively ennumerable languages that are not recursive. If L is accepted by a Non deterministic TM T, and every possible sequence of moves of T causes it to halt, then L is recursive.

4. Choose the correct option:
Statement: If L1 and L2 are recursively ennumerable languages over S, then the following is/are recursively ennumerable.
a) L1 U L2
b) L2 ∩ L2
c) Both (a) and (b)
d) None of the mentioned
View Answer
Answer: c
Explanation: Both the union and intersection operations preserve the property of recursive ennumerablity(Theorem).

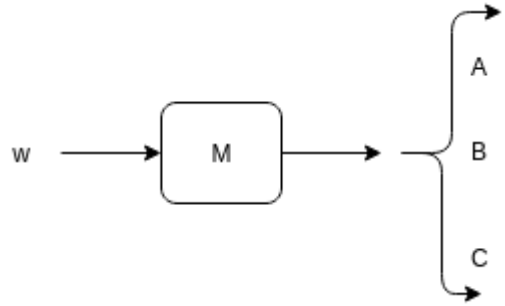


5. If L is a recursive language, L' is:
a) Recursive
b) Recursively Ennumerable
c) Both (a) and (b)
d) None of the mentioned
View Answer
Answer: c
Explanation: If T is a turing machine recognizing L, we can make it recognize L' by interchanging the two outputs. And every recursive language is recursively ennumerable.

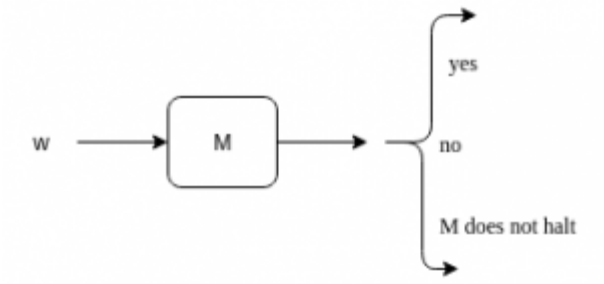
6. Choose the appropriate option:
Statement: If a language L is recursive, it is closed under the following operations:
a) Union
b) Intersection
c) Complement
d) All of the mentioned
View Answer
Answer: d
Explanation: The closure property of recursive languages include union, intersection and complement operations.

7. A recursively ennumerable language L can be recursive if:
a) L' is recursively ennumerable
b) Every possible sequence of moves of T, the TM which accept L, causes it to halt
c) Both (a) and (b)
d) None of the mentioned
View Answer
Answer: c
Explanation: Theorem- If L is a recursively ennumerable language whose complement is recursively ennumerable, then L is recursive.

8. A language L is recursively ennumerable if L=L(M) for some turing machine M.



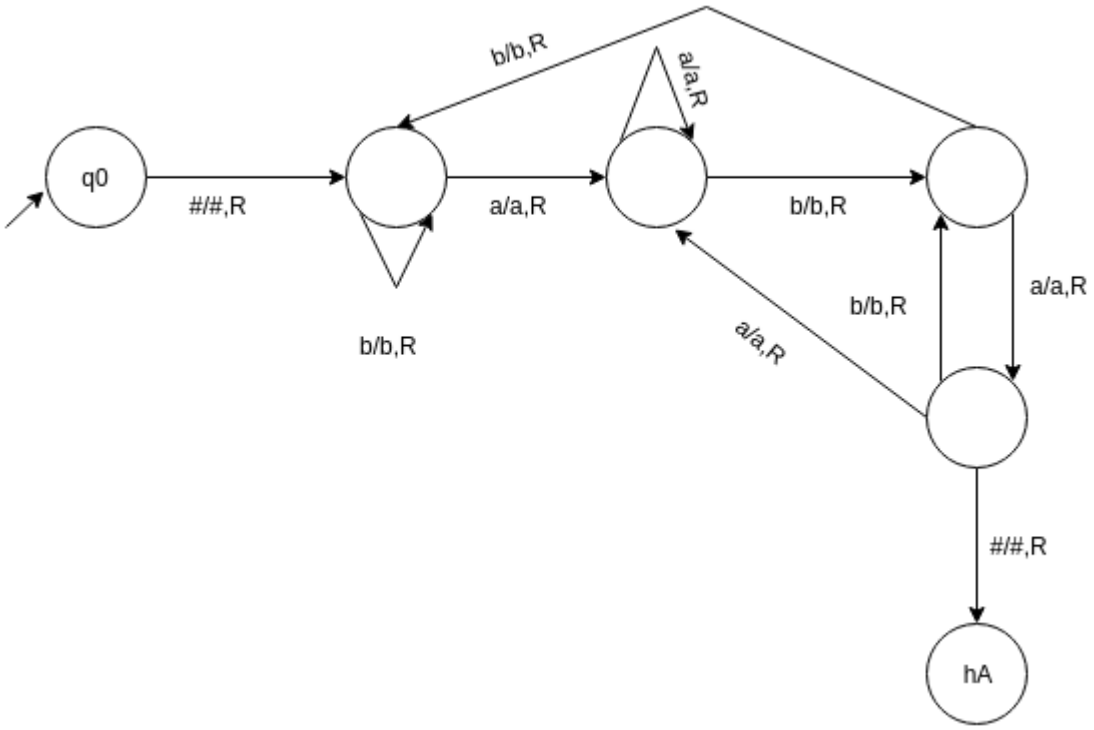

Which among the following cannot be among A, B and C?
a) yes w ∈ L
b) no w ∉ L
c) M does not halt w ∉ L
d) None of the mentioned
View Answer
Answer: d
Explanation:




9. State true or false:
Statement: An ennumerator is a turing machine mwith extra output tape T, where symbols, once written, are never changed.
a) true
b) false
View Answer
Answer: a
Explanation: To ennumerate a set means to list the elements once at a time, and to say that a set is ennumerable should perhaps mean that there exists an algorithm for ennumerating it.

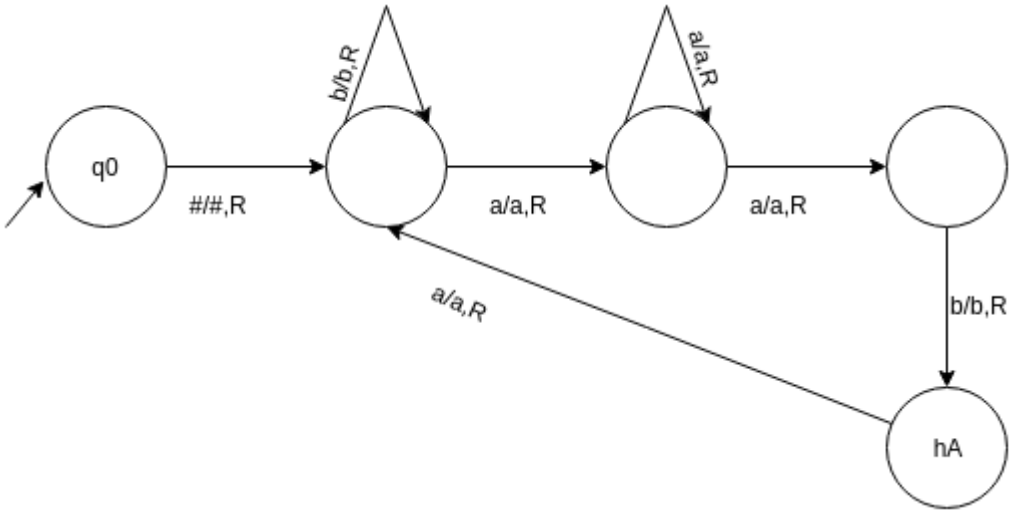
10. A Language L may not be accepted by a Turing Machine if:
a) It it is recursively ennumerable
b) It is recursive
c) L can be ennumerated by some turing machine
d) None of the mentioned
View Answer
Answer: b
Explanation: A language L is recursively ennumerable if and only if it can be ennumerated by some turing machine. A recursive ennumerable language may or may not be recursive.

1. Which of the following regular expression resembles the given diagram?

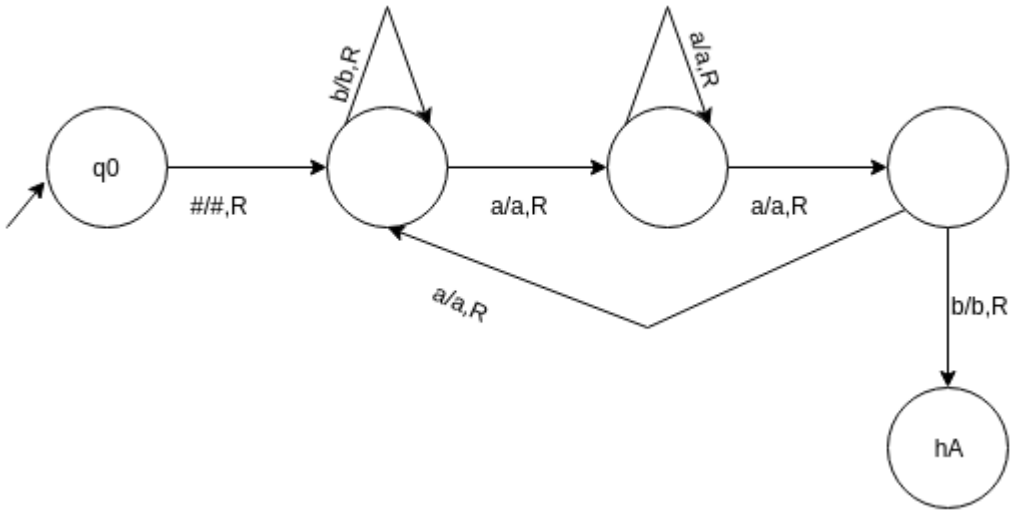



a) {a}*{b}*{a,b}
b) {a,b}*{aba}
c) {a,b}*{bab}
d) {a,b}*{a}*{b}*
View Answer
Answer: b
Explanation: The given diagram is a transition graph for a turing machine which accepts the language with the regular expression {a,b}*{aba}.

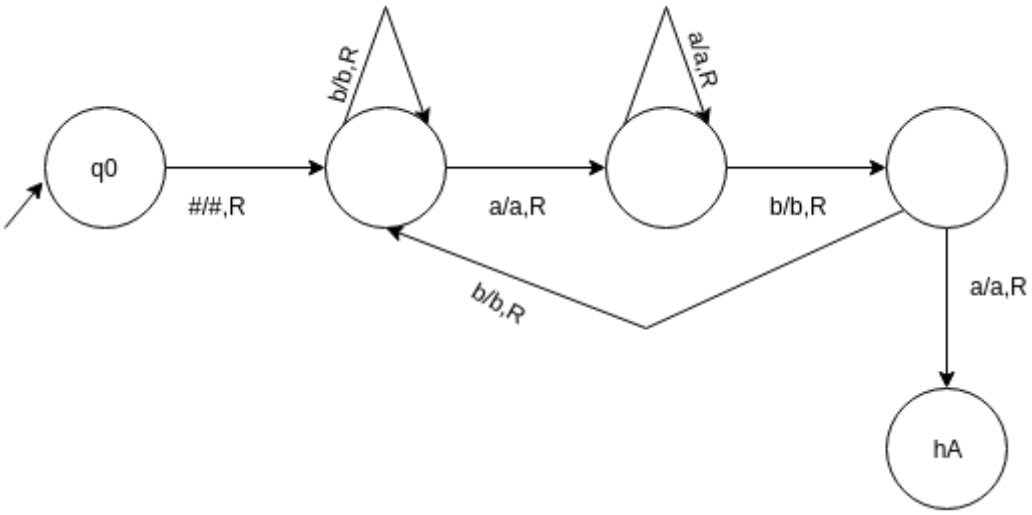
2. Construct a turing machine which accepts a string with ‘aba’ as its substring.



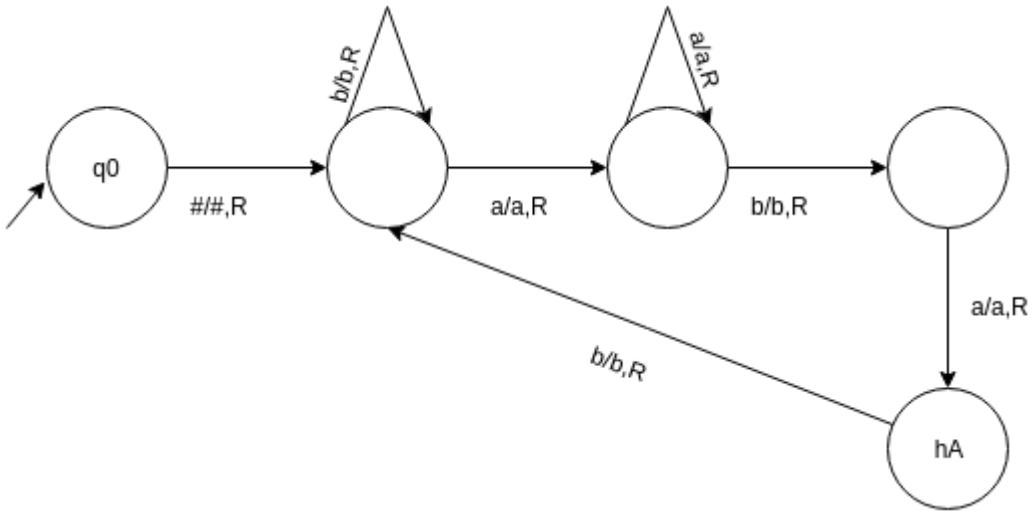

a)




b)




c)



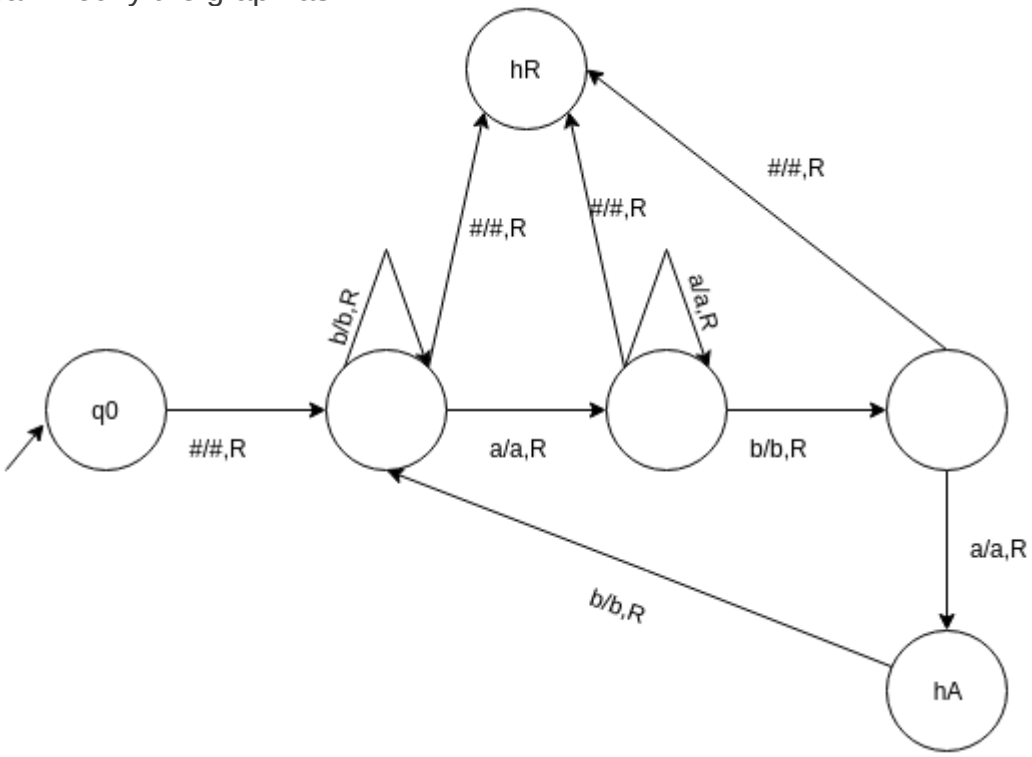

d)

View Answer

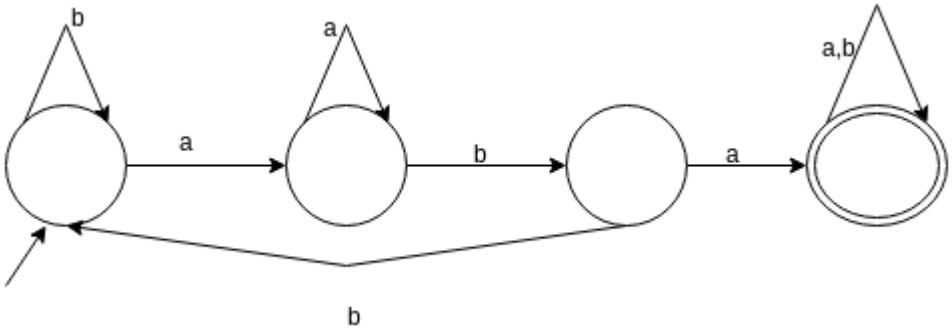
Answer: c

Explanation: The language consist of strings with a substring ‘aba’ as fixed at its end and the left part can be anything including epsilon. Thus the turing machine uses five states to express the language excluding the rejection halting state which if allowed

can modify the graph as:




3. The number of states required to automate the last question i.e. {a,b}*{aba}{a,b}* using finite automata:
a) 4
b) 3
c) 5
d) 6
View Answer
Answer: a
Explanation: The finite automata can be represented as:




4. The machine accept the string by entering into hA or it can:
a) explicitly reject x by entering into hR
b) enter into an infinte loop
c) Both (a) and (b)
d) None of the mentioned
View Answer
Answer: c
Explanation: Three things can occur when a string is tested over a turing machine:
a) enter into accept halting state

b) enter into reject halting state
c) goes into loop forever

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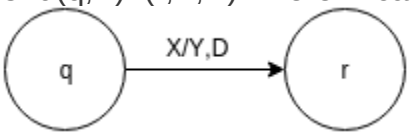
5. d(q,X)=(r,Y,D) where D cannot be:



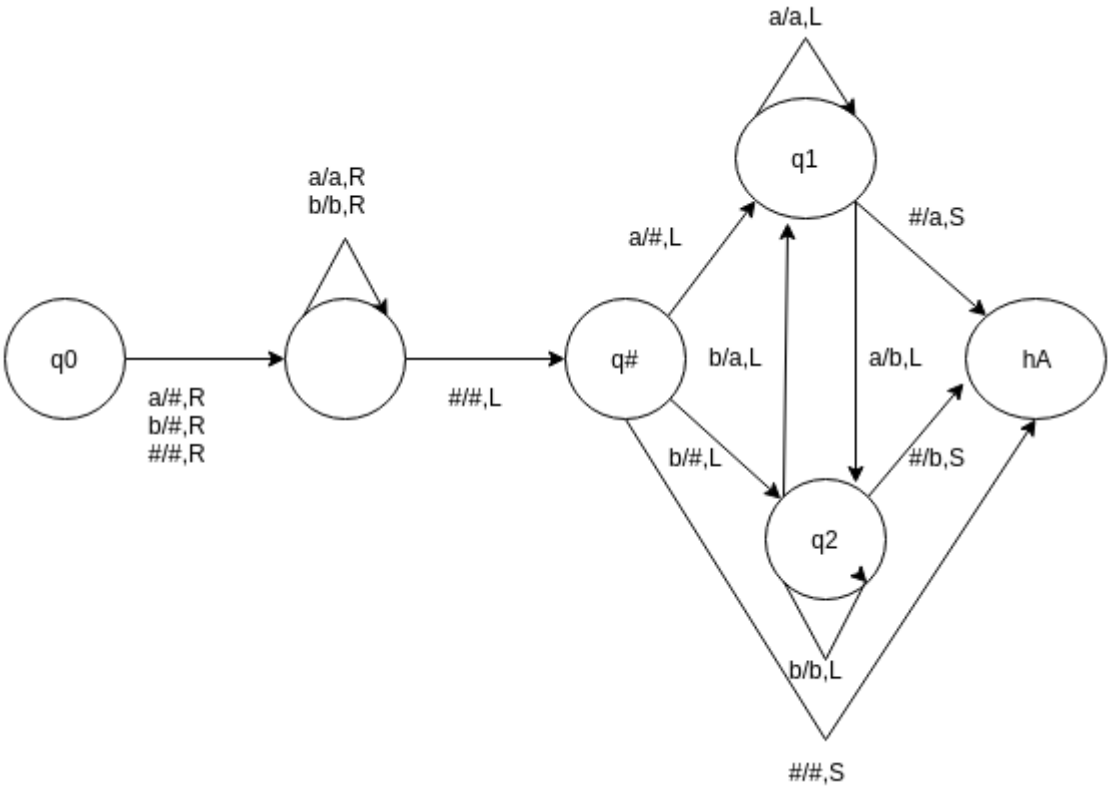

a) L
b) R
c) S
d) None of the mentioned
View Answer
Answer: c
Explanation: D represents the direction in which automata moves forward as per the queue which surely cannot be a starting variable.

6. Which of the following can accept even palindrome over {a,b}
a) Push down Automata
b) Turing machine
c) NDFA
d) All of the mentioned
View Answer
Answer: c
Explanation: A language generating strings which are palindrome is not regular, thus cannot b represented using a finite automaton.

7. Which of the functions can a turing machine not perform?
a) Copying a string
b) Deleting a symbol
c) Accepting a pal
d) Inserting a symbol
View Answer
Answer: d
Explanation: Different turing machines exist for operations like copying a string, deleting a symbol, inserting a symbol and accepting palindromes.

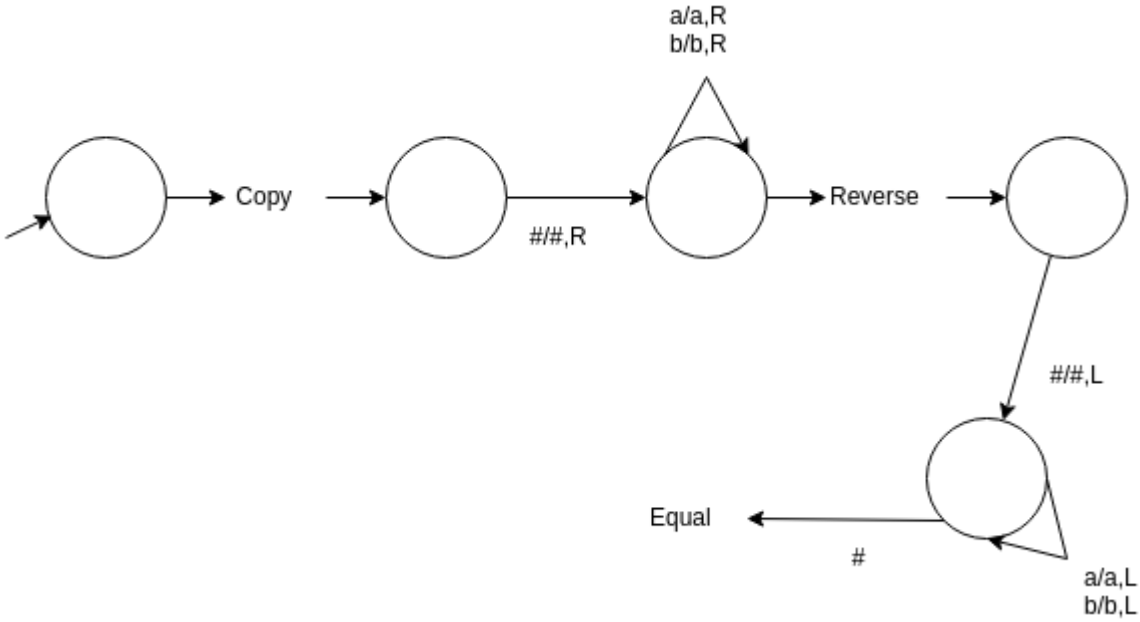
8. If T1 and T2 are two turing machines. The composite can be represented using the expression:
a) T1T2
b) T1 U T2
c) T1 X T2
d) None of the mentioned
View Answer
Answer: a
Explanation: If T1 and T2 are TMs, with disjoint sets of non halting states and transition function d1 and d2, respectively, we write T1T2 to denote this composite TM.

9. The following turing machine acts like:




a) Copies a string
b) Delete a symbol
c) Insert a symbol
d) None of the mentioned
View Answer
Answer: b
Explanation: A turing machine does the deletion by changing the tape contents from yaz to yz, where y belongs to (S U {#})*.

10. What does the following transition graph shows:

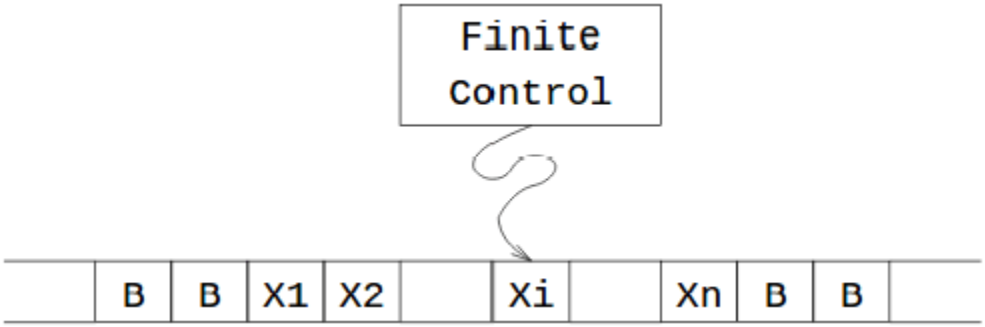


a) Copies a symbol
b) Reverses a string
c) Accepts a pal
d) None of the mentioned
View Answer
Answer: c
Explanation: The composite TM accepts the language of palindromes over {a, b} by comparing the input string to its reverse and accepting if and only if the two are equal.

1. A turing machine has _____ number of states in a CPU.
a) finite
b) infinte
c) May be finite
d) None of the mentioned
View Answer
Answer: a
Explanation: A turing machine has finite number of states in its CPU. However the states are not small in number. Real computer consist of registers which can store values (fixed number of bits).

2. Suppose we have a simple computer with control unit holding a PC with a 32 bit address + Arithmetic unit holding one double length 64 bit Arithmetic Register. The number of states the finite machine will hold:
a) $2^{(32*64)}$
b) $2^{96}$
c) 96
d) 32
View Answer
Answer: b
Explanation: According to the statistics of the question, we will have a finite machine with 2^96 states.

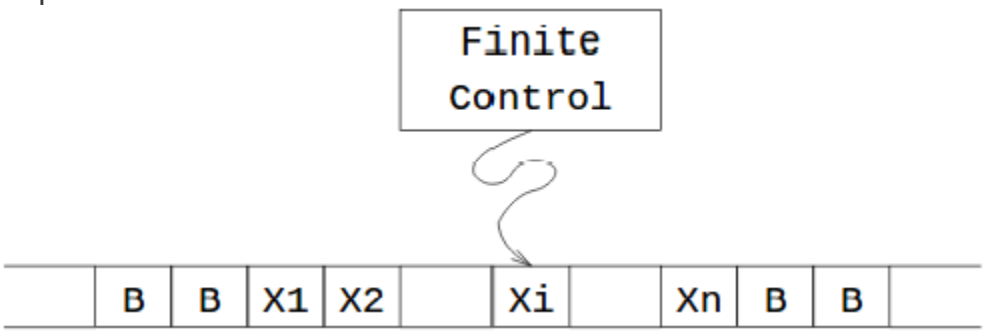
3. In one move a turing machine will:




a) Change a state
b) Write a tape symbol in the cell scanned
c) Move the tape head left or right
d) All of the mentioned
View Answer

Answer: d
Explanation: A move of a turing machine is the function of the state of finite control and the tape symbol just scanned.

4. State true or false:
Statement: We can use the finite control of turing machine to hold a finite amount of data.
a) true
b) false
View Answer
Answer: a
Explanation:




The finite control not only contains state q but also three data, A, B, C. The following technique requires no extension to the Turing Machine model. Shaping states this way allows to describe transitions in more systematic way and often to simplify the strategy of the program.



5. Statement 1: Multitrack Turing machine.
Statement 2: Gamma is Cartesian product of a finite number of finite sets.
Which among the following is the correct option?
a) Statement 1 is the assertion and Statement 2 is the reason
b) Statement 1 is the reason and Statement 2 is the assertion
c) Statement 1 and Statement 2 are independent from each other
d) None of the mentioned
View Answer
Answer: a
Explanation: Cartesian product works like a struct in C/C++. For Example: Computer tape storage is something like 8 or 9 bits in each cell. One can recognize a multi track tape machine by looking at the transitions because each will have tuples as the read and write symbols.

6. A multi track turing machine can described as a 6-tuple (Q, X, S, d, q0, F) where X represents:
a) input alphabet
b) tape alphabet
c) shift symbols
d) none of the mentioned
View Answer
Answer: b
Explanation: The 6-tuple (Q, X, S, d, q0, F) can be explained as:

Q represents finite set of states,
X represents the tape alphabet,
S represents the input alphabet
d represents the relation on states and the symbols
q0 represents the initial state
F represents the set of final states.

7. Which of the following statements are false?
a) A multi track turing machine is a special kind of multi tape turing machine
b) 4-heads move independently along 4-tracks in standard 4-tape turing machine
c) In a n-track turing machine, n head reads and writes on all the tracks simultaneously.
d) All of the mentioned
View Answer
Answer: c
Explanation: In a n-track turing machine, one head reads and writes on all the tracks simultaneously.

8. State true or false:
Statement: Two track turing machine is equivalent to a standard turing machine.
a) true
b) false
View Answer
Answer: a
Explanation: This can be generalized for n- tracks and can be proved equivalent using ennumerable languages.

9. Which of the following is/are not true for recursively ennumerable language?
a) partially decidable
b) Turing acceptable
c) Turing Recognizable
d) None of the mentioned
View Answer
Answer: d
Explanation: In automata theory, a formal language is called recursively ennumerable language or partially decidable or semi decidable or turing acceptable or turing recognizable if there exists a turing machine which will ennumerate all valid strings of the language.

10. According to Chomsky hierarchy, which of the following is adopted by Recursively Ennumerable language?
a) Type 0
b) Type 1
c) Type 2
d) Type 3
View Answer
Answer: a
Explanation: Recursively Ennumerable languages are type 0 languages in the Chomsky hierarchy. All regular, context free, context sensitive languages are recursivelyennumerable language.

1. A turing machine with several tapes in known as:
a) Multi-tape turing machine
b) Poly-tape turing maching
c) Universal turing machine
d) All of the mentioned
View Answer
Answer: a
Explanation: A multitape turing machine is an ordinary turing machine with multiple tapes. Each tape has its own head to control the read and write.

2. A multitape turing machine is _____ powerful than a single tape turing machine.
a) more
b) less
c) equal
d) none of the mentioned
View Answer
Answer: a
Explanation: The multitape turing machine model seems much powerful than the single tape model, but any multi tape machine, no matter how many tapes, can be simulated by single taped TM.

3. In what ratio, more computation time is needed to simulate multitape turing machines using single tape turing machines?
a) doubly
b) triple
c) quadratically
d) none of the mentioned
View Answer
Answer: c
Explanation: Thus, multitape turing machines cannot calculate any more functions than single tape machines.

4. Which of the following is true for two stack turing machines?
a) one read only input
b) two storage tapes
c) Both (a) and (b)
d) None of the mentioned
View Answer
Answer: c
Explanation: Two-stack Turing machines have a read-only input and two storage tapes. If a head moves left on either tape a blank is printed on that tape, but one symbol from a “library” can be printed.



5. Which of the following is not a Non deterministic turing machine?
a) Alternating Turing machine
b) Probabalistic Turing machine
c) Read-only turing machine

d) None of the mentioned
View Answer
Answer: c
Explanation: A read only turing machine or 2 way deterministic finite automaton is a class of model of computability that behaves like a turing machine, and can move in both directions across input, except cannot write to its input tape.

6. Which of the turing machines have existential and universal states?
a) Alternating Turing machine
b) Probalistic Turing machine
c) Read-only turing machine
d) None of the mentioned
View Answer
Answer: a
Explanation: ATM is divide into two sets: an existential state is accepting if some transitions leads to an accepting state; an universal state is accepting if every transition leads to an accepting state.

7. Which of the following is false for Quantum Turing machine?
a) Abstract machine
b) Any quantum algorithm can be expressed formally as a particular quantum turing machine
c) Gives a solution to 'Is a universal quantum computer sufficient'
d) None of the mentioned
View Answer
Answer: c
Explanation: 'Is a universal quantum computer sufficient' is one of the unsolved problem from physics.

8. A deterministic turing machine is:
a) ambiguous turing machine
b) unambiguous turing machine
c) non-deterministic
d) none of the mentioned
View Answer
Answer: b
Explanation: A deterministic turing machine is unambiguous and for every input, there is exactly one operation possible. It is a subset of non-deterministic Turing machines.

9. Which of the following is true about Turing's a-machine?
a) a stands for automatic
b) left ended, right end-infinite
c) finite number of tape symbols were allowed
d) all of the mentioned
View Answer
Answer: d
Explanation: Turings a- machine or automatic machine was left ended,right end infinite.Any of finite number of tape symbols were allowed and the 5 tuples were not in order.

10. Which of the following is a multi tape turing machine?
a) Post turing Machine
b) Wang-B Machine
c) Oblivious turing Machine
d) All of the mentioned
View Answer
Answer: c
Explanation: An oblivious turing machine where movements of various heads are fixed functions of time, independent of the input. Pippenger and Fischer showed that any computation that can be performed by a multi-tape Turing machine in n steps can be performed by an oblivious two-tape Turing machine in O(n log n) steps.

1. Which of the following are related to construction of One Tape turing machines?
a) JFLAP
b) NFLAP
c) Both (a) and (b)
d) None of the mentioned
View Answer
Answer: a
Explanation: JFLAP is educational software written in java to experiment with the topics in automata theory and area of formal languages.

2. Which of the following topics cannot be covered using JFLAPS?
a) L-System
b) Unrestricted Grammar
c) Regular Expression
d) None of the mentioned
View Answer
Answer: d
Explanation: Topics like regular expressions, context free languages and unrestricted grammar including parsers like LL,SLR parsers can be covered using JFLAPS.

3. State true or false:
Statement: Multitape turing machine have multi tapes where each tape is accessed with one head.
a) true
b) false
View Answer
Answer: b
Explanation: Multitape turing machines do have multiple tapes but they they are accessed by separate heads.

4. Which of the following statements is/are true?
a) Every multitape turing machine has its equivalent single tape turing machine
b) Every multitape turing machine is an abstract machine
c) Both (a) and (b)
d) None of the mentioned
View Answer

Answer: c
Explanation: A multitape turing machine is an ordinary turing machine which is always abstract.And they do have their equivalent single tape turing machines.



5. Are Multitape and Multitrack turing machines same?
a) Yes
b) No
c) Somewhat yes
d) Cannot tell
View Answer
Answer: a
Explanation: Multitrack turing machines are special types of Multitape turing machines. In a standard n-tape Turing machine, n heads move independently along n-tracks.

6. In a n-track turing machine, _____ head/heads read and write on all tracks simultaneously.
a) one
b) two
c) n
d) infinite
View Answer
Answer: a
Explanation: In a n-track Turing machine, one head reads and writes on all tracks simultaneously. A tape position in a n-track Turing Machine contains n symbols from the tape alphabet.

7. Which of the following does not exists?
a) Turing Machine with Multiple heads
b) Turing Machine with infinite tapes
c) Turing machine with two dimensional tapes
d) None of the mentioned
View Answer
Answer: d
Explanation: All of the mentioned are one or the other kind of Turing machines in existence.

8. Can a multitape turing machine have an infinte number of tapes?
a) Yes
b) No
View Answer
Answer: b
Explanation: One needs a finite number of tapes. The proofs that show the equivalence between multi-tape TM and one-band TM rely on the fact that the number of tapes is bounded.

9. Every language accepted by a k-tape TM is _____ by a single-tape TM.
a) accepted
b) not accepted

c) generated
d) not generated
View Answer
Answer: a
Explanation: Its the theorem that states Every multitape turing machine can be simulated by a single tape turing machine and the corresponding language can be accepted.

10. Which of the following is/are a basic TM equivalent to?
a) Multitrack TM
b) Multitape TM
c) Non-deterministic TM
d) All of the mentioned
View Answer
Answer: d
Explanation: Tms can be used as both: language recognizers/Computers. TMs are like universal computing machines with universal storage.

1. X is a simple mathematical model of a computer. X has unrestricted and unlimited memory. X is a FA with R/W head. X can have an infinite tape divided into cells, each cell holding one symbol.
Name X?
a) Push Down Automata
b) Non deterministic Finite Automata
c) Turing machines
d) None of the mentioned
View Answer
Answer: c
Explanation: Turing machine is known as universal computer. It is denoted by $M=(Q,\Sigma,\Gamma',\delta,q0,B,F)$

2. Which of the following is/are not an application of turing machine?
a) Language Recognization
b) Computers of functions on non negative numbers
c) Generating devices
d) None of the mentioned
View Answer
Answer: d
Explanation: A turing machine can have many applications like : Enumerator (A turing machine with an output printer), function computer, etc.

3. State true or false:
Statement: Turing Machine can change symbols on its tape, whereas the FA cannot change symbols on tape.
a) true
b) false
View Answer
Answer: a
Explanation: The following mentioned is the difference between 2-way FA and TM. Another instance is that TM has a read/write tape head while FA doesn't.

4. Which of the following cannot be a possibility of a TM while it processes an input?
a) Enters accepting state
b) Enters non-accepting state
c) Enters infinite loop and never halts
d) None of the mentioned
View Answer
Answer: d
Explanation: The following mentioned are the only possibilities of operating a string through a turing machine.

5. Pick the odd one out.
a) Subroutines
b) Multiple tracks
c) Shifting over
d) Recursion
View Answer
Answer: d
Explanation: Except Recursion, all the other options are techniques of Turing Machine construction which further includes, Checking off symbols and Storage in finite control.



6. Which among the following is not true for 2-way infinte TM?
a) tape in both directions
b) Leftmost square not distinguished
c) Any computation that can be performed by 2-way infinite tape can also be performed by standard TM.
d) None of the mentioned
View Answer
Answer: d
Explanation: All of the mentioned are correct statements for a two way infinite tape turing machine. Theorems say the power of such a machine is in no way superior than a standard turing machine.

7. Can a turing machine act like a transducer?
a) yes
b) no
View Answer
Answer: a
Explanation: A turing machine can be used as a transducer. The most obvious way to do this is to treat the entire non blank portion of the initial tape as input, and to treat the entire blank portion of the tape when the machine halts as output.

8. Which of the following does not exists?
a) Mutitape TM
b) Multihead TM
c) Multidimentional TM
d) None of the mentioned
View Answer

Answer: d
Explanation: If the tape contains k-dimentional array of cells infinte in all $2^k$ directions, for some fixed k and has a finite control, the machine can be called Multidimentional TM.

9. Enumerator is a turing machine with _____
a) an output printer
b) 5 input tapes
c) a stack
d) none of the mentioned
View Answer
Answer: a
Explanation: Here, the turing machine can use the printer as an output device to print strings.
Note: There is no input to an enumerator. If it doesn't halt, it may print an infinite set of strings.

10. For the following language, an enumerator will print:
$L=\{a^nb^n|n>=0\}$
a) $a^nb^n$
b) $\{ab, a^2b^2, a^3b^3, \ldots\}$
c) $\{e, ab, a^2b^2, a^3b^3, \ldots\}$
d) None of the mentioned
View Answer
Answer: b
Explanation: An enumerator is a turing machine with an output printer. It can use an printer as an output device to print output strings. As n also holds the value , epsilon will also be a part of the output set.

11. Complete the following statement:
Statement : A language is turing recognizable if an only if _____
a) an enumerator enumerates it
b) it is finite
c) both (a) and (b)
d) none of the mentioned
View Answer
Answer: a
Explanation: If an Enumerator E enumerates a language L, there is a turing machine M that recognizes language L. Also, If a turing machine M recognizes a language L, there is an enumerator for L.

1. Can a single tape turing machine be simulated using deterministic 2-stack turing machine?
a) Yes
b) No
c) Cannot be said
d) none of the mentioned
View Answer
Answer: a
Explanation: The symbols to left of the head of turing macine being simulated can be stored on the stack while the symbols on the right of the head can be placed on

another stack. On each stack, symbols closer to the TM’s head are placed closer to the top of the stack than symbols farther from the TM’s head.

2. A _____ is a multi tape turing machine whose input tape is read only.
a) Counter Machine
b) Multi-stack
c) Alternating Turing machine
d) None of the mentioned
View Answer
Answer: a
Explanation: Counter machines are offline(a multitape turing machine whose input is read only) whose storage tapes are semi-infinite and whose tape symbols contains only two symbols Z and a blank symbol B.

3. Instantaneous description of a counter machine can be described using:
a) the input tape contents
b) position of the input head
c) distance of storage heads from symbol Z
d) all of the mentioned
View Answer
Answer: d
Explanation: Instantaneous description of a counter machine can be described by the state, the input tape contents, the position of input head, and the distance of storage heads from the symbol Z. The counter machine can really store a count on each tape and tell if the count is zero.

4. Which of the following parameters cannot be used to restrict a turing machine?
a) tape alphabets
b) number of tapes
c) number of states
d) none of these
View Answer
Answer: d
Explanation: Another procedure to restrict a turing machine is to limit the size of tape alphabet or reduce the number of states. If the tape alphabets, number of tapes or number of states are limited, then there is only a finite number of different turing machine, so the restricted model is more powerful than the original one.



5. Linear Bounded Automaton is a:
a) Finite Automaton
b) Turing Machine
c) Push down Automaton
d) None of the mentioned
View Answer
Answer: b
Explanation: Linear Bounded Automaton is a type of Turing Machine where tape is not allowed to move off the portion of the tape containing the input. It is a Turing machine with limited amount of memory.

6. State true or false:
Statement: Using a two track tape, we can use a semi infinite tape to simulate an infinte tape.
a) true
b) false
View Answer
Answer: true
Explanation: A TM with a semi-infinite tape means that there are no cells to the left of the initial head position. A TM with a semi infinite tape simulates a TM with an infinite tape by using a two-track tape.

7. Which of the following is true with reference to semi-infinite tape using a two track tape?
a) Can simulate a two way tape
b) Upper track represents the head-right cells
c) Lower track represents the head-left cells
d) All of the mentioned
View Answer
Answer: d
Explanation: The upper track represents the cells of the original TM that are at the right of the initial head position. The lower track represents the cells to the left of the initial head position, but in reverse order.

8. Which among the following options are correct?
Statement 1: TMs can accept languages that are not accepted by any PDA with one stack.
Statement 2: But PDA with two stacks can accept any language that a TM can accept.
a) Statement 1 and 2, both are correct
b) Statement 1 is correct but Statement 2 is false
c) Statement 2 is correct while Statement 1 is false
d) Statement 1 and 2, both are false
View Answer
Answer: a
Explanation: Both the statements are true. Both the statements are properties of Multistack machines.

9. A two-way infinite tape turing machine is _____ superior than the basic model of the turing machine in terms of power.
a) more
b) less
c) no way
d) none of the mentioned
View Answer
Answer: c
Explanation: A two way infinite tape turing machine is a turing machine with its input tape infinte in both directions, the other component being the same as the basic model.

10. For a basic turing machine, there exists an equivalent :
a) 2-counter machine

b) 3-counter machine
c) 4-counter machine
d) All of the mentioned
View Answer
Answer: d

1. Fill in the blank with an appropriate option.
In automata theory, _____ is said to be Computationally Universal if can be used to simulate any single taped Turing Machine.
a) Computer's instruction set
b) A programming language
c) Cellular Automaton
d) All of the mentioned
View Answer
Answer: d
Explanation: Computationally Universal or Turing Complete is a set of data manipulation rules if it can be used to simulate a single-taped turing machine.

2. Give a classic example of the concept of turing complete.
a) lambda calculus
b) C++
c) Lisp
d) All of the mentioned
View Answer
Answer: d
Explanation: Most of the programming languages, conventional or unconventional are turing complete. Functional languages like Lisp and Haskell are also turing complete.

3. Let two machines be P and Q. The state in which P can simulate Q and Q can simulate P is called:
a) Turing Equivalence
b) State Equivalence
c) Universal Turing Machine
d) None of the mentioned
View Answer
Answer: a
Explanation: It is a closely related concept with Turing complete. It says, two computers P and Q are called equivalent if P can simulate Q and Q can simulate P.

4. Which of the following remarks the given statement?
Statement: Any function whose values can be computed by an algorithm, can be computed by a Turing machine.
a) Smn theorem
b) Structured Program theorem
c) Church-Turing thesis
d) None of the mentioned
View Answer
Answer: c
Explanation: The following conclusion is laid down from the Church-Turing thesis: Any function whose values can be computed by an algorithm, can be computed by a

Turing machine. If any real world computer can be simulated by a turing machine, it is Turing equivalent to a Turing Machine.



5. Which of the following can be used to simulate any turing machine?
a) Finite State Automaton
b) Universal Turing Machine
c) Counter machines
d) All of the mentioned
View Answer
Answer: b
Explanation: The computational aspect of any possible real world computer can be simulated using an Universal Turing Machine so can be any turing machine.

6. State true or false:
Statement: Inorder to show something is Turing complete, it is enough to demonstrate that it can be used to simulate some Turing complete system.
a) true
b) false
View Answer
Answer: a
Explanation: Yes it is. For instance, an imperative language is called Turing complete if it tends to have conditional branching and an ability to maintain an arbitrary number of symbols.

7. Which of the following can lack in a Universal computer?
a) Turing Complete Instruction set
b) Infinite memory
c) Infinite time
d) None of the mentioned
View Answer
Answer: d
Explanation: Real computers which are manufactured till date, all are similar to single taped turing machine. However, they have limited physical resources so they are linearly bounded complete on the contrary.

8. Which among are not the results of computational theory?
a) In general, it is impossible to predict that what a Turing-complete program will do over an arbitrarily long time.
b) It is impossible to determine for every input, whether the program will eventually stop or continue forever.
c) It is not possible to determine whether a program will return true or false.
d) None of the mentioned
View Answer
Answer: d
Explanation: All of the following mentioned are the conclusions of automata theory or computability theory.

9. Which of the games fill under the category of Turing-complete?
a) Minecraft

b) Minesweeper
c) Dwarf Fortress
d) All of the mentioned
View Answer
Answer: d
Explanation: Many games fall under the category og turing complete:
a) Minecraft
b) Minesweeper
c) Dwarf Fortress
d) Conway's Game of Life
e) Pokemon Yellow, etc.

10. Which of the following a Non-turing Complete language?
a) Regular Language
b) Context free grammars
c) Epigram
d) All of the mentioned
View Answer
Answer: There exists some computational languages which are not turing complete. Regular language which is accepted by finite automata tops the list. Other examples are pixel shader languages embedded in Direct3D and OpenGL extensions.

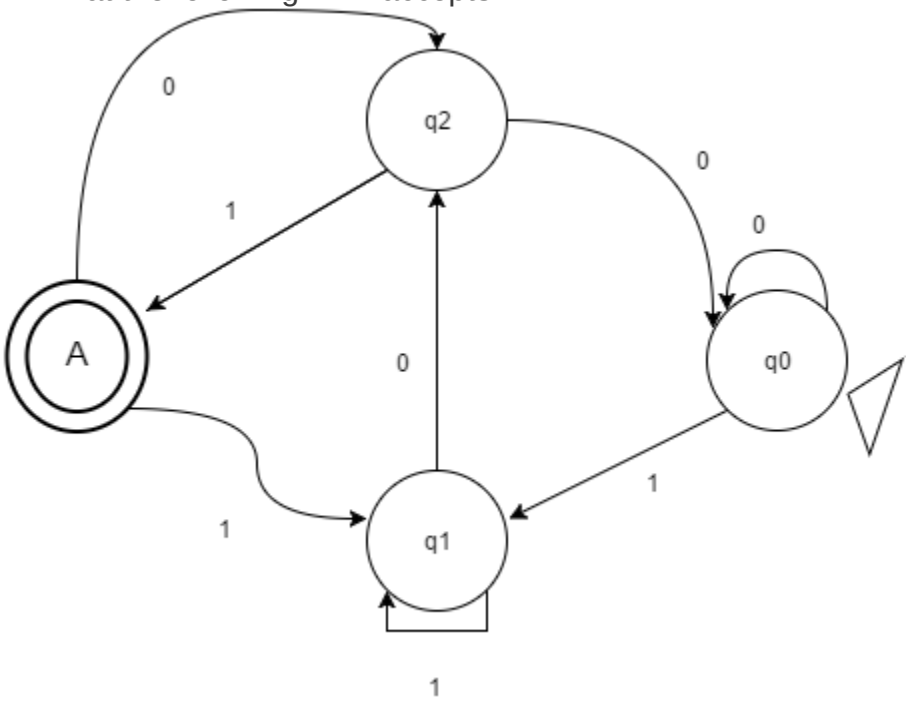
1. Which of the following not an example Bounded Information?
a) fan switch outputs {on, off}
b) electricity meter reading
c) colour of the traffic light at the moment
d) none of the mentioned
View Answer
Answer: b
Explanation: Bounded information refers to one whose output is limited and it cannot be said what were the recorded outputs previously until memorized.

2. A Language for which no DFA exist is a_____
a) Regular Language
b) Non-Regular Language
c) May be Regular
d) Cannot be said
View Answer
Answer: b
Explanation: A language for which there is no existence of a deterministic finite automata is always Non Regular and methods like Pumping Lemma can be used to prove the same.

3. A DFA cannot be represented in the following format
a) Transition graph
b) Transition Table
c) C code
d) None of the mentioned
View Answer

Answer: d
Explanation: A DFA can be represented in the following formats: Transition Graph, Transition Table, Transition tree/forest/Any programming Language.

4. What the following DFA accepts?

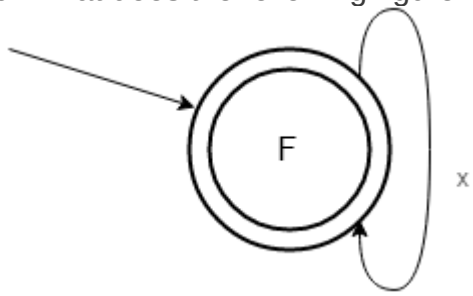



a) x is a string such that it ends with ‘101’
b) x is a string such that it ends with ‘01’
c) x is a string such that it has odd 1’s and even 0’s
d) x is a strings such that it has starting and ending character as 1
View Answer
Answer: a
Explanation: Strings such as {1101,101,10101} are being accepted while {1001,11001} are not. Thus, this conclusion leads to option a.



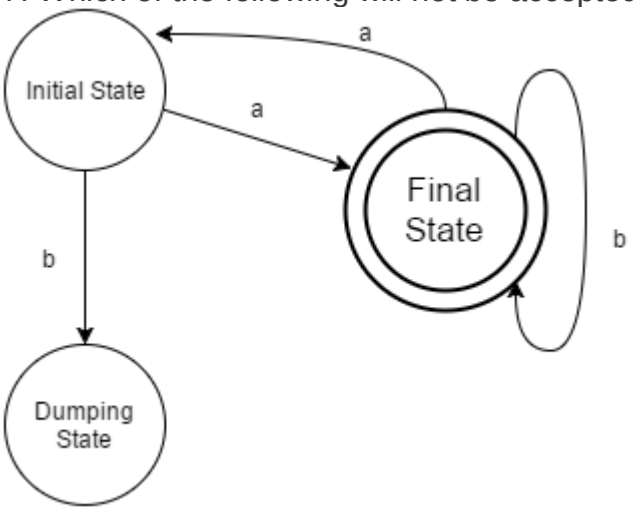
5. When are 2 finite states equivalent?
a) Same number of transitions
b) Same number of states
c) Same number of states as well as transitions
d) Both are final states
View Answer
Answer: c
Explanation: Two states are said to be equivalent if and only if they have same number of states as well as transitions.

6. What does the following figure most correctly represents?



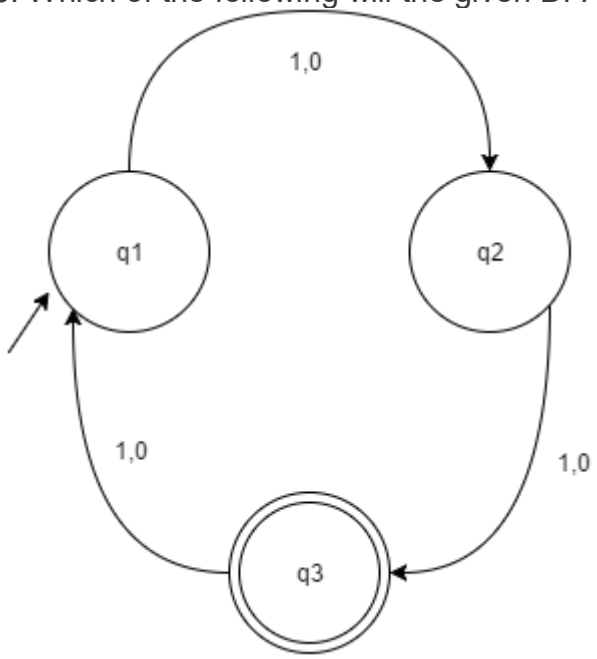

a) Final state with loop x
b) Transitional state with loop x
c) Initial state as well as final state with loop x
d) Insufficient Data
View Answer
Answer: c
Explanation: The figure represents the initial as well as the final state with an iteration of x.

7. Which of the following will not be accepted by the following DFA?




a) ababaabaa
b) abbbaa
c) abbbaabb
d) abbaabbaa
View Answer
Answer: a
Explanation: All the Strings are getting accepted except ‘ababaabaa’ as it is directed to dumping state. Dumping state also refers to the reject state of the automata.

8. Which of the following will the given DFA won't accept?




a) ε
b) 11010
c) 10001010
d) String of letter count 11
View Answer
Answer: a
Explanation: As the initial state is not made an acceptance state, thus ε will not be accepted by the given DFA. For the automata to accept ε as an entity, one should make the initial state as also the final state.

9. Can a DFA recognize a palindrome number?
a) Yes
b) No
c) Yes, with input alphabet as ∑*
d) Can't be determined
View Answer
Answer: b
Explanation: Language to accept a palindrome number or string will be non-regular and thus, its DFA cannot be obtained. Though, PDA is possible.

10. Which of the following is not an example of finite state machine system?
a) Control Mechanism of an elevator
b) Combinational Locks
c) Traffic Lights
d) Digital Watches
View Answer
Answer: d

Ans. ¬To describe the complement of a language, it is very important to describe the --------- of that language over which the language is defined. A.Alphabet B.Regular Expression

C.String D.Word Ans. A ¬If L is a regular language then, --------- is also a regular language. A.Lm B.Ls C.Lx D.Lc Ans. D ¬L= language of words containing even number of a's. Regular Expression isA.(a+b)aa(a+b) B.(b+aba) C.a+bbaaba D.(a+b)ab(a+b) Ans. B

Automata Theory Objective Questions Answers gkseries.com/automata-theory/multiple-choice-questions-and-answers-on-automata-theory Questions

1 The recognizing capability of NDFSM and DFSM

A must be the same

B may be different

C must be different

D none of the above

View Answer

Answer: Option [A] The recognizing capability of NDFSM and DFSM both are same. Because it is possible to generate equivalent DFSM from NDFSM and Vice versa.

2 Pumping lemma is generally used for proving

A a given grammar is regular

B a given language is not regular

C whether two given regular expressions are equivalent

D none of the above View Answer

Answer: Option [B]

3 Why Palindromes can't be recognized by any FSM ?

A an FSM can't deterministically fix the mid-point

B an FSM can't remember arbitrarily large amount of information

C even if the mid-point is known, an FSM can't find whether the second half of the string matches the first half

D all of the above View Answer

Answer: Option [D]

4 L = {a b a | n = 1, 2, 3 ……..} is an example of a language that is n n n 1/3

A not context free but whose complement is CF

B not context free

C only [A]

D both (B) and (C) View Answer Answer: Option [D]

5 Any given Transition graph has an equivalent

A DFSM

B NDFSM

C regular expression

D all of the above

View Answer Answer: Option [D]

6 The lexical analysis for a modern computer language such as Java needs the power of which one of the following machine models in a necessary and sufficient sense?

A Finite state automata

B Deterministic pushdown automata

C Non-Deterministic pushdown automata

D Turing machine

View Answer Answer: Option [A]

7 Context-free grammar is not closed under

A complementation

B union

C concatenation

D kleene star

View Answer Answer: Option [A] 2/3

8 A PDM behaves like an FSM when the number of auxiliary memory it has is

A 0 B 1 C 2 D none of the above

View Answer Answer: Option [A]

9 A PDM behaves like a TM when number of auxiliary memory it has is

A 0 B 1 C 2 or more D none of the above

View Answer Answer: Option [C]

10 Which of the following statements is/are true?

A DFSM and NDFSM both are equivalent.

B An FSM with 2 stacks is as powerful as a TM.

C A DFSM with 2 stacks and an NDFSM with 2 stacks have the same power.

D All of the above

View Answer Answer: Option [D] 3/3

○ Aptitude ◉ GATE ○ Other Misc.

Summary

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Theory of Computation

Turing Machines

Any Marks

All Questions

Type: MCQ Marks: 1

Rating: 4.67/5

★★★★★

**1)** Algorithms and Procedures are modeled by

Top

**A)** Turing Machines that may or may not halt on some inputs

**B)** Turing Machines that always halt

**C)** Algorithms are modeled by general Turing Machines and procedures by Turing Machines that always halt

**D)** None of the above

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 4.33/5

★★★★★

**2)** Consider the class of all assemble language programs on the Pentium computer and the class of all functions computed by Turing Machines with a two way infinite tape and only three heads

**A)** Both classes are the same by Church's Thesis

**B)** The Turing Machines will describe a richer set of functions than those computable by assembly language programs on the Pentium Computer

**C)** The assembly language programs on the Pentium computer describe a richer set of functions

**D)** None of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**3)** The following properties are valid for recursive and r.e. sets

**A)** Both classes are closed under union, intersection and complement

**B)** The recursive sets are closed under union, intersection and complement but the r.e. sets are not closed under complement

**C)** Neither the recursive or the r.e. sets are closed under union, intersection and complement

**D)** None of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 4.33/5

Top

★★★★★

**4)** For the class of Turing Machines and Turing Machines that always halt

**A)** the nondeterministic models are more powerful than the deterministic model

**B)** we can obtain the deterministic machines by constructing the subset machine

**C)** Nondeterminism does not add any power to the Turing Machines even if they halt on all inputs

**D)** None of the above

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**5)** The Universal Turing Machine

**A)** does not exist for Turing Machines that halt on all inputs

**B)** does not exist for Turing Machines that may or may not halt but exists for Turing Machines that halt on all inputs

**C)** does not exist for Turing Machines that have three purshdown tapes

**D)** none of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**6)** Consider the language of extended regular expressions whose complement is empty

**A)** the set if not a CSL but is recursive

**B)** the set if a regular set

**C)** the set is a CFL but not regular

**D)** the set is r.e. but not recursive

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query Top

Explanation

Type: MCQ Marks: 1

★★★★★

**7)** Hyper-computers accept

**A)** sets that may not be r.e.

**B)** only r.e. sets

**C)** only recursive sets

**D)** only CSLs

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**8)** Turing machines that do not leave their input

**A)** accept all the r.e. sets

**B)** accept only the CSLs

**C)** accept all the recursive sets

**D)** accept languages that are not r.e.

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 3/5 ★★★★★

**9)** A Type 0 or unrestricted grammar

**A)** generates all the sets that are accepted by Halting Turing Machines but not by all Turing machines

**B)** generates all the sets accepted by the class of Turing Machines

**C)** generates sets that are not regular expression

**D)** None of the above

Top

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 4/5 ★ ★ ★ ★ ★

**10)** A Type 1 or context sensitive grammar

**A)** generates all the sets accepted by halting Turing Machines

**B)** generates all the sets that are r.e.

**C)** generates only the sets accepted by Turing Machines that do not leave their input

**D)** generates all the sets accepted by Linear Bounded Automata

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★ ★ ★ ★ ★

**11)** The language {wwwwww|w in(a+b+c+)*}

**A)** is a recursive set but not a CFL

**B)** is a r.e. set but not regular

**C)** is context free but not regular

**D)** is context sensitive but not context free

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★ ★ ★ ★ ★

**12)** The language $\{a^n b^n c^n | n>1\}$

**A)** is a r.e. set but not regular

**B)** is recursive but not CFL

**C)** is a context is sensitive language but not context free

**D)** is recursive but not context sensitive

Top

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**13)** The language $\{ww^Rww^Rww^R|w \text{ in } (a+b)^*\}$

**A)** is r.e. but not recursive

**B)** is recursive but not context sensitive

**C)** is context sensitive but not context free

**D)** is context free but not regular

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**14)** The set of all natural numbers that are powers of 16, represented in base 16

**A)** is r.e. but not recursive

**B)** is recursive but not context sensitive

**C)** is context sensitive but not context free

**D)** is context free and regular

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**15)** The set of all natural numbers that are powers of 47 represented in unary

**A)** is r.e. but not recursive

**B)** is recursive but not context sensitive

**C)** is context sensitive but not context free

**D)** is neither context free or regular or context sensitive

Top

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**16)** The recursive and r.e. sets are

**A)** closed under homomorphism, inverse homomorphism, complement

**B)** closed under substitution, reversal and concatenation

**C)** closed under union, intersection, quotient with a regular set and complement

**D)** none of the above

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**17)** Any NTM N with time complexity t(n) can be simulated by a DTM M in time ____.

**A)** $T(n)^4$

**B)** $c(N)^{t(n)}$

**C)** T(n)!

**D)** Cannot be simulated by a deterministic Turing machine

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**18)** A Turing Machine is an accepting device which accepts the languages generated by

**A)** type 0 grammars

**B)** type 1 grammars

Top

**C)** type 2 grammars

**D)** type 3 grammars

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**19)** Time and Space complexity of a Turing machine:

**A)** O(n), O(n log n)

**B)** $O(n^2)$, $O(n^2)$

**C)** O(n log n), O(n log n)

**D)** O(n log n), O(n)

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 2

★★★★★

**20)** L = {M | M is a TM and there exists an input on which M halts in less than | M | steps}.

State whether the given language is

**A)** Recursive

**B)** Recursively enumerable

**C)** Recursively enumerable but not recursive

**D)** Not Recursively enumerable

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 2 Top

★★★★★

**21)** L = {M | M is a TM and | L(M) | ≥ 3}

**A)** Recursive

**B)** Recursively enumerable

**C)** Recursively enumerable but not recursive

**D)** Not Recursively enumerable

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**22)** L = {M | M is a TM that accepts all even numbers}.

**A)** Recursive

**B)** Recursively enumerable

**C)** Recursively enumerable but not recursive

**D)** Not Recursively enumerable

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**23)** L = {M| M is a TM and L(M) is countable}.

**A)** Recursive

**B)** Not Recursive

**C)** Recursively enumerable but not recursive

**D)** Not Recursively enumerable

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query Top

Explanation

Type: MCQ Marks: 2

★★★★★

**24)** Which of the following is true for the language
$\{a^p \mid p \text{ is a prime}\}$.

**A)** It is not accepted by a Turing machine

**B)** It is regular but not context-free

**C)** It is context-free but not regular

**D)** It is neither regular nor context-free, but accepted by a Turing machine

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**25)** I. Halting problem of (halting) turing machine of recursive language is decidable.
II. Halting problem of turing machine of recursive enumerable language is decidable.

Which of the above statement is/are true?

**A)** Only I

**B)** Only II

**C)** Both I and II

**D)** Neither I nor II

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 2

★★★★★

**26)** L = {(M, w) | M is a TM that accepts w using at most $2^{|w|}$ squares of its tape}.

**A)** RE

**B)** Not recursive

Top

**C)** CFL

**D)** Recursive

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**27)** An arbitrary single-tape Turing machine can be simulated by a

**A)** Counter machine

**B)** Two-stack machine

**C)** One-stack machine

**D)** None of the machine

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**28)** Turing machine (TM) is more powerful than FMS (Finite State Machine) because

**A)** tape movement is confined to one direction

**B)** it has no finite state

**C)** it has the capability to remember arbitrarily long sequences of input symbols

**D)** none of these

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

Top

**29)** Universal TM influenced the concept of

**A)** stored program computers

**B)** interpretative implementation of programming language

**C)** computability

**D)** all of these

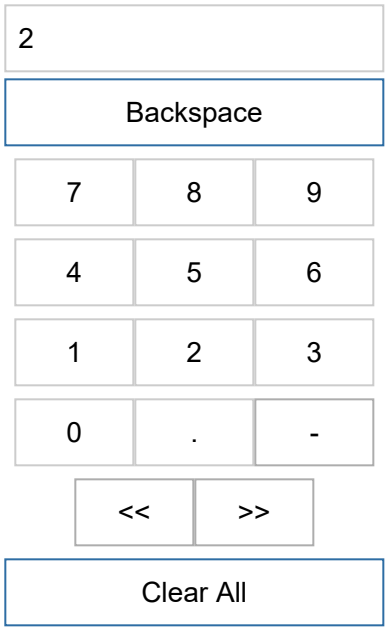
○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: NAT Marks: 1

★★★★★

**30)** Number of external states of a UTM should be at least

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Explanation



Top

Aptitude GATE Other Misc.

Summary

Advance Search

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Theory of Computation

Push Down Automata

Any Marks

All Questions

Type: MCQ Marks: 1

Rating: 4/5 ★ ★ ★ ★ ★

**1)** The language accepted by a push down automaton in which the stack is limited to 10 items is best described as

**A)** Context Free

**B)** Regular

Top

**C)** Deterministic Context free

**D)** Recursive

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 4.5/5

★★★★★

**2)** The following Grammar
S → bS
S → b
S → aA
A → bA
is

**A)** Type-3 grammar

**B)** Type-2 grammar

**C)** Type-1 grammar

**D)** Type-0 grammar

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 5/5 ★★★★★

**3)** L = $\{a^n, b^n, c^n \mid n > 1\}$ check for CFL's

**A)** Given grammar is CFL

**B)** Given grammar is not CFL

**C)** Given grammar is CSL

**D)** None of these

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 4.5/5

★★★★★

Top

**4)** L = {ωω | ω ∈ $(a + b)^+$} Check for CFL's

**A)** It is CFL

**B)** It is not CFL

**C)** It is CSL not CFL

**D)** None

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 4.5/5

★★★★★

**5)** L = {$a^i b^j c^k$ | i < j < k} check for CFL by using Pumping Lemma

**A)** Not CFL

**B)** It is CFL

**C)** Given grammar is CSL

**D)** None

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 2

★★★★★

**6)** L = {$a^j b^j$ | i = $j^2$} check for CFL using pumping lemma

**A)** L is not CFL

**B)** It satisfying Pumping lemma

**C)** It is CFL

**D)** None

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 2 Top

Rating: 5/5 ★★★★★

**7)** L = all strings are {a, b, c} with an equal nos. of a's, b's, and c's

**A)** L is CFL

**B)** It is CSL

**C)** L is not CFL

**D)** None of the above

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 2

★★★★★

**8)** What is the final accessible ID of PDA that accepts { $\omega\omega^R$ | $\omega$ in (0 + 1)*} with input string as 001100?

**A)** ($q_2$, ε, ε)

**B)** ($q_2$, ε, R)

**C)** ($q_1$, ε, ε)

**D)** ($q_1$, ε, R)

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**9)** If L is N(M) for some PDA M, then L is a

**A)** Not Context-Free Language

**B)** Context-Free Language

**C)** CSL

**D)** NPDA

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

Top

**10)** Construct a PDA from the following CFG.
**G = ({S, X}, {a, b}, P, S)**
where the productions are:
**S → XS | ε , A → aXb | Ab | ab**

**A)** P = ({q}, {b, a}, {a, b, X, S}, δ, q, S)

**B)** P = ({q}, {a, b}, {b, a, X, S}, δ, q, S)

**C)** P = ({q}, {a, b}, {a, b, X, S}, δ, q, S)

**D)** P = ({q}, {b, a}, {b, a, X, S}, δ, q, S)

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

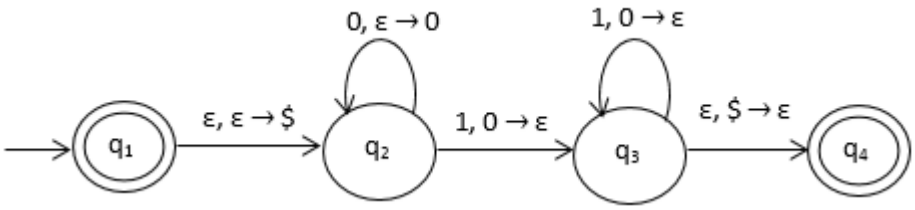
Explanation

Type: MCQ Marks: 2

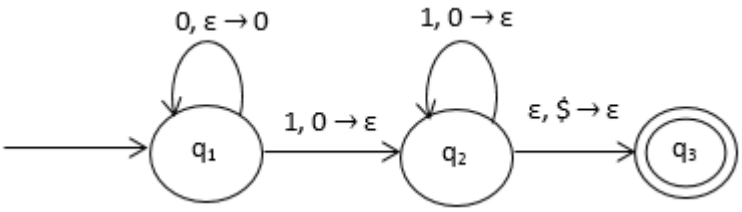
★★★★★

**11)** Construct a PDA that accepts **L= {$0^n 1^n$ | n ≥ 0}.**

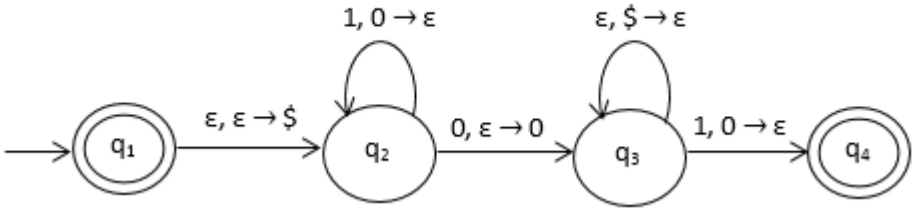
**A)**



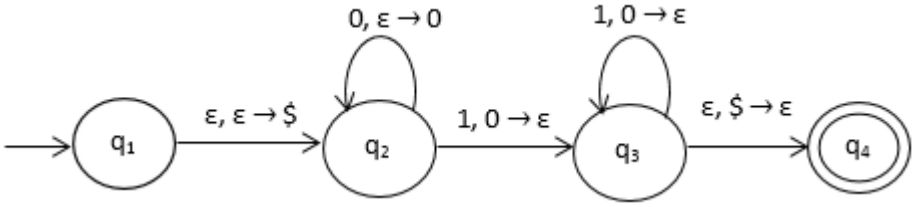

**B)**




**C)**




**D)**




Top

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

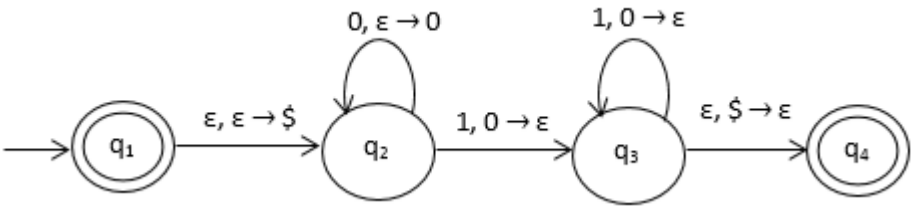
Explanation

Type: MCQ Marks: 2

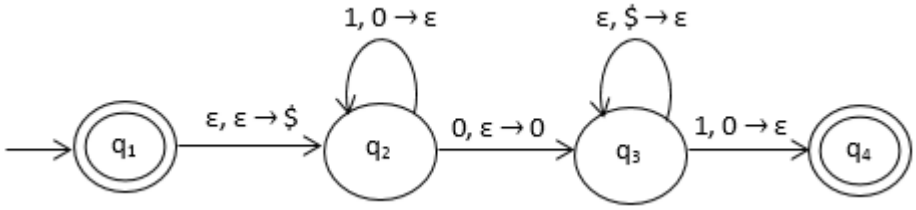
★★★★★

**12)** Construct a PDA that accepts L= { $\omega\omega^R$ | $\omega = (a+b)^*$ }

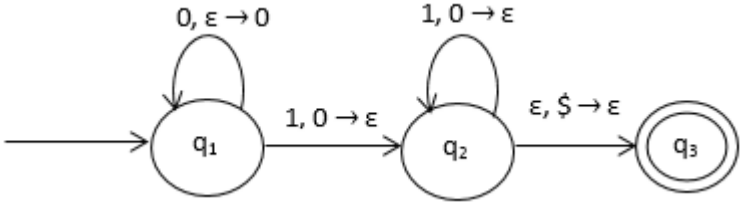
**A)**



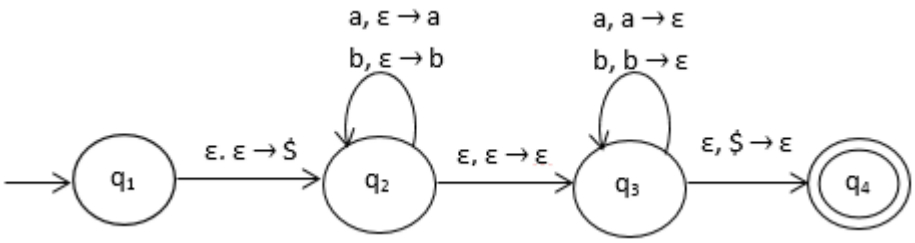

**B)**




**C)**




**D)**




○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**13)** If a grammar G is context-free, we can build an equivalent _____ which accepts the language that is produced by the context-free grammar G. A parser can be built for the grammar G.

Top

**A)** CFG

**B)** Nondeterministic PDA

**C)** CSL

**D)** CFL

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**14)** If a grammar **G** is context-free, we can build an equivalent

**A)** Turing Machine

**B)** CSL

**C)** RE

**D)** Nondeterministic PDA

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**15)** The language accepted by A Pushdown Automaton in which the stack is limited to 10 items is best described as

**A)** Context free

**B)** Regular

**C)** Deterministic Context free

**D)** Recursive

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**16)** Let G = ({S}, {a, b}R, S) be a context free grammar where the rule set R is
S → aSb | SS| ε
Which of the following is true?

Top

**A)** G is not ambiguous

**B)** There exists x, y $\in$ L(G) such that xy $\notin$ L(G)

**C)** There is a deterministic pushdown automaton that accepts L(G)

**D)** We can find a deterministic finite state automaton that accepts L(G)

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**17)** Which of the following is FALSE?

**A)** There is a unique minimal DFA for every regular language.

**B)** Every NFA can be converted to an equivalent PDA.

**C)** Complement of every context-free language is recursive.

**D)** Every nondeterministic PDA can be converted to an equivalent deterministic PDA.

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation



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Theory of Computation

Finite Automata & Regular Expressions

Any Marks

All Questions

Type: MCQ Marks: 1

Rating: 4/5 ★ ★ ★ ★ ★

**1)** The set $\{a^i b^j \mid i < 100 \text{ and } j < 10000\}$ is

**A)** a finite set

**B)** a regular set

**C)** a null set

Top

**D)** an infinite set

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 4.17/5

★★★★★

**2)** The minimal finite automata accepting the set of all strings over {1, 0}* that have three consecutive 000's has

**A)** 6 states

**B)** 5 states

**C)** 4 states

**D)** None of the above

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 3.67/5

★★★★★

**3)** The minimal finite automata accepting the set of all strings over (0,1)* that do not have the sub-string 0001 has

**A)** 7 states

**B)** 6 states

**C)** 5 states

**D)** None of the above

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 3.71/5

★★★★★

**4)** The minimal finite automata accepting the set of all strings over (p + q)* where the fourth symbol from the right is a p has

Top

**A)** 12 states

**B)** 16 states

**C)** 20 states

**D)** None of the above

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 4.4/5 ★★★★★

**5)** The minimal finite automata accepting the set of all strings over {0, 1}* that starting with a 0 and interpreted as the binary representation of an integer are congruent to 2 modulo 5 has

**A)** 4 stales

**B)** 5 states

**C)** 6 states

**D)** None of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 4.33/5 ★★★★★

**6)** The minimal finite automata accepting the set of all strings over (0 + 1)* that end in 000 has

**A)** 4 states

**B)** 5 states

**C)** 6 states

**D)** None of the above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 5/5 ★★★★★

**7)** The minimal finite automata accepting the set of all strings over (a + b)* where the number of a's is divisible by 3 and the number of b's is divisible by 5 has

Top

**A)** 12 states

**B)** 15 states

**C)** 17 states

**D)** None of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 4.5/5 ★★★★★

**8)** The regular expression (00)* + 0(00)* + 00(000)* represents

**A)** the set 0*

**B)** the set of all even length strings over 0

**C)** the set of all strings over 0 divisible by 2 or 3

**D)** None of the above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 5/5 ★★★★★

**9)** Consider the regular expression identities
i) r* | s*= (r + s)* ii) rs* i sr* - (r* s*)*
iii) r* (r*s*r*r*)* = (r + s)* iv) r (ar)* = (ra)*r
Choose the correct statements

**A)** i-iii are false and iv is true

**B)** All are true

**C)** All are false

**D)** r(ar)* = (ra)*r

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 4/5 ★★★★★

Top

**10)** When a NFA is converted to an equivalent DFA the construction always yields

**A)** the same number of states

**B)** always more states

**C)** sometimes less number of states

**D)** $2^n$ states in the worst case where 'n' is the number of states of the NFA

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 5/5 ★★★★★

**11)** The minimal finite automata for the empty set has

**A)** No states

**B)** 1 state

**C)** 1 accepting state and 1 rejecting state

**D)** None

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 3.75/5

★★★★★

**12)** The minimal finite automata for the set of all strings over (0 + 1 + 2)* that interpreted as the representation of a base three number as congruent to 5 modulo 6 has

**A)** 5 states

**B)** 6 states

**C)** 7 states

**D)** None of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 3.5/5

★★★★★

Top

**13)** The regular sets are not closed under the following operations

**A)** Union, Intersection, Complement

**B)** Homomorphism, Inverse homomorphism, Substitution

**C)** Concatenation, Kleene closure, Reversal

**D)** None of the above

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 5/5 ★★★★★

**14)** The set $\{0^n 1^n \mid n > 1\}$ when represented by the state diagram of a finite automata has

**A)** an infinite number of states

**B)** a finite number of states

**C)** cannot be represented by a state diagram

**D)** None of the above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**15)** Consider the following languages

i. $\{a^{2**N} \mid N = 1\}$

ii. $\{a^p \mid p \text{ prime}\}$

iii. $\{0^i 1^j < 1000\}$

iv. The set of all strings (0+1)* that do not have the substring

**A)** All are regular sets

**B)** Only iii and iv are regular sets

**C)** Only i and ii and iv are regular sets

**D)** None of them is a regular set

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 5/5 ★★★★★ Top

**16)** Consider the following languages

i) $\{ww^Rx \mid w, x \text{ in}(r + s)^*\}$

ii) $\{wxw^R \mid w, x \text{ in } (t + u)^*\}$

iii) {wwwww | w | <=100, w in (0 + 1)*J

iv) $\{a^n b^n c^n \mid n >= 1000\}$

**A)** None of the above is regular

**B)** i and ii are not regular but iii and iv are regular

**C)** i and iv are regular but ii and iii are not

**D)** All are regular sets

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**17)** Let L = {ε} and let L ⊆ {0, 1}*. The minimal finite automata for L has

**A)** 1 state

**B)** 2 states

**C)** 3 states

**D)** None of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 4/5 ★★★★★

**18)** The languages

i) $\{a^i b^j c^k \mid i, j, k > 1000\}$

ii) $\{a^i b^j c^k \mid i, j, k<10000\}$

iii) $\{a^i b^j c^k \mid i<j<k<1000\}$

iv) $\{a^i b^j c^k \mid i+ j + k>200\}$

**A)** all are finite sets

**B)** all are regular sets

**C)** all are infinite sets

**D)** None

Top

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 2

Rating: 4.4/5

★★★★★

**19)** The grammars

(i) S → 0 | 0S | 1 (ii) S → 1 | 1S | 0 (iii) S → SS | 0S | 0 (iv) S → 0S0 | 0

**A)** (i) is right linear and (ii) is left linear and represent regular sets

**B)** All are regular grammars

**C)** (ii) and (iv) are regular grammars and generate regular sets

**D)** None of the above

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Rating: 5/5 ★★★★★

**20)** Consider the minimal finite automata for the set of all strings over {0, 1}* where

(i) the fifth symbol from the right end is a 1

(ii) the fifth symbol from the left end is a 1

**A)** Both have 6 states

**B)** (i) has 64 states and (ii) has 6 states

**C)** Both have 64 states

**D)** None of the above

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**21)** The grammar for 0* which is a regular set is given by S → 0S | S0 | 0S0 | 0 | ε

**A)** the grammar is a left linear grammar

**B)** the grammar is a right linear grammar

**C)** the grammar is not a regular grammar

**D)** None of the above

Top

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**22)** The set of all strings over {a, b, c}* that have an equal number of a's b's and c's is

**A)** a regular set

**B)** a finite automata with a very large number of states

**C)** not a regular set

**D)** a regular set when the reversal of the language is considered

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**23)** Consider the sets

i) $a^i b^j \mid \gcd(i, j) = 1\}$

ii) $\{0^m 1^n 0^{W} + n \mid m, n>10\}$

iii) {ww | w in (c + d)*}

iv) $\{a^i b^j \mid j = \max(i, j)\}$

**A)** None of them is a regular set

**B)** All are regular sets

**C)** Only ii is a regular set the others are not

**D)** Only iii is a regular set the rest are not

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**24)** Let $L_D$ be the set of all languages accepted by a PDA by final state and $L_E$ the set of all languages accepted by empty stack. Which of the following is true?

**A)** $L_D = L_E$

**B)** $L_D \subset L_E$ Top

**C)** $L_D \supset L_E$

**D)** None of the above

A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

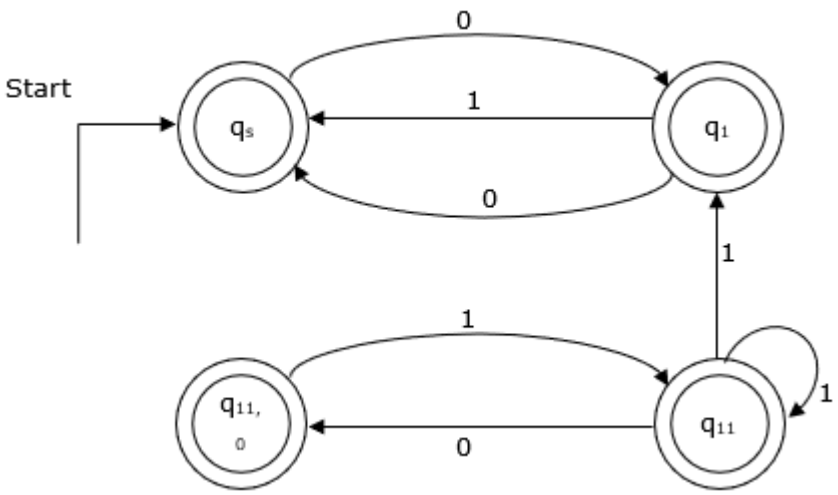
Type: MCQ Marks: 2

Rating: 3.67/5

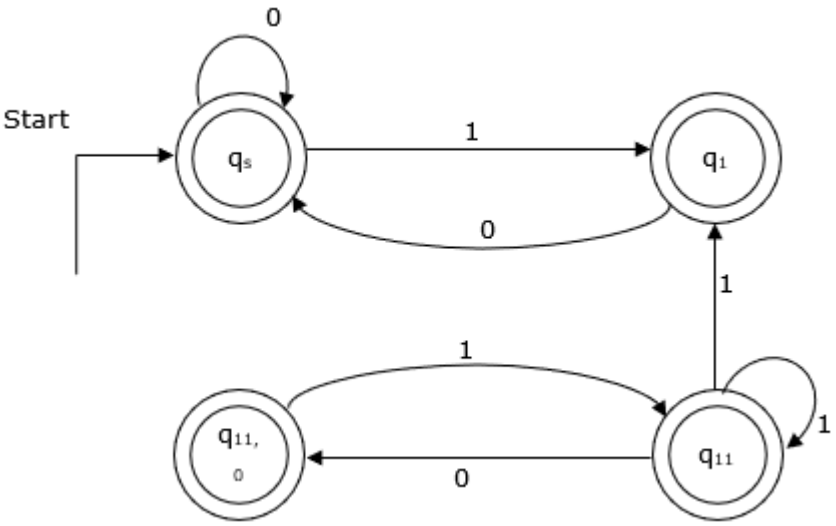
★★★★★

**25)** Design a DFA accepting set of all strings are {0, 1} where, every pair of constitutive 0's occurs before any pair of adjacent 1's.

**A)**




**B)**

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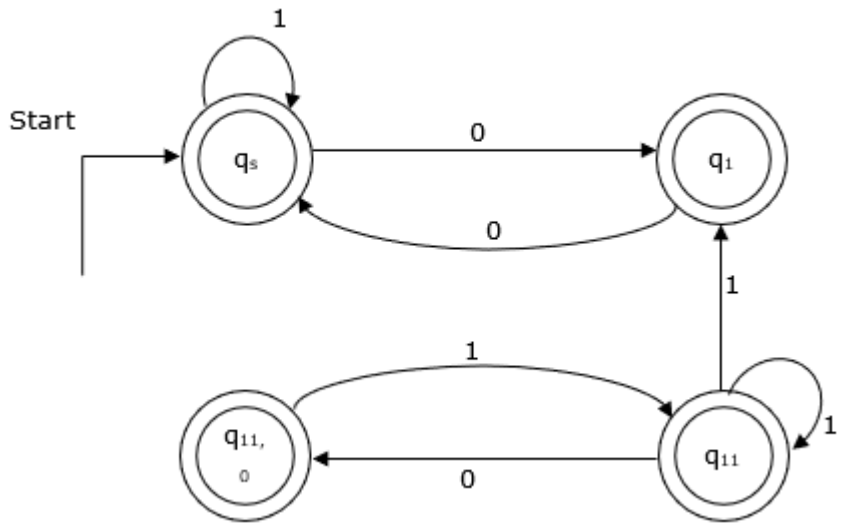
**C)**




**D)** None of the above

A B C D ✔ Share Mark IMP Raise Query

Explanation

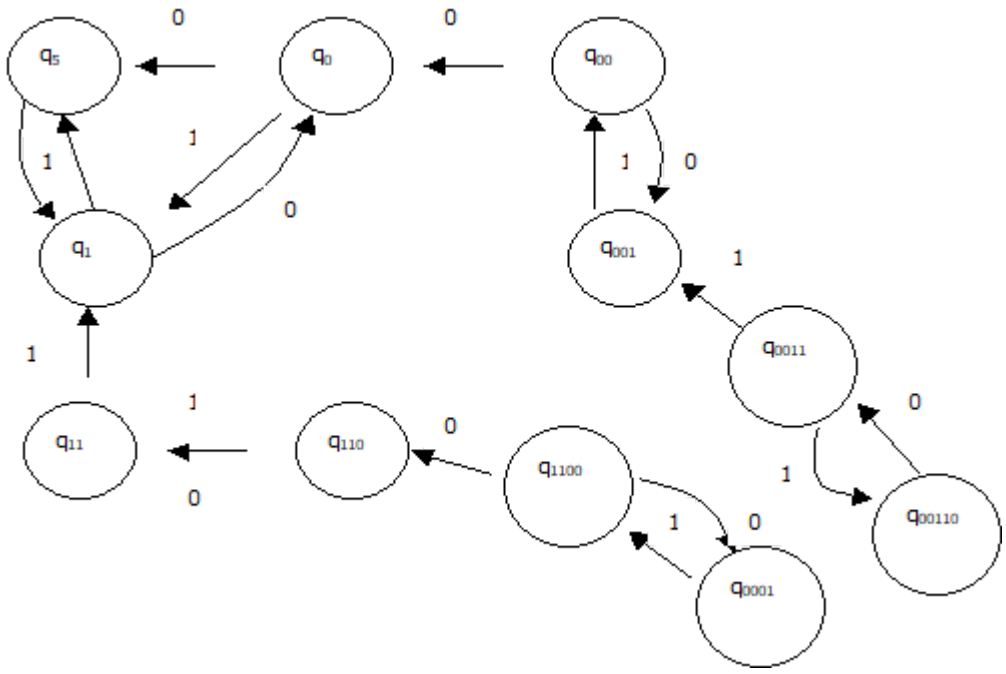
Type: MCQ Marks: 1

Rating: 3.67/5

★★★★★

**26)** Design a DFA accepting set of all strings are {0, 1} Containing at most one pair of consecutive 0's and at most one pair of consecutive 1's.

**A)**

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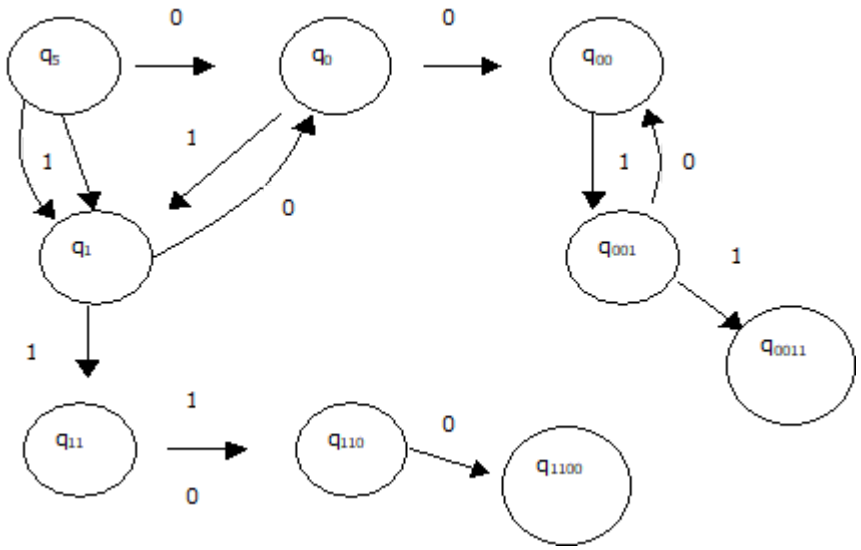
**B)**




**C)** Both A and B possible.

**D)** None of the above.

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

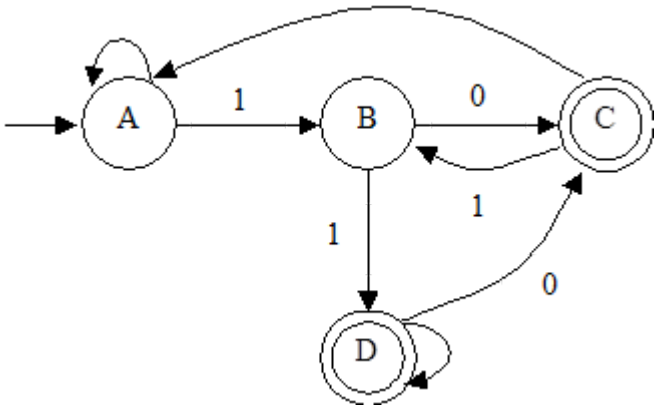
Type: MCQ Marks: 1

★★★★★

**27)** One fine day I draw a DFA for a language, which I know very well and placed, in the house.

On that night, my house was robbed. The robber did the following:

He just removed one of non-starting state from my DFA and removed all edges associated with it, and redrawn it on another paper and robbed my original paper. Next day morning I found that my paper was robbed and saw another FA there. From that day I am thinking that what could be the language accepted by that FA. My original DFA is shown below.




Can you help me in finding out the language of that FA? If you got it choose one of the following.

**A)** The finite automata accepts all strings whose last but one symbol is 1

**B)** The finite automata accept all strings, which end with 11

**C)** The finite automata accepts any length of zeros

**D)** The finite automata accept all strings "which end with 10 and does not contain two consecutive ones"

Top

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

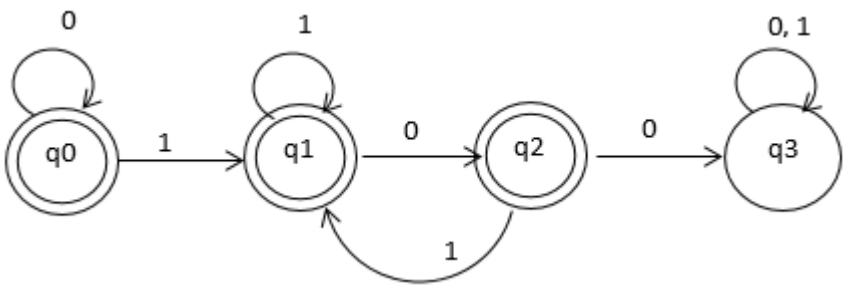
Explanation

Type: MCQ Marks: 1

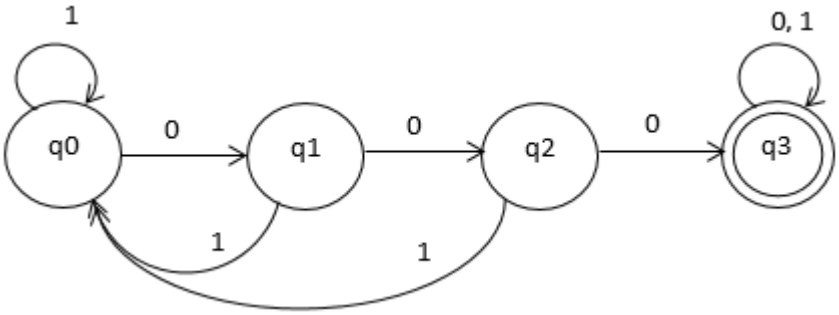
★★★★★

**28)** Give DFA accepting set of all strings are {0, 1} not containing 100 as a substring

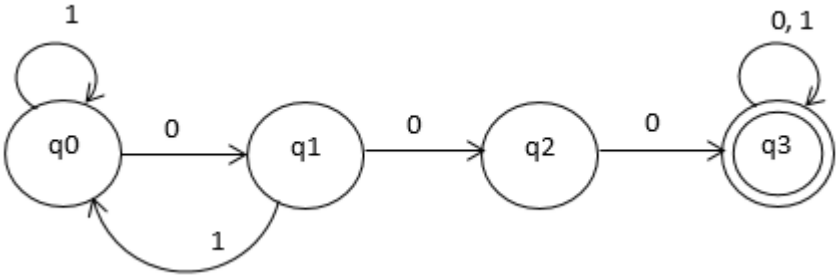
**A)**




**B)**




**C)**




**D)** None of the above.

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

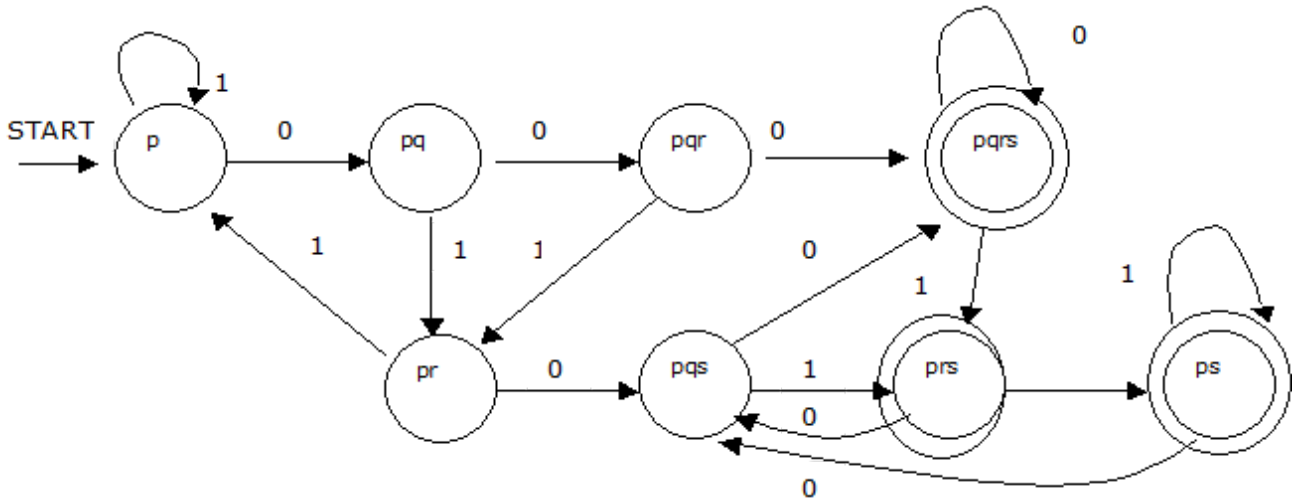
Top

**29)** Construct DFA's equivalent to NFA's

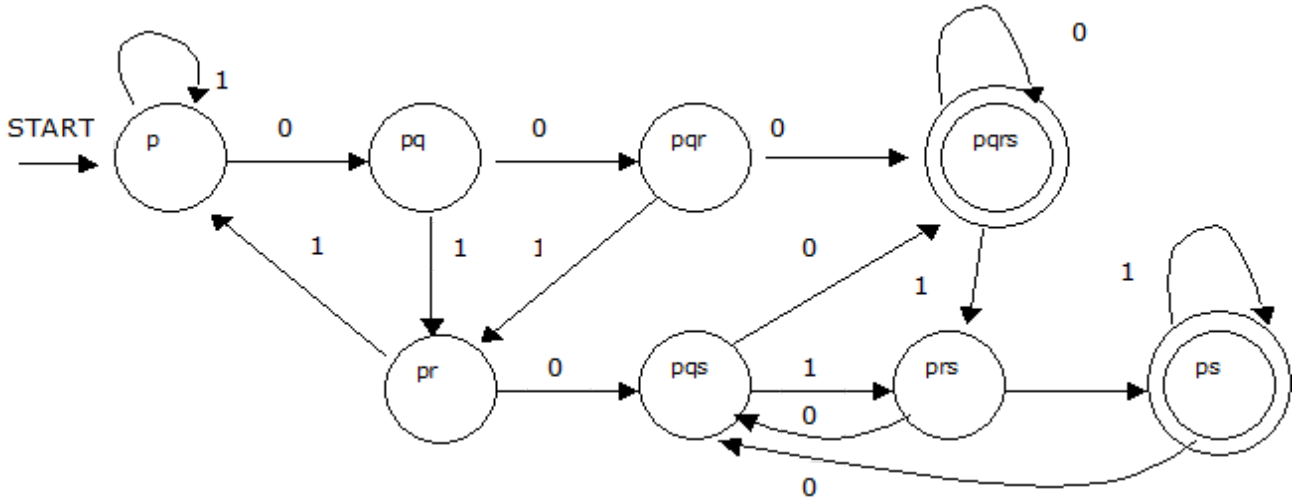
$(\{p, q, r, s\}, \{0, 1\}, \delta_1, r, \{s\})$

| $\delta_1$ | 0 | 1 |
|---|---|---|
| p | pq | p |
| q | r | r |
| r | s | - |
| *s | s | s |

**A)**




**B)**

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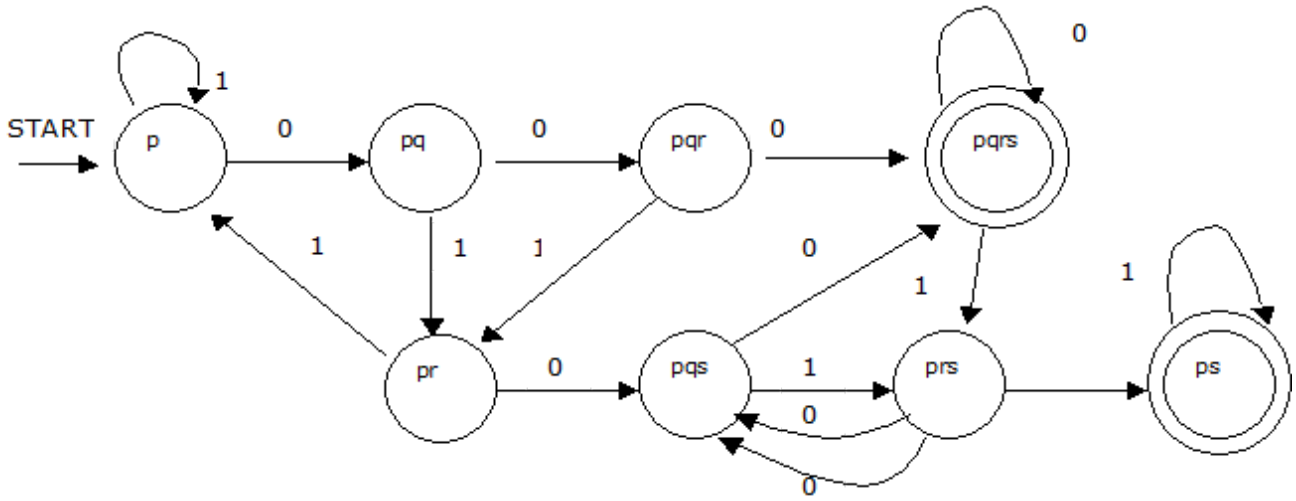
**C)**




**D)** None of the above.

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**30)** Construct DFA's equivalent to NFA's ({p, q, r, s}, {0, 1}, $\delta_2$, P, {q, s})

| $\delta_2$ | 0 | 1 |
|---|---|---|
| → P | q,s | q |
| *q | r | q,r |
| r | s | p |
| *s | - | p |

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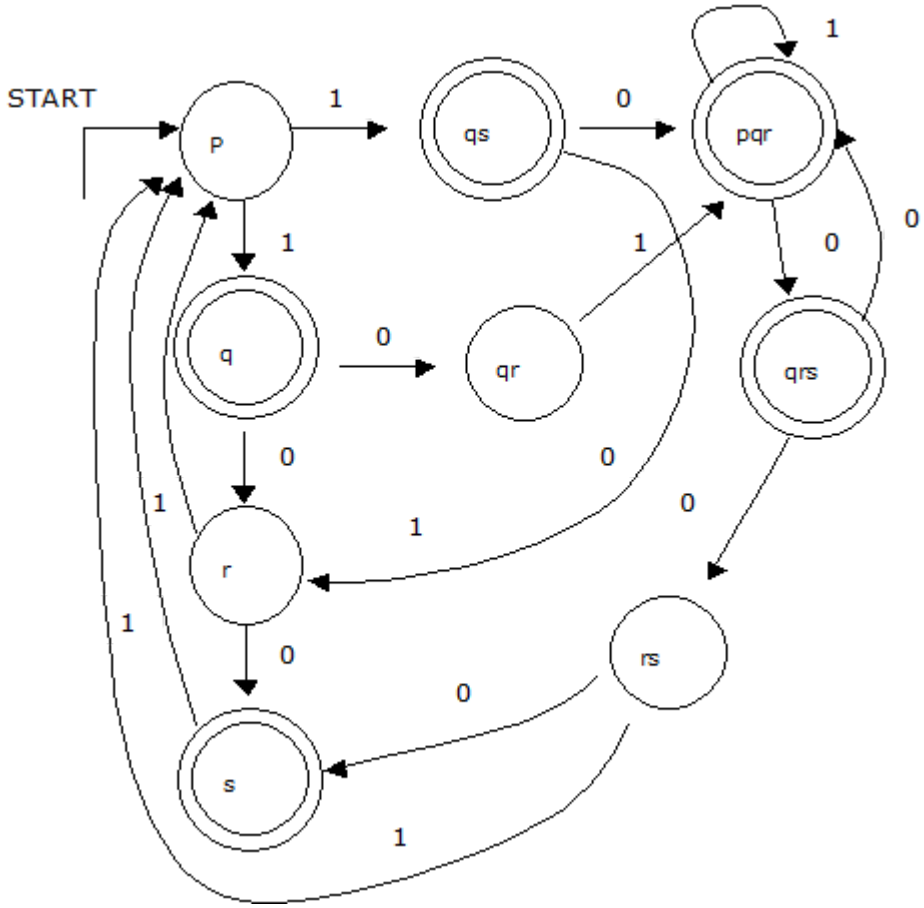
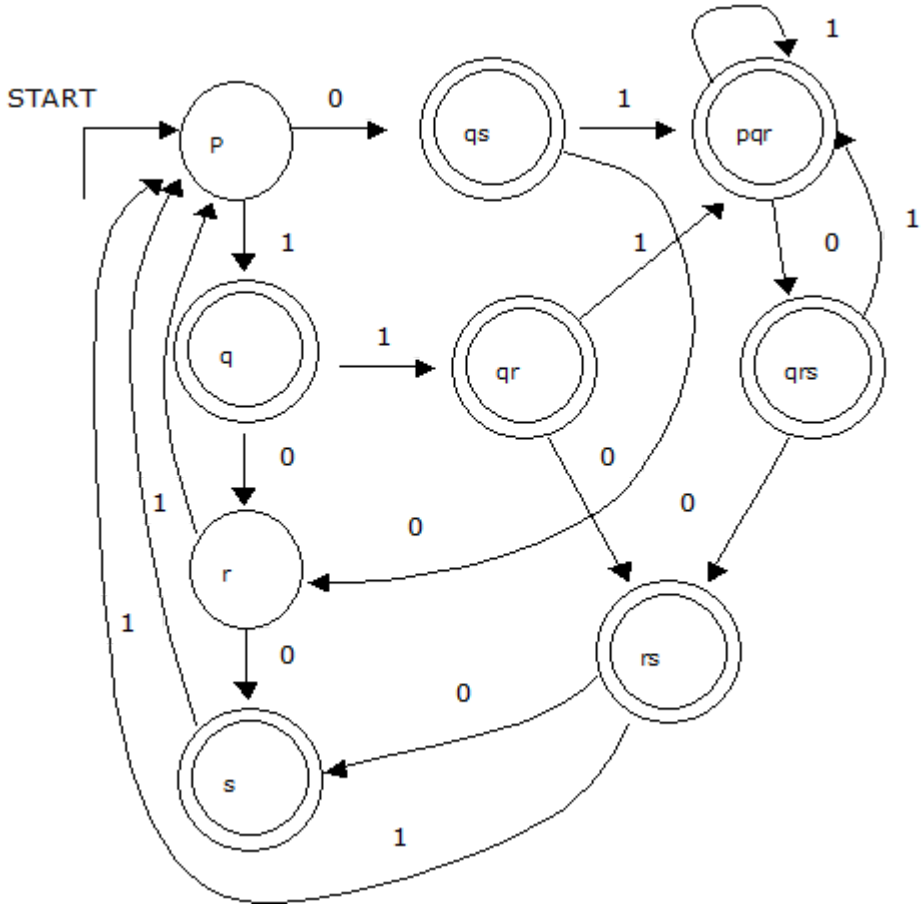
**A)**




**B)**




**C)** Both are Possible

**D)** None of above

Top

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

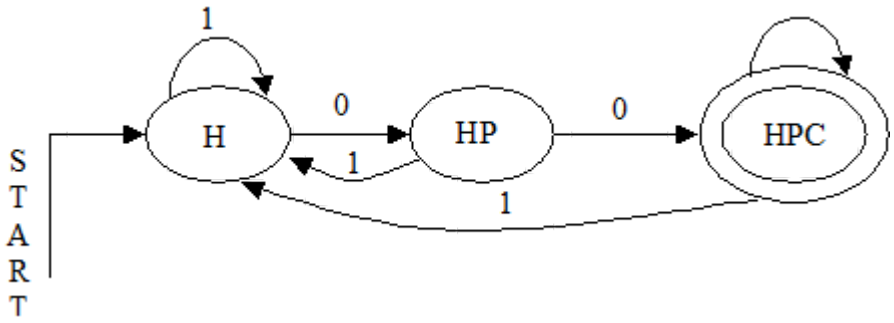
Explanation

Type: MCQ Marks: 1

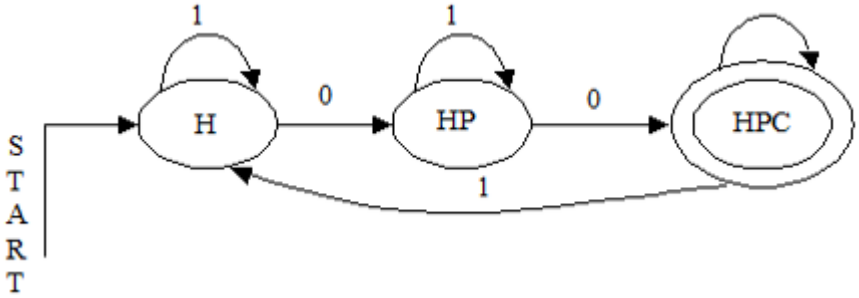
★★★★★

**31)** Give DFA accepting the following language are {0, 1} The set of all strings ending in 00

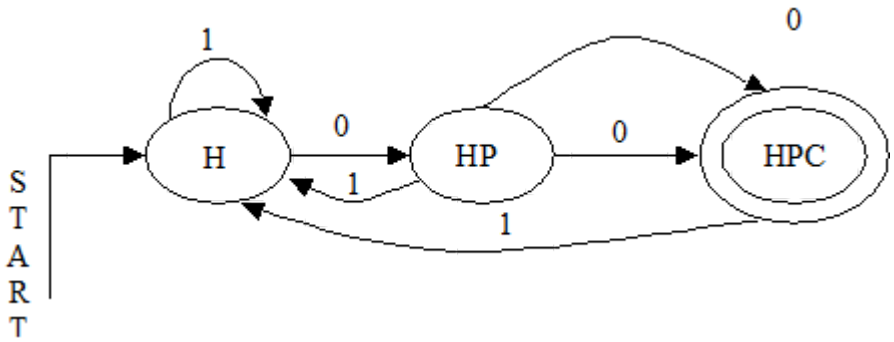
**A)**




**B)**




**C)**




**D)** None of the above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

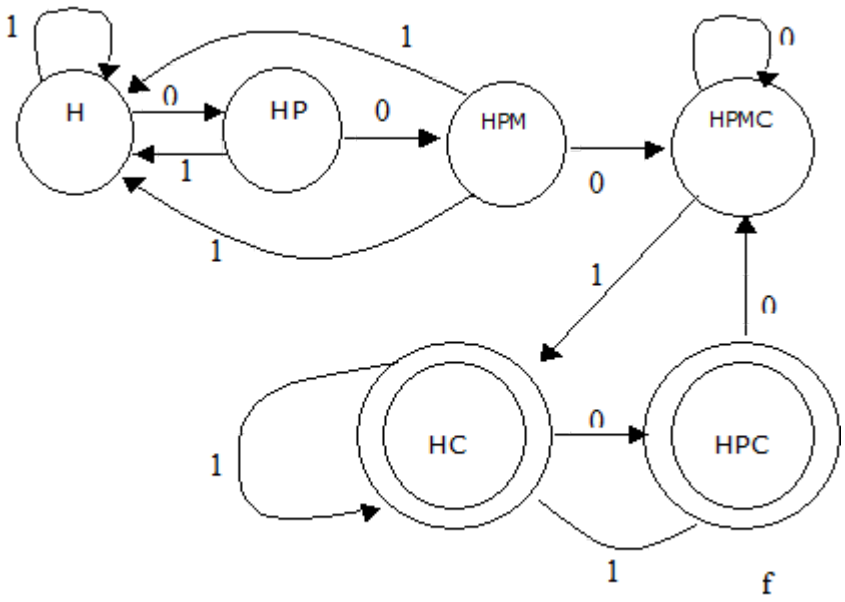
Type: MCQ Marks: 1

Rating: 3.67/5

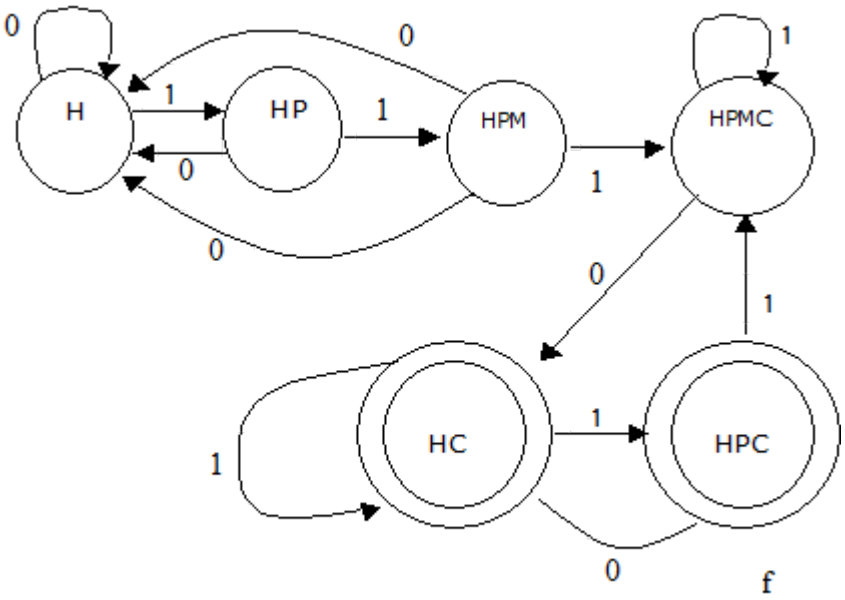
★★★★★

**32)** Give DFA accepting the following languages are {0, 1} The set of all things containing three consecutive 0's Top

**A)**




**B)**




**C)** Both are correct

**D)** None of above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

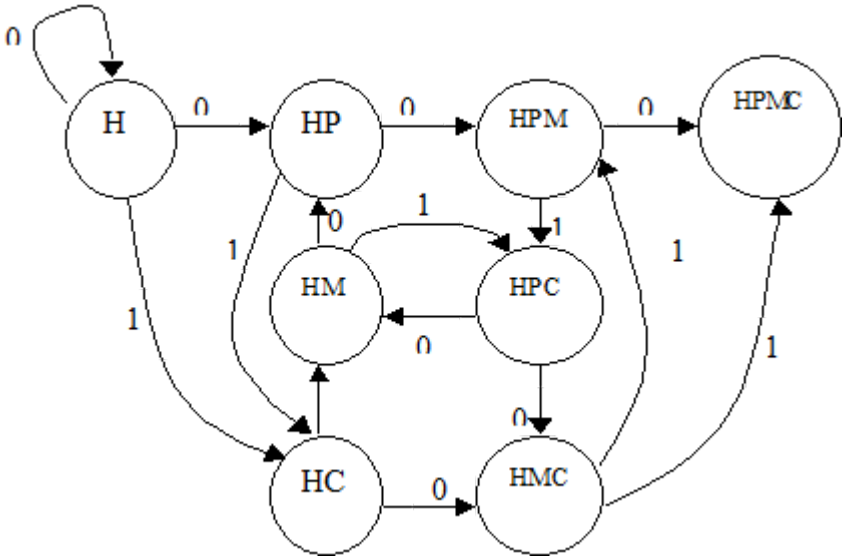
Rating: 3.25/5

★★★★★

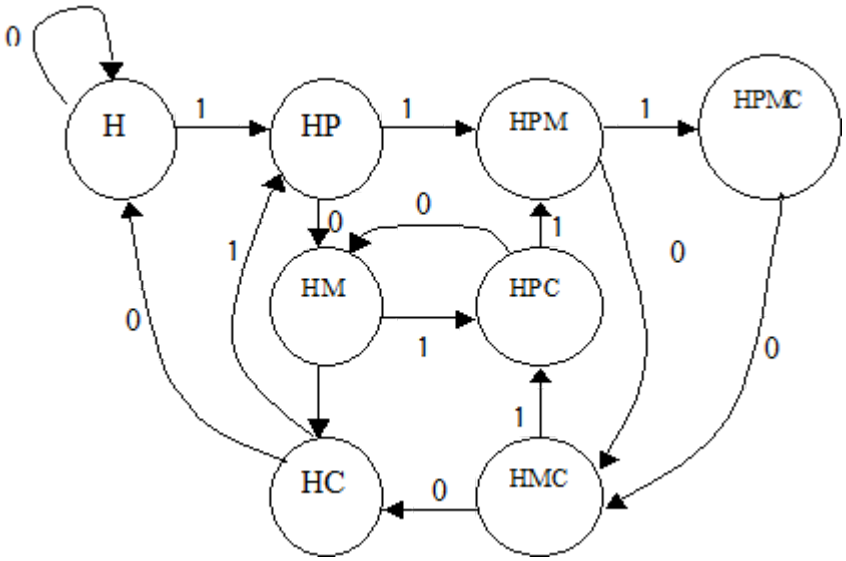
**33)** Give DFA accepting the following languages are {0, 1} The set of all strings where the third symbol from the right end is a 1.

Top

**A)**




**B)**




**C)** Both are correct

**D)** None of above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: NAT Marks: 2

★★★★★

**34)** The set of all strings where the tenth symbol from the right end is a 1. How many no. of states in DFA

1024

Backspace

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| | | |
|---|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |
| 0 | . | - |
| << | >> | |
| Clear All | | |

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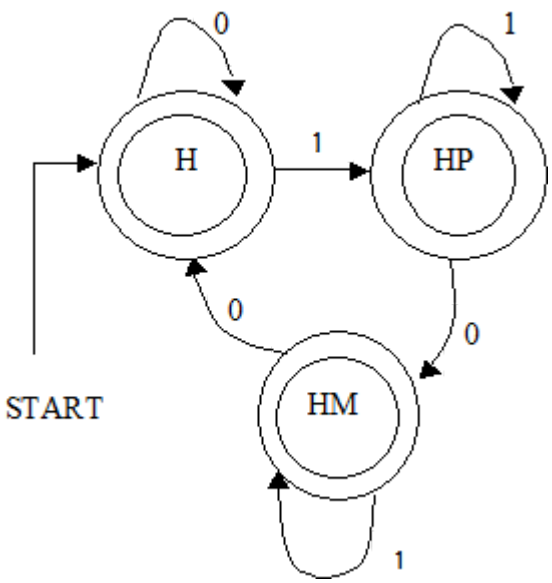
Explanation

Type: MCQ Marks: 1

★★★★★

**35)** Give DFA accepting the following languages are (0, 1) The set of all strings not containing 101 as a substring

**A)**

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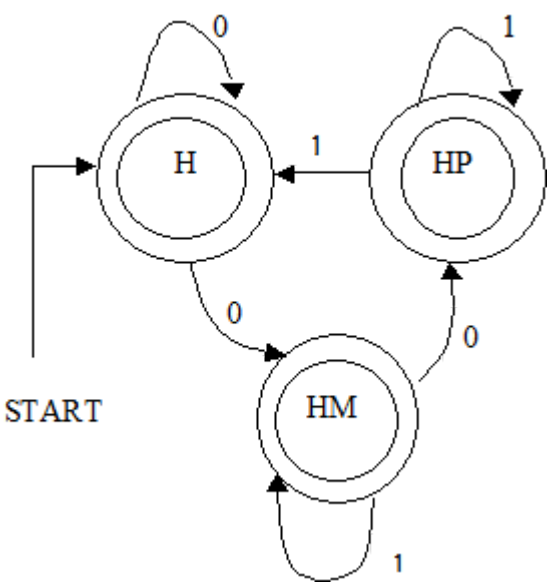
**B)**




**C)** Either A or B

**D)** None of the above

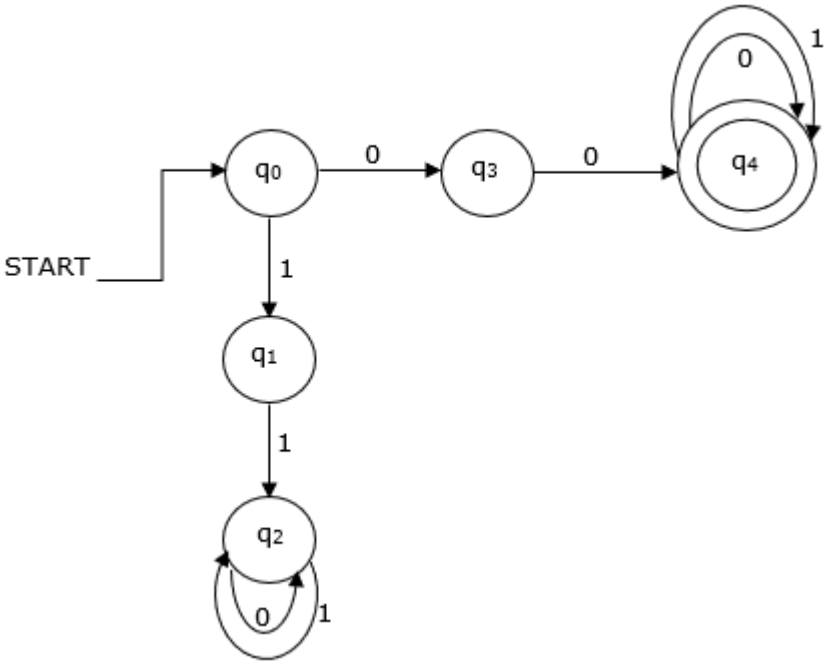
◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 2

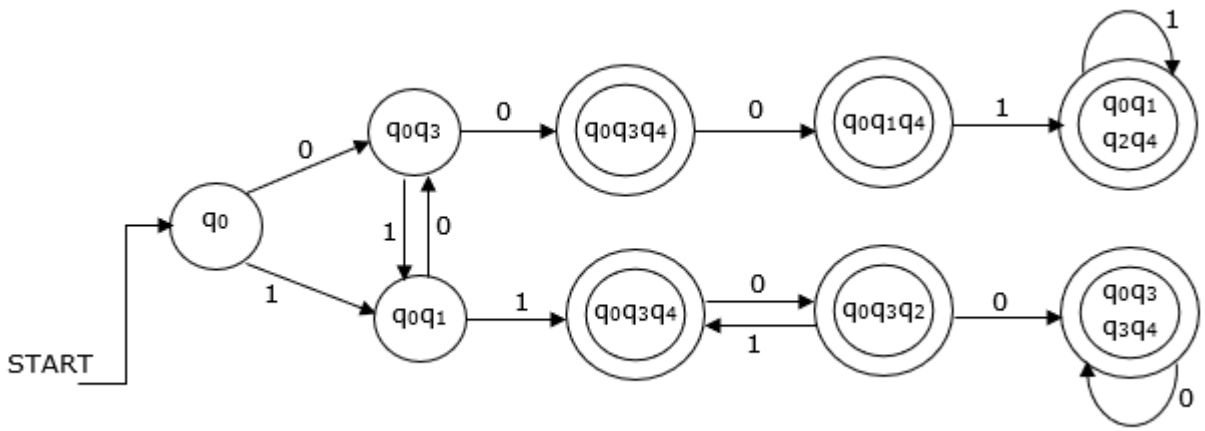
Rating: 5/5 ★★★★★

**36)** Convert following NFA to DFA:

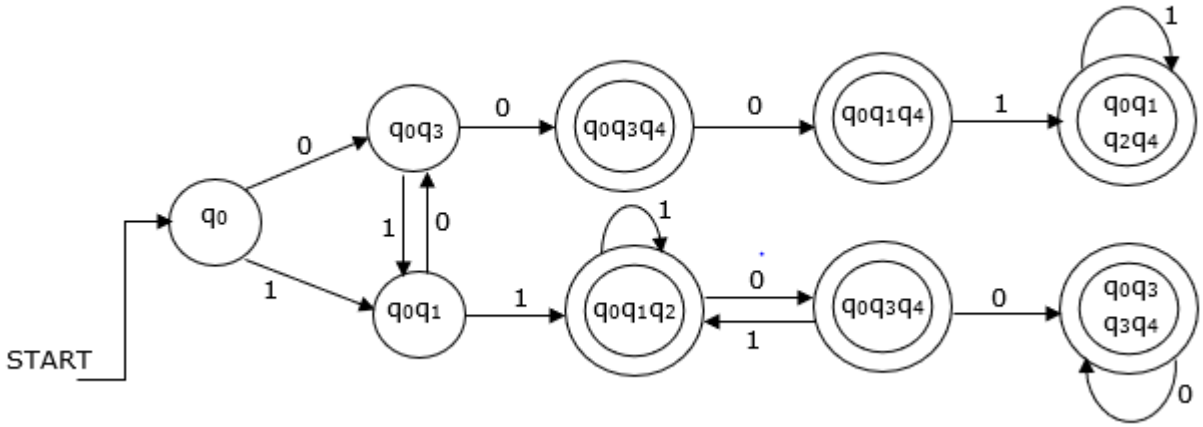



Top

**A)**




**B)**




**C)** Either A or B

**D)** None of above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

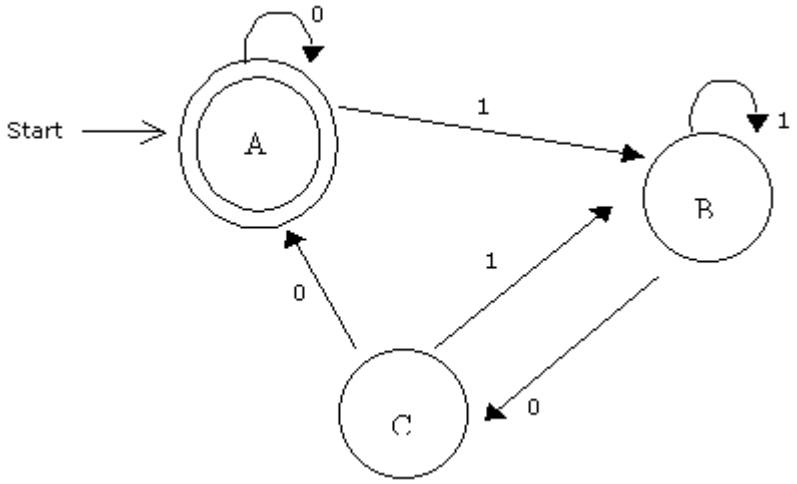
Explanation

Type: MCQ Marks: 1

★★★★★

Top

**37)** Construct regular expression corresponding to the state diagram




**A)** 1 * + (0*1)*10*

**B)** 0 * + (0*1)*000*

**C)** 0 * + (0*1)*010*

**D)** None of the above

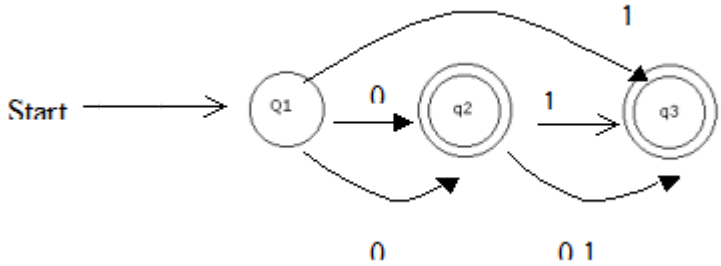
○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**38)** Construct regular expression corresponding to the state diagram




**A)** 0 + (0 + 01 + 11) [00 + (01 + 1) (0 + 1)*]*[1 + 01]

**B)** 1 + (0 + 10 + 11) [ 00 + (01 + 1) (0 + 1)*]*[ ε+ 1 + 01 ]

**C)** 1 + (1 + 10 + 00) [ 00 + (01 + 1) (0 + 1)*]*[ ε + 1 + 11 ]

**D)** None of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

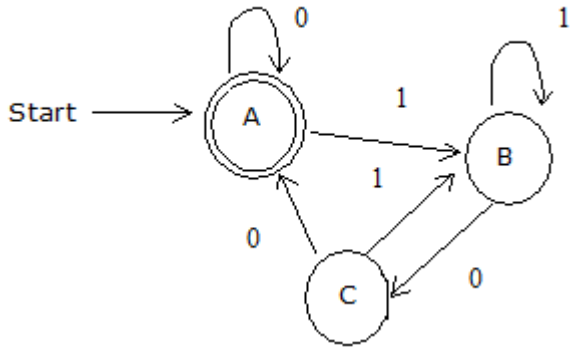
Explanation

Top

Type: MCQ Marks: 1

★★★★★

**39)** Construct regular expression corresponding to the state diagram.




**A)** [0 + 1 (1 + 01)* 00]*

**B)** [1 + 0 (0 + 10)* 11]*

**C)** [0 + 1 (01 + 0)* 00]*

**D)** None of the above

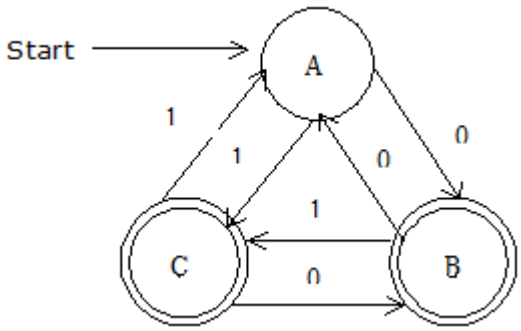
◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**40)** Construct regular expression corresponding to the state diagram.




**A)** 0*1(11)*[(10+0)0*1(11)*]* + 1*0(00)*[(01+1)1* 0(00)*]*

**B)** 0*1(11)*[(11+0)0*1(11)*]* + 1*0(00)*[(00+1)1* 1(00)*]*

**C)** 0*(10)*[(11+1)0*1(11)*]* + 1*0(00)*[(01+1)1* 0(00)*]*

**D)** None of the above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

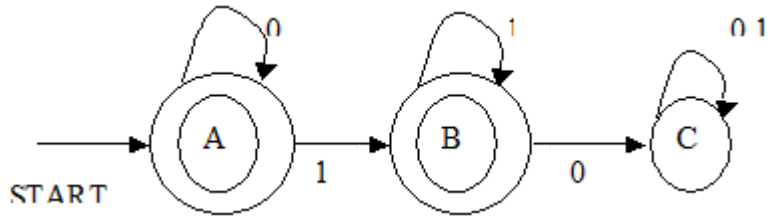
Explanation

Top

Type: MCQ Marks: 1

★★★★★

**41)** Construct regular expression corresponding to the state diagram




**A)** 0*10

**B)** 0*1

**C)** 10*111

**D)** None

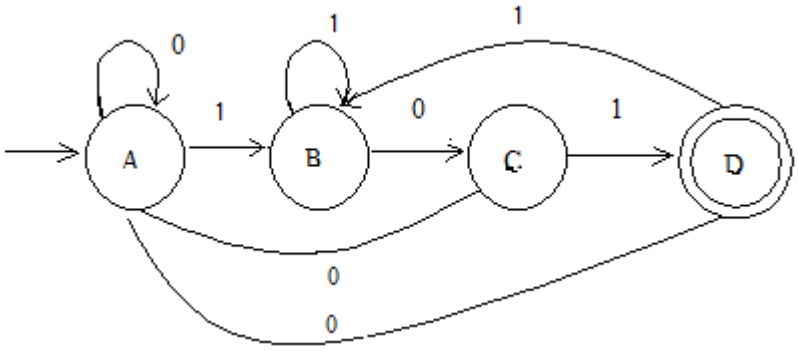
○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**42)** Construct regular expression corresponding to the state diagram




**A)** 0* 1[(11 + 010) 0* 1 (1 + 001)]* 10

**B)** 0* 1[(00 + 010) 0* 1 (1 + 011)]* 01

**C)** 0* 1[(11 + 010) 0* 1 (1 + 011)]* 01

**D)** None of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

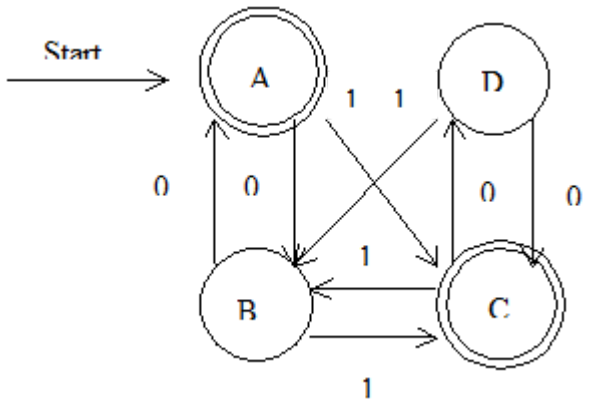
Explanation

Type: MCQ Marks: 1

★★★★★

Top

**43)** Construct regular expression corresponding to the state diagram




**A)** [11 + (1 + 10) (11 + 00 + 100)* (0 + 10) 1]*[ ε (0 + 10) . (11 + 00 + 100)*]

**B)** [00 + (1 + 01) (00 + 11 + 011)* (1 + 01) 0]*[ ε (1 + 01) . (00 + 11 + 011)*]

**C)** [11 + (1 + 01) (11 + 00 + 011)* (1 + 01) 0]*[ ε (1 + 01) . (00 + 11 + 011)*]

**D)** None of above

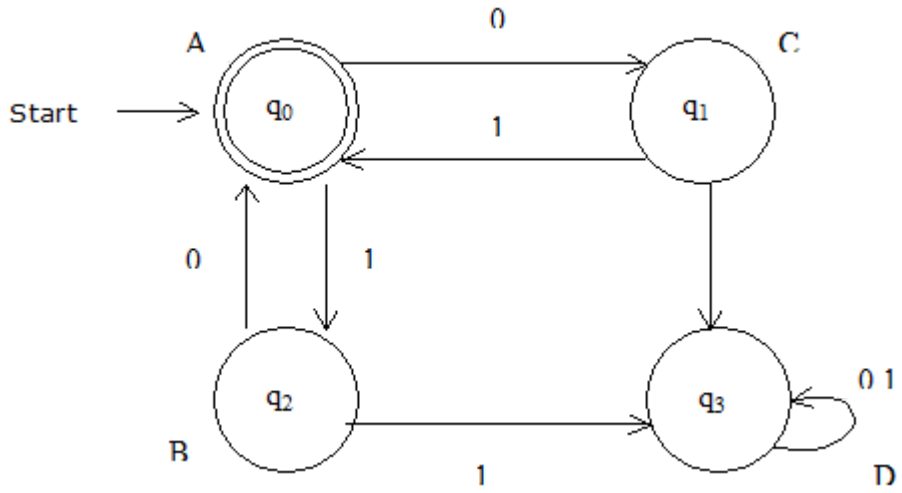
○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**44)** Construct regular expression corresponding to the state diagram




**A)** (11 + 00)*

**B)** (01 + 10)*

**C)** (10 + 01)*

**D)** None of the above

Top

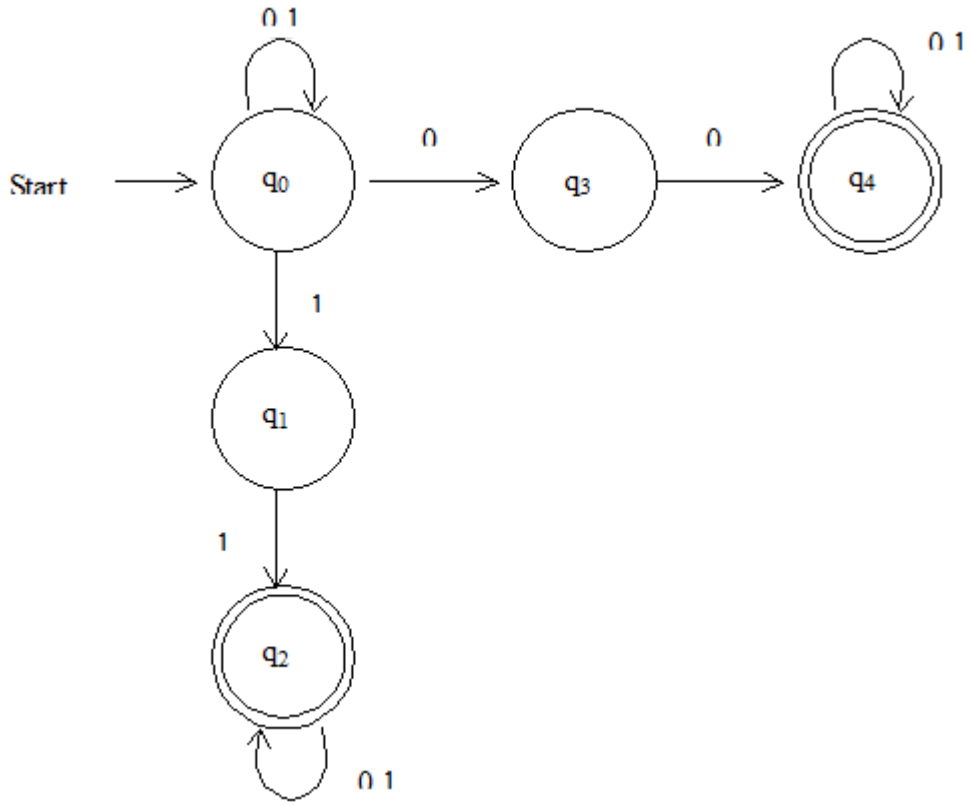
○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**45)** Construct regular expression corresponding to the state diagram




**A)** (0 + 1)* 11 (0 + 1)* + (0 + 1) 11 (0 + 1)*

**B)** (0 + 1)* 00 (0 + 1)* + (0 + 1) 00 (0 + 1)*

**C)** (0 + 1)* 00 (0 + 1)* + (0 + 1) 00 (0 + 1)*

**D)** (0 + 1)* 00 (0 + 1)* + (0 + 1) 11 (0 + 1)*

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**46)** Give regular expression for the following language over {0, 1}.
The set of all strings ending in 00

**A)** (0 + 1)* 00 (0 + 1)*

**B)** (0* + 1*)* 00

Top

**C)** (0 + 1)* 00

**D)** (01)* 00

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**47)** Give regular expression for the following language over {0, 1} The set of all strings containing three consecutive 0's

**A)** (0 + 1)* 000 (0 + 1)*00

**B)** (0 + 1)* 000 (0 + 1)*

**C)** 111(0 + 1)* 000 (0 + 1)*

**D)** (0 + 1)* 000 (01)*

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**48)** Give regular expression for the following language over {0, 1}. The set of all strings where the $10^{th}$ symbol from the right end is a 1

**A)** (0 + 1)* 1 (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1)

**B)** (0 + 1)* 01 (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1)

**C)** (0 + 1)* 1 (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1) (0 + 1)*

**D)** None of above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**49)** Give regular expression for the following language over {0, 1}. The set of all strings not containing 101 as a string

**A)** $(1 + 1^{+}00)^{*} (0^{*} + 1^{+}0)$

**B)** $(0 + 1^{+}00)^{*} (1^{*} + 1^{+}0)$

**C)** $(0 + 1^{+}00)^{*} (1^{*} + 1^{+}0)$

Top

**D)** $(0 + 0^{+}01)^{*} (0^{*} + 01^{+})$

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**50)** Give Regular expression for the following languages over {0, 1}. The set of all strings where every pair of adjacent 0's occurs before any pair of adjacent 1's

**A)** $(0 + 11)^{*} (0 + 10)^{*}$

**B)** $(0 + 10)^{*} (1 + 10)^{*}$

**C)** $(0 + 10)^{*} (0 + 11)^{*}$

**D)** $(1 + 00)^{*} (1 + 10)^{*}$

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**51)** Give Regular expression for the following languages over {0, 1}. The set of all strings with an equal number of 0's and 1's such that no prefix has two more 0's than 1's nor two more 1's than 0's

**A)** $(01 + 10)^{*}$

**B)** $(10 + 01)^{*}$

**C)** $(01 + 10)^{*}111$

**D)** None of above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

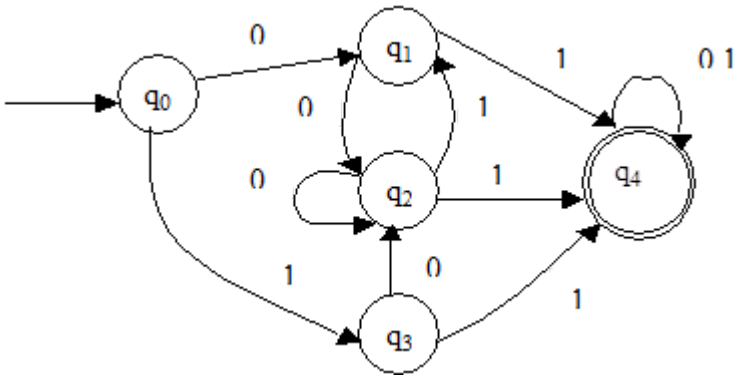
Explanation

Type: NAT Marks: 2

★★★★★

Top

**52)** How many states are there are in minimized DFA of the following DFA.

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Clear All

Submit ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**53)** Describe in English the sets accepted by the following regular expressions (11)*

**A)** Even no. of 1's

**B)** Odd no of 1's

**C)** Both are possible odd & even

**D)** None of above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Top

Type: MCQ Marks: 1

★★★★★

**54)** Describe in English the sets accepted by the following regular expressions

(1 + 01) (001)* (ε + 0 + 00)

**A)** The set of all string over {0, 1} containing three consecutive 0's

(0 + 1)* 000 (0 + 1)*

**B)** The set of all string over {0, 1} not containing three consecutive 0's

(0 + 1)* 000 (0 + 1)*

**C)** The set of all string over {0, 1} not containing three consecutive 1's

(0 + 1)* 000 (0 + 1)*

**D)** None of the above.

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**55)** Describe in English the sets accepted by the following regular expressions

[00 + 11 + (01 + 10) (00 + 11)* (01 + 10)]*

**A)** Set of all strings over {0, 1} with an even no. of 0's and an even no. of 1's

**B)** Set of all strings over {0, 1} with an odd no. of 0's and an odd no. of 1's

**C)** Set of all strings over {0, 1} with an odd no. of 0's and an even no. of 1's

**D)** None of above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

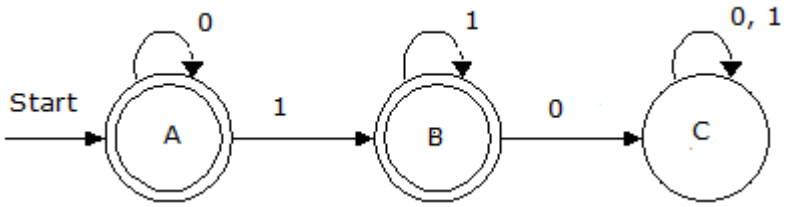
Type: MCQ Marks: 1

Rating: 4.67/5

★★★★★

Top

**56)** Describe in English the sets acceptable by the fig. Where dia. are given




**A)** The set of all strings over {0, 1} with avg. no. of 0's followed by avg. no. of 1's

**B)** The set of all strings over {0, 1} with any no. of 0's followed by any no. of 1's

**C)** The set of all strings over {0, 1} with any no. of 0's followed by avg no. of 1's

**D)** The set of all strings over {0, 1} with avg. no. of 0's followed by any no. of 1's

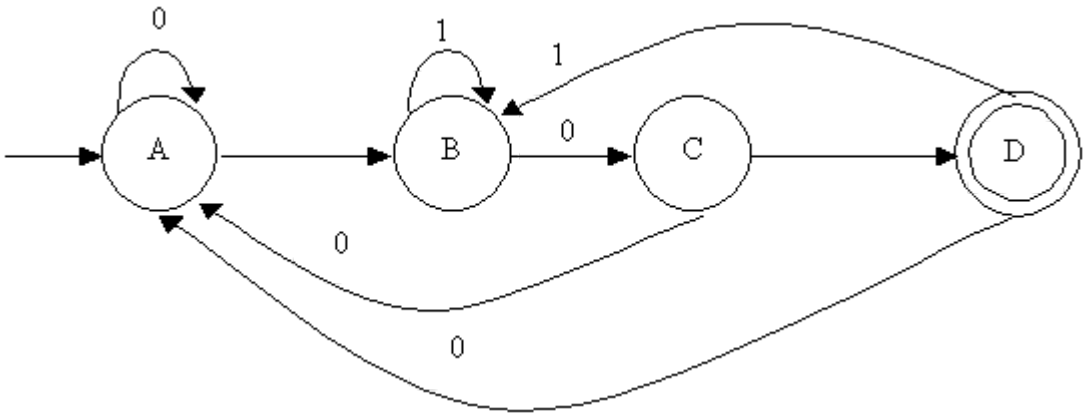
○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**57)** Describe in English the sets acceptable by the fig. Where dia. are given




**A)** The set of all strings containing one or more repetition of set of all strings ending in 111 and having only one Occurrence of 101

**B)** The set of all strings containing one or more repetition of set of all strings ending in 101 and having only one Occurrence of 101

**C)** The set of all strings containing one or more repetition of set of all strings ending in 101 and having only one Occurrence of 110

**D)** None of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Top

Type: MCQ Marks: 1

★★★★★

**58)** Write a regular expression for the following set

The set of all strings with at most one pair of consecutive 0's and of most one pair of consecutive 1's

**A)** $\overline{(0+1)^*00(0+1)^*00(0+1)^*}\,/\,01(0+1)^*11(0+1)^*11(0+1)^*$

**B)** $\overline{(0+1)^*00(0+1)^*11(0+1)^*}\,/\,01(0+1)^*11(0+1)^*00(0+1)^*$

**C)** $\overline{(0+1)^*11(0+1)^*11(0+1)^*}\,/\,01(0+1)^*00(0+1)^*00(0+1)^*$

**D)** None of the above.

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**59)** Write a regular expression for the following set

The set of all strings are {0, 1} where every block of five consecutive symbols contains at least 2 0's

**A)** $\overline{[(0+1)(0+1)(0+1)(0+1)(0+1)]^*}\,/\,[(0+1)(0+1)(0+1)(0+1)(0+1)]^*$

**B)** $\overline{[(0+1)(0+1)(0+1)(0+1)(0+1)]^*r}\,/\,[(0+1)(0+1)(0+1)(0+1)(0+1)]^*$

**C)** $\overline{[(0+1)(0+1)(0+1)(0+1)(0+1)]^*rrr}\,/\,[(0+1)(0+1)(0+1)(0+1)(0+1)]^*$

**D)** None of above.

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

Top

**60)** Write a regular expression for the following set.The set of all strings over {0, 1} beginning with 01. which interpreted the binary representation of an integer is congruent to zero module 5

**A)** 1 (1 (11* 0*)* 11* 11 10*

**B)** 1 (0 (11* 0*)* 11* 10 10*

**C)** 1 (0 (11* 0*)* 00* 11 10*

**D)** None of the above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**61)** Time spent for FA minimization is

**A)** $O(kn^3)$

**B)** $O(kn^2)$

**C)** $O(n^2)$

**D)** None of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

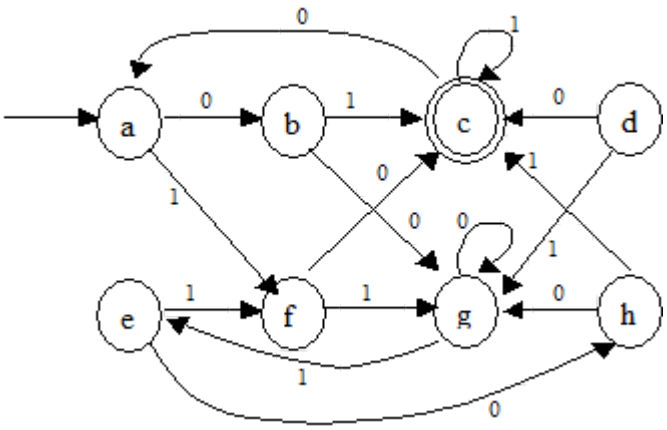
Explanation

Type: NAT Marks: 2

★★★★★

Top

**62)** State the minimum no of states in minimul DFA for following DFA

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Clear All

Submit ✔ Share Mark IMP Raise Query

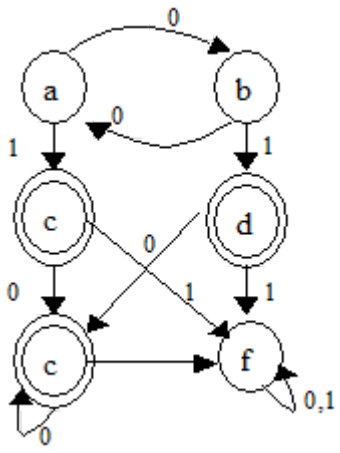
Explanation

Type: NAT Marks: 2

★★★★★

Top

**63)** Find the minimum no of states in minimal states in for following DFA.

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Clear All

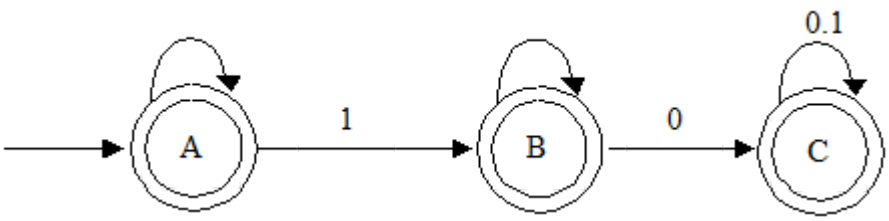
Submit Explanation Share Mark IMP Raise Query

Type: NAT Marks: 2

Rating: 3.5/5

★★★★★

**64)** Find the minimum no. of states in minimal states DFA for following DFA.

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Clear All

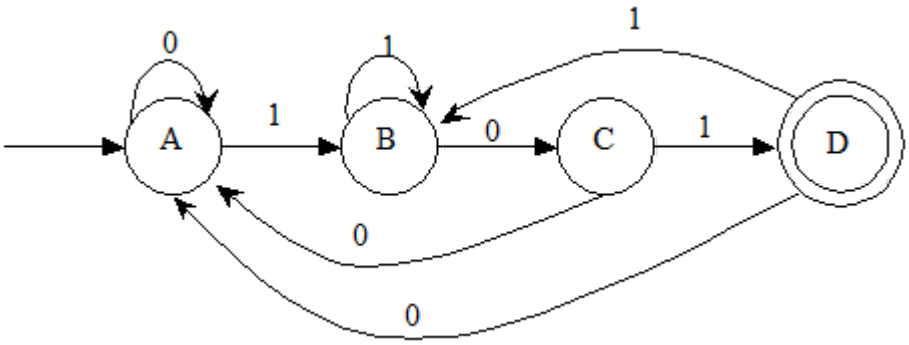
Submit ✔ Share Mark IMP Raise Query

Explanation

Type: NAT Marks: 2

Rating: 4/5 ★ ★ ★ ★ ★

**65)** Find the minimum no. of states in minimal states DFA for following DFA.

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Top

Clear All

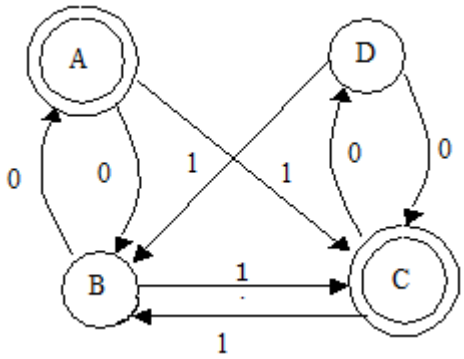
Submit ✔ Share Mark IMP Raise Query

Explanation

Type: NAT Marks: 2

★★★★★

**66)** Find the minimum no. of states in minimal states DFA for following DFA.

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Clear All

Submit ✔ Share Mark IMP Raise Query

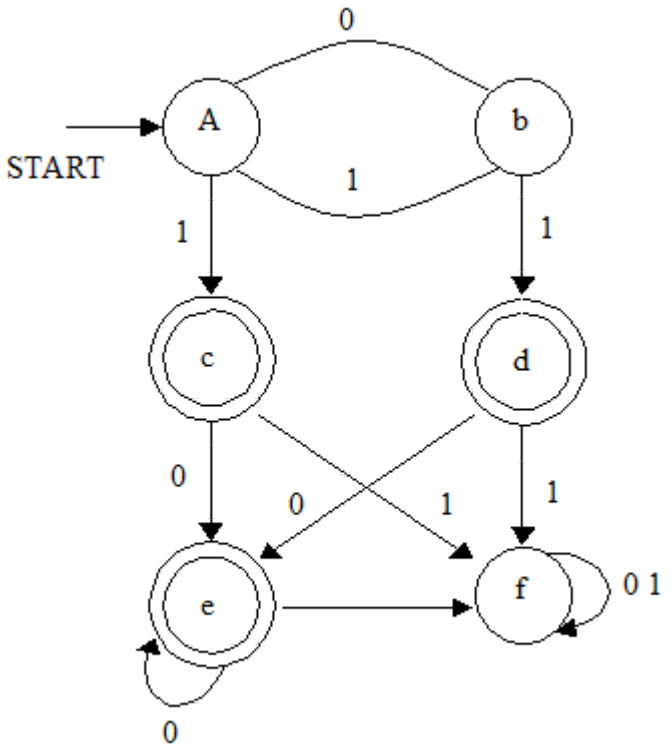
Explanation

Type: NAT Marks: 2

★★★★★

Top

**67)** Find the minimum no. of states in minimal states DFA for following DFA.

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Clear All

Submit ✔ Share Mark IMP Raise Query

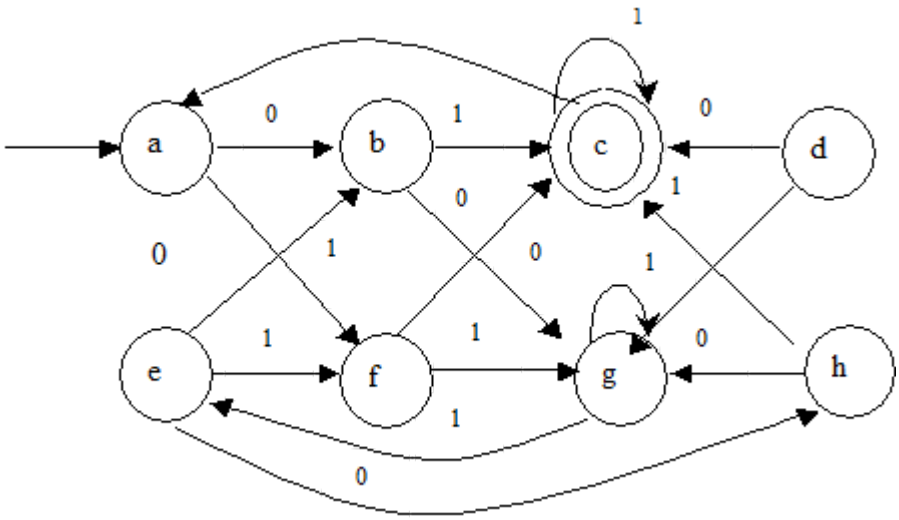
Explanation

Type: NAT Marks: 2

★★★★★

Top

**68)** Find the minimum no. of states in minimal states DFA for following DFA.

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Clear All

Submit ✔ Share Mark IMP Raise Query

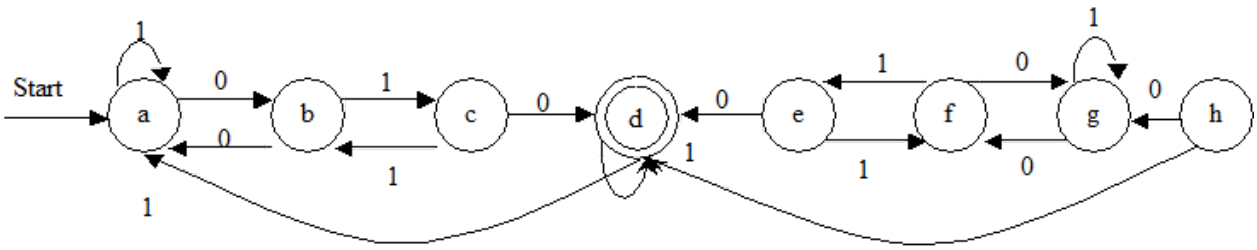
Explanation

Type: NAT Marks: 2

★★★★★

Top

**69)** Find the minimum no. of states in minimal states DFA for following DFA.

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Clear All

Submit ✔ Share Mark IMP Raise Query

Explanation

Type: NAT Marks: 1

★★★★★

**70)** The minimal FA accepting set of all strings over {0, 1} that end in 00 has

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| 4 | 5 | 6 |
| 1 | 2 | 3 |

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Clear All

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Explanation

Type: MCQ Marks: 1

★★★★★

**71)** The minimal FA accepting Set of all strings over {0, 1} containing 3 consecutive 0's

**A)** 3 states

**B)** 5 states

**C)** 4 states

**D)** None

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**72)** The smaller FA that accept the language {x| length of x divisible by 3} how many states?

**A)** 2 states

**B)** 4 states

**C)** 3 states

**D)** 5 states

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

Top

**73)** Given an arbitrary NFA with N states, the maximum number of states in an equivalent minimized DFA is at least

**A)** $N^2$

**B)** $2^N$

**C)** N

**D)** N!

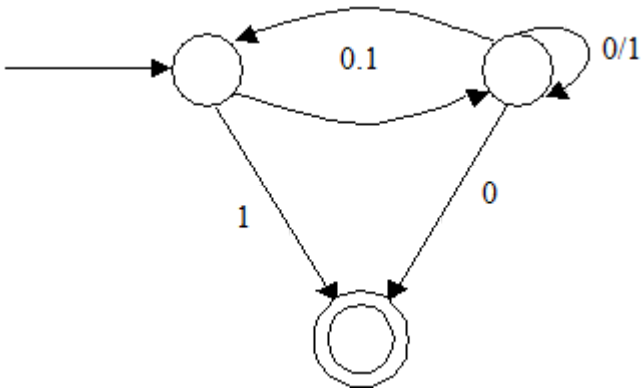
○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**74)** Consider the NFA M shown below




Language accepted by M be L. Let $L_1$ be the language accepted by the NFA $M_1$, obtained by changing non-accepting states of M to accepting states. Which of the following statements is true?

**A)** $L_1 = \{0, 1\}^* - L$

**B)** $L_1 = \{0, 1\}^*$

**C)** $L_1 \subseteq L$

**D)** $L_1 = L$

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

Top

**75)** The word 'formal' in formal languages means

**A)** The symbols used have well-defined meaning

**B)** Only the form of the string of symbols is significant

**C)** They are unnecessary, in reality

**D)** None of the above

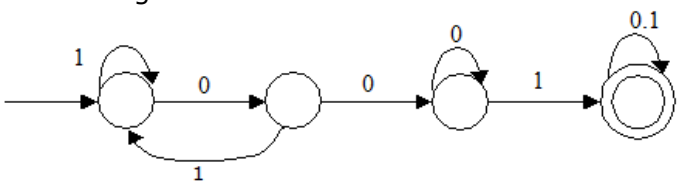
○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: NAT Marks: 2

★★★★★

**76)** Consider the following Deterministic finite state automaton M.




Let S denote the set of seven bit binary strings in which the first, the fourth, and the last bits are 1, The number of strings in S that are accepted by M is

7

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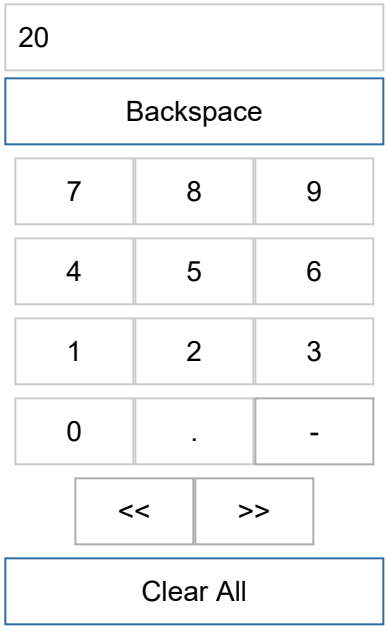
Explanation

Type: NAT Marks: 1

★★★★★

Top

**77)** How many two state FA can be drawn over alphabet {0, 1}, which accepts empty language?

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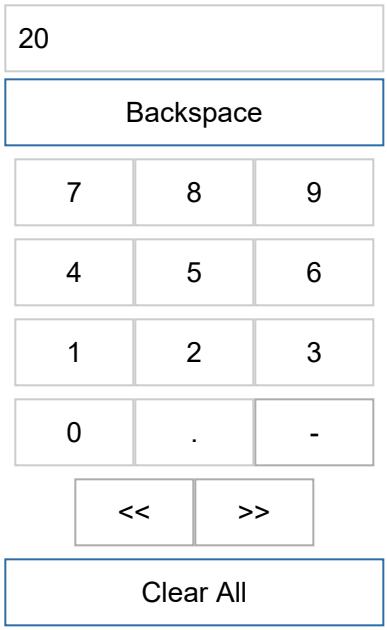
Explanation

Type: NAT Marks: 1

★★★★★

**78)** How many two state FA can be drawn over alphabet {0, 1}, which accepts (0 + 1)*

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Top

Explanation

Type: NAT Marks: 1

★★★★★

**79)** How many DFA's exist with two states over the input alphabet {0, 1}.

64

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Explanation

Type: NAT Marks: 2

★★★★★

**80)** How many DFA's exist with three states over the input alphabet {0, 1}.

5832

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Explanation

Type: MCQ Marks: 1

★★★★★

**81)** The recognizing capabilities of NDFSM and DFSM

**A)** may be different

**B)** must be same

**C)** must be different

**D)** none of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: NAT Marks: 1

★★★★★

**82)** What is the minimum number of states of the NFA which accepts the language {ab : $ab^n$ : n ≥ 0} U {a b $a^n$ : n ≥ 0}

3

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Explanation

Top

Type: NAT Marks: 2

★★★★★

**83)** What are the minimum number of states in the NFA accepting the language {ab, abc}*?

2

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Explanation

Type: MCQ Marks: 1

★★★★★

**84)** The basic limitation of FSM is that

**A)** It can't remember arbitrary large amount of information

**B)** It sometimes fails to recognize grammars that are regular

**C)** It sometimes recognizes grammars that are not regular

**D)** All of the above comments are true

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

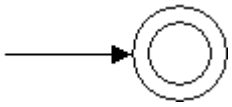
Explanation

Type: MCQ Marks: 1

★★★★★

Top

**85)** The FSM pictured below recognizes



**A)** all strings

**B)** no string

**C)** ε- alone

**D)** None of the above

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**86)** The number of states of the FSM, required to simulate the behaviour of a computer, with a memory capable of storing 'm' words, each of length 'n' bits is

**A)** $m \times 2^n$

**B)** $2^{mn}$

**C)** $2^{m+n}$

**D)** None of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**87)** Which of the following regular expression identities are true?

**A)** r(*) = r*

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

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

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

Top

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**88)** Which of the following regular expressions over {0, 1} denotes the set of all strings not containing 100 as a substring?

**A)** 0*(1 + 0)*

**B)** 0*1*01

**C)** 0*1010*

**D)** 0*(10 + 1)*

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**89)** The string 1101 does not belong to the set represented by

**A)** 110*(0 + 1)

**B)** (10)*(01)*(00 + 11)*

**C)** 1(0 + 1)*101

**D)** (00 + (11)*0)*

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**90)** Let r = 1(1 + 0)*, s = 11*0 and t = 1*0 be three regular expressions. Which one of the following is true?

**A)** L(s) ⊆ L(r) and L(s) ⊆ L(t)

**B)** L(s) ⊆ L(r) and L(s) ⊆ L(t)

**C)** L(r) ⊆ L(s) and L(s) ⊆ L(t)

**D)** L(t) ⊆ L(s) and L(s) ⊆ L(r)

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Top

Type: MCQ Marks: 1

★★★★★

**91)** Two of the following four regular expression are equivalent which of two? (ε is the empty string)
i) (00)*( ε + 0) ii) (00)* iii) 0* iv) 0(00)*

**A)** i and ii

**B)** i and iii

**C)** ii and iii

**D)** iii and iv

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**92)** If the regular set 'A' represented by A = (01 + 1)* and the regular set 'B' is represented by B = ((01)*1*)* which of the following is true?

**A)** A ⊆ B

**B)** A and B are in comparable

**C)** B ⊆ A

**D)** A = B

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**93)** Let 'S' and 'T' be languages over Σ = {a, b} represented by the regular expression (a + b*)* and (a + b)*

**A)** S ⊂ T

**B)** S = T

**C)** T ⊂ S

**D)** S ∩ T = Ø

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Top

Type: MCQ Marks: 1

★★★★★

**94)** The regular expression 0*(10*)* denotes the same set as

**A)** (1*0)*1*

**B)** 0 + (0 + 10)*

**C)** (0 + 1)*10(0 + 1)*

**D)** none of the above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**95)** Consider the following regular expressions
i) (a/b)* ii) (a*/b*)* iii) ((ε/a)b*)*
Which of the following statements is correct?

**A)** (i), (ii) are equal and (ii), (iii) are not

**B)** (i), (ii) are equal and (i), (iii) are not

**C)** (ii), (iii) are equal and (i), (ii) are not

**D)** all are equal

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: NAT Marks: 2

★★★★★

**96)** How many stings of length less than 4 contains the language described by the regular expression (a + b)*b (a + ab)*.

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Explanation

Type: MCQ Marks: 1

★★★★★

**97)** Which of the following is true ?

**A)** (ab)*a = a(ba)* and (P*Q*)* = (p* + Q*)*

**B)** (a + b)*ab[(a + b)*ab(a + b)* + b*a*] + b*a* = (a + b)*

**C)** (a + b)*ab(a + b)* + b*a* = (a + b)*

**D)** all of the above

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**98)** Which of the following is false?

**A)** (a*b)*a* = a*(ba*)*

**B)** (a*bbb)*a* = a*(bbba*)*

**C)** (a)*( ε + a) = a*a

**D)** Let R, S and T be three languages and assume that ε is not in S. Then from the premise R = SR + T we can conclude that R = S*T and from the premise R = S*T we can conclude that R = SR + T

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

Top

★★★★★

**99)** Consider the following 2-DFA ($\{q_0, ....., q_5\}$, $\{0,1\}$, $\delta$, $q_0$, $\{q_2\}$), where $\delta$ is

| | 0 | 1 |
|---|---|---|
| $q_0$ | $(q_0, R)$ | $(q_1, R)$ |
| $q_1$ | $(q_1, R)$ | $(q_2, R)$ |
| $q_2$ | $(q_2, R)$ | $(q_3, L)$ |
| $q_3$ | $(q_4, L)$ | $(q_3, L)$ |
| $q_4$ | $(q_0, R)$ | $(q_4, L)$ |

Which of the following strings is accepted by the above FA?

**A)** 1100011001000

**B)** 1000001110000

**C)** 1100000000111

**D)** 1100001100110

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**100)** Choose the incorrect statement

**A)** Moore and Melay machines are FSM 's with output capability

**B)** Any given Melay machine has an equivalent Moore machine.

**C)** Any given Moore machine has an equivalent Melay machine

**D)** Moore machine is not a FSM.

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**101)** The major difference between a Moore and Melay machine is that

**A)** The output of the former depends on the present state and present input

**B)** The output of the former depends only on the present state

**C)** The output of the former depends only on the present input

Top

**D)** None of the above

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**102)** An FSM with output capability can be used to add two given integers in binary representation.This is

**A)** True

**B)** False

**C)** May be true

**D)** None of the above

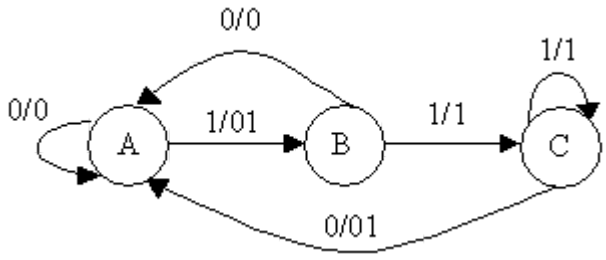
◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**103)** The finite state machine described by the following state diagram with A as starting state , where an arc label is x/y and x stands for 1-bit input and y stands for 2-bit output.




**A)** outputs the sum of the present previous bits of the input.

**B)** outputs 00 whenever input sequence contains 10.

**C)** outputs 01 whenever input sequence contains 11

**D)** none of the above

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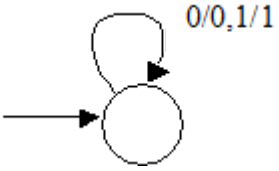
◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

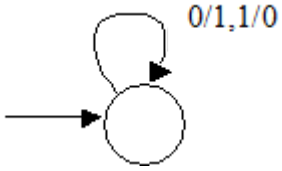
Explanation

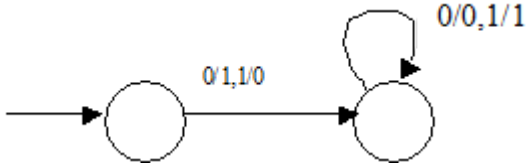
Type: MCQ Marks: 1

★★★★★

**104)** Let $(Me)^2$ mean that given a Mealy machine, an input string is processed and then the output string is immediately fed into the machine (as input) and reprocessed. Only this second resultant output is considered the final output of $(Me)^2$. If the final output string is the same as the original input string, we say that $(Me)^2$ has an identity property. Symbolically, we write $(Me)^2$ = identity. Consider the following machines.

i) 


ii) 


iii) 


Which of the above machines have identity property

**A)** i) and iii) but not ii)

**B)** i) and ii) but not iii)

**C)** i) only

**D)** All have identity property

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

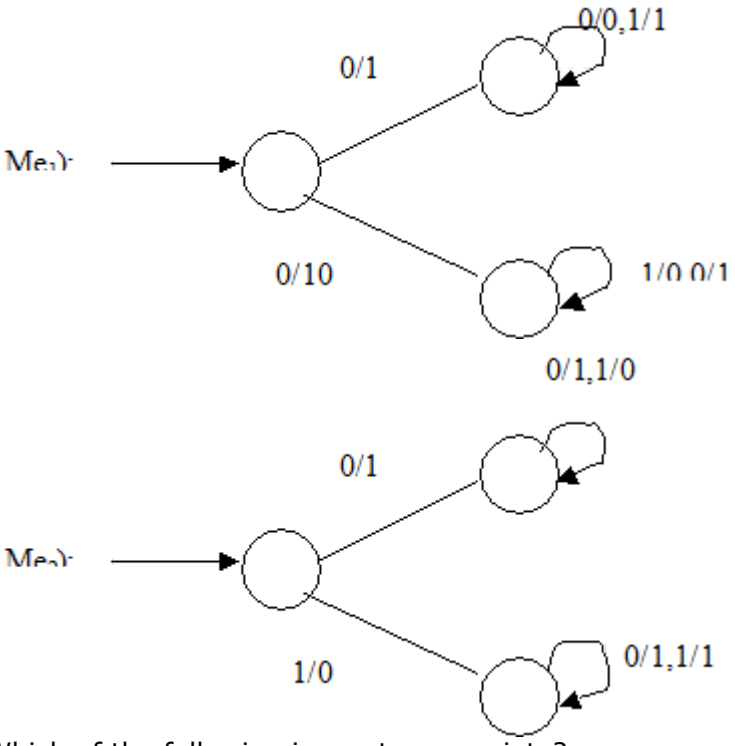
Explanation

Type: MCQ Marks: 1

★★★★★

Top

**105)** Let ($Me_1$) ($Me_2$) mean that an input string is processed on $Me_1$ and then the output string is immediately fed in to $Me_2$(as input) and reprocessed. Only this second resultant output is considered the final output of ($Me_1$) ($Me_2$). If the output string is the same as the original input string, we say that ($Me_2$)( $Me_2Me_2$) has the identity property, symbolically written ($Me_2$) ( $Me_2$) = identity, consider following machines.




Which of the following is most appropriate?

**A)** ($Me_1$ $Me_2$) = ($Me_2$)( $Me_1$)

**B)** ($Me_2$) is the inverse machine of ($Me_1$)

**C)** ($Me_1$) is the inverse machine of ($Me_2$)

**D)** All the above is true

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**106)** Which of the following definitions below generates the same language as L, where L = { $x^n$ $y^n$ such that n > 1}
I. E → xEy/xy
II. xy / ($x^+xyy^+$)
III . $x^+y^+$

**A)** I only

**B)** I and II

**C)** II and III

**D)** II only

Top

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**107)** Choose the correct statements

**A)** A class of languages that is closed under union and complementation has to be closed under intersection

**B)** Union and intersection has to be closed under complementation

**C)** Intersection and complementation has to be closed under union

**D)** All of the above

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 2

★★★★★

**108)** Read the following statements

I. For every NFA with an arbitrary number of final states there is an equivalent NFA with only one final state

II. Regular sets are closed under infinite union.

III. Regular sets are closed under inverse substitution.

Which of the following is true?

**A)** I and III are the only correct statements

**B)** I, II, and III are correct statements

**C)** I is the only correct statement

**D)** None of the above is correct

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Top

Type: MCQ Marks: 1

★★★★★

**109)** Which of the following statement is false?

**A)** if R is regular and N is non-regular there exist R + N, which is regular

**B)** if R is regular and N is non-regular there exist R + N, which is non-regular

**C)** $\{a^n$ / n is not a prime $\}$ is regular.

**D)** if we add a finite set of words to a regular language, the result is regular language

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**110)** Let $R_1$ and $R_2$ be regular sets defined over the alphabet Σ then

**A)** $R_1 \cap R_2$ is not regular

**B)** $\Sigma^* - R_1$ is regular

**C)** $R_1 \cup R_2$ is not regular

**D)** $R_1^*$ is not regular

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**111)** Let Σ = {0, 1}, L = Σ* and R = $\{0^n 1^n$ such that n > 0} then the language L U R and R are respectively?

**A)** Regular, Regular

**B)** Not Regular, Regular

**C)** Regular, Not Regular

**D)** Not Regular, Not Regular

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

Top

**112)** Which of the following statements is false?

**A)** Every finite subset of a non-regular set is regular

**B)** Every finite subset of a regular set is regular

**C)** Every subset of a regular set is regular

**D)** The intersection of two regular sets is regular

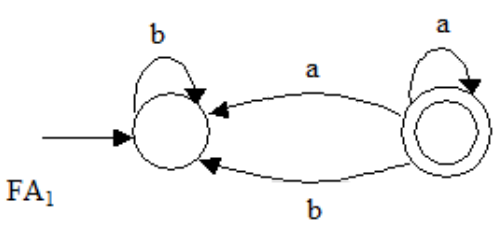
○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

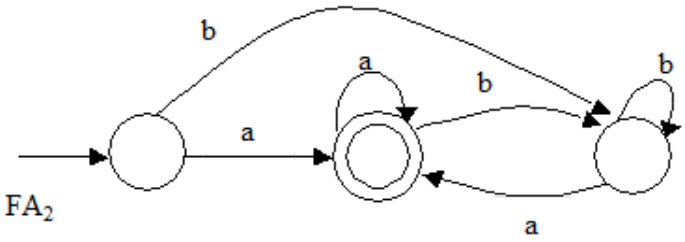
Explanation

Type: MCQ Marks: 1

★★★★★

**113)** Consider the following FA's




Which of the following is true

**A)** FA1 ⊂ FA2

**B)** FA2 ⊂ FA1

**C)** FA1 = FA2

**D)** none of the above

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**114)** Which of the following is regular?

**A)** Strings of 0's whose length is a perfect square

**B)** Set of all palindromes made up of 0's and 1's

**C)** Strings of 0's, whose length is a prime number

**D)** Strings of odd number of zeros

Top

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**115)** Consider the following statements
$S_1$: $\{0^{2n} / n \geq 1\}$ is a regular language
$S_2$: $\{0^m 1^n 0^{m+n} / m \geq 1, n \geq 1\}$ is a regular language

**A)** Only $S_1$ is correct

**B)** Only $S_2$ is correct

**C)** both $S_1$ and $S_2$ are correct

**D)** None of $S_1$ and $S_2$ are correct

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**116)** Which of the following set can be recognized by a DFS Automata?

**A)** The numbers 1,2,4, ..., $2^n$, ..... written in binary

**B)** The set of binary strings in which the number of 0's is same as the number of 1's

**C)** The set {1, 101, 11011, 1110111, ....}

**D)** The numbers 1, 2, 4, ..., $2^n$, ..... written in unary

◉ A ○ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**117)** Let $L \subseteq \Sigma^*$ where $\Sigma = \{a, b\}$. Which of the following is true?

**A)** L = {x/x has an equal number of a's and b's } is regular

**B)** $L = \{a^n b^n / n \geq 1\}$ is regular

**C)** L = {x/x has more a's than b's } is regular

**D)** $L = \{a^m b^n / m \geq 1, n \geq 1\}$ is regular

Top

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**118)** Consider the following languages
$L_1$ = {ww/w ∈ {a, b}*}
$L_2$ = {$ww^R$ /w ∈ (a, b}*, $w^R$ is the reverse of w}
$L_3$ ={$a^n$ $b^n$ / n=0, 1…$10^{20lakh}$}
$L_4$ = {$0^i$/ i is an integer}
Which of the languages are regular?

**A)** Only $L_1$ and $L_2$

**B)** Only $L_3$ and $L_4$

**C)** Only $L_2$, $L_3$, $L_4$

**D)** Only $L_3$

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**119)** Which of the following statement is true?

**A)** The language {$a^n$: n ≥ 0, n ≠ 4} is regular

**B)** The language {$a^n$: n= i + jk; i, k fixed, j = 0, 1, 2, .....} is regular

**C)** The set of all pascal real numbers is a regular language

**D)** all of the above

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

Top

**120)** Read the following statements

I. L = {vwv : v, w ∈ {a, b} *, |v| = 2} is regular

II. Let us define an operation truncate, which remains right most symbol from any string. Truncated (L) = (truncate (w): w ∈ L} is regular

III. Let x = $a_0a_1$ ..... $a_n$, y = $b_0b_1$ ..... $b_n$, z = $c_0c_1$..... $c_n$ be binary numbers. The set of strings of triplets

$$\begin{matrix} a_0 & a_1 & & a_n \\ b_0 & b_1 & \cdots\cdots & b_n \\ c_0 & c_1 & & c_n \end{matrix}$$

where, the ai, bi, ci are such that x + y = z is a regular language.
Which of the following is true?

**A)** I and II are the only correct statements

**B)** I and III are the only correct statements

**C)** II is the only correct statement

**D)** I, II and III are correct statements

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**121)** Consider the following languages

i) {$a^nb^m$: (n + m) is even

ii) { $a^nb^m$:n ≥ 1, m ≥ 1, nm ≥ 3}

iii) The complement of { $a^nb^m$: n ≥ 4, m ≤ 3}

Which of the following is true?

**A)** i) and ii) are regular but not (iii)

**B)** ii) and iii) are regular but not (i)

**C)** All are regular sets

**D)** (i) and iii) are regular but not (ii)

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**122)** Consider the following languages

i) { uv : u ∈ L, ∈ $L^R$} where 'L' is regular

ii) {$a^n$ $b^l$ $a^k$: k ≥ n + 1}

iii) {$a^n$ $b^l$ $a^k$: n = l or l ≠ k}

Which of the following is true?

Top

**A)** ii) and (iii) are regular but not (i)

**B)** i) is regular but not (ii) and (iii)

**C)** all are regular sets

**D)** None of them is regular

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**123)** Consider the regular expression (0 + 1) (0 + 1)..... 'n' times he minimum state finite automata that recognizes the language represented by this regular xpression contains

**A)** n states

**B)** n + 1 states

**C)** n + 2 states

**D)** none

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**124)** What can be said about a regular language L over {a} whose minimal finite state automata as two states

**A)** L must be $\{a^n / n \text{ is odd}\}$

**B)** L must be $\{a^n/n \geq 0\}$

**C)** L must be $\{a^n / n \text{ is a even}\}$

**D)** Either L must be $\{a^n/n \text{ is odd}\}$ or L must be $\{a^n/n \text{ is even}\}$

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: NAT Marks: 2

★★★★★

**125)** Consider a DFA over Σ = {a, b} accepting all strings which have number of a's divisible by and number of b's divisible by 8. What is the minimum number of states that the DFA will have?

Top

48

Backspace

| | | |
|---|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |
| 0 | . | - |

<< >>

Clear All

Submit ✔ Share Mark IMP Raise Query

Explanation

Type: NAT Marks: 1

★★★★★

**126)** What is the number of states in the minimized DFA, which accepts all strings whose 8$^{th}$ symbol from Right end is 1?

256

Backspace

| | | |
|---|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |
| 0 | . | - |

<< >>

Clear All

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Explanation

Top

Type: MCQ Marks: 1

★★★★★

**127)** Which of the following statements is true?

**A)** The union of two equivalence relations is also an equivalence relation.

**B)** All subsets of regular sets are regular

**C)** Regularity is preserved under the operation of string reversal

**D)** A minimal DFA that is equivalent to an NFA with 'n' nodes has always $2^n$ states

○ A ○ B ◉ C ○ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**128)** Consider the following statements

I. A FSM can be designed to add two integers of any arbitrary length (arbitrary number of digits)

II. Every subset of a countable set is countable.

Which of the following statements is correct?

**A)** I only

**B)** Neither I nor II

**C)** II only

**D)** I and II

○ A ○ B ○ C ◉ D ✔ Share Mark IMP Raise Query

Explanation

Type: MCQ Marks: 1

★★★★★

**129)** Choose the correct statements

**A)** A = $\{a^n b^n / n = 0,1,2,3, ...\}$ is a regular language

**B)** L(A*B*) n B gives the set A

**C)** The set B, of all strings of equal number of a's and b's defines a regular language

**D)** None of the above

Top

○ A ◉ B ○ C ○ D ✔ Share Mark IMP Raise Query

Explanation



Top

# POSTAL Book Package 2021

# Computer Science & IT

## Objective Practice Sets

## Theory of Computation

*Contents*



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# 1 CHAPTER Grammars, Languages & Automata

**Q.1** Suppose $L_1 = \{10, 1\}$ and $L_2 = \{011, 11\}$. How many distinct elements are there in $L = L_1L_2$.
(a) 4 (b) 3
(c) 2 (d) None of these

**Q.2** In a string of length $n$, how many proper prefixes can be generated
(a) $2^n$ (b) $n$
(c) $\frac{n(n+1)}{2}$ (d) $n-1$

**Q.3** Let $u, v, \in \Sigma^*$ where $\Sigma = \{0, 1\}$. Which of the following are TRUE?
1. $|u.v| = |v.u|$
2. $u.v = v.u$
3. $|u.v| = |u| + |v|$
4. $|u.v| = |u||v|$

(a) 1 and 3 (b) 1, 2 and 3
(c) 2 and 4 (d) 1, 2 and 4

**Q.4** How many odd palindromes of length 11 are possible with alphabet $S = \{a, b, c\}$
(a) $3^6$ (b) $2^5$
(c) $2^6$ (d) $3^5$

**Q.5** The number of distinct subwords present in 'MADEEASY' are _____ .

**Q.6** Consider the following statements:
1. Type 0 grammars generate all languages which can be accepted by a Turing machine.
2. Type 1 grammars generate the languages which can all be recognised by a push down automata.
3. Type 3 grammars have one to one correspondence with the set of all regular expressions.
4. There are some languages which are not accepted by a Turing machine.

Which of the above statements are TRUE?
(a) 1, 2 and 3 (b) 1, 2 and 4
(c) 1, 3 and 4 (d) 2, 3 and 4

**Q.7** Consider the following table of an FA:

| $\delta$ | $a$ | $b$ |
|---|---|---|
| start | $q_1$ | $q_0$ |
| $q_0$ | $q_1$ | $q_0$ |
| $q_1$ | $q_2$ | $q_1$ |
| $q_2$ | $q_3$ | $q_2$ |
| $q_3$ | $q_4$ | $q_3$ |
| $q_4$ | $q_4$ | $q_4$ |

If the final state is $q_4$, the which of the following strings will be accepted?
1. *aaaaa*
2. *aabbaabbbbb*
3. *bbababababb*

(a) 1 and 2 (b) 2 and 3
(c) 3 and 1 (d) All of these

**Q.8** Which of the following statements is correct?
(a) Some finite automatas accept non regular languages.
(b) A grammar with recursion always generates infinite languages.
(c) An infinite language can be generated by a non recursive grammar.
(d) A deterministic push down automata cannot generate all context free languages.

**Q.9** The grammer with start symbol $S$ over $\Sigma = \{a, b\}$ $S \rightarrow aSbb|\ abb$ belongs to the class
(a) Type 0 (b) Type 1
(c) Type 2 (d) Type 3

**Q.10** What is the language generated by the grammer where S is the start symbol and the set of terminals and non terminals is $\{a\}$ and {A, B} respectively?
$S \rightarrow Aa$
$A \rightarrow B$
$B \rightarrow Aa$
(a) Set of strings with atleast one $a$
(b) Set of strings with even no. of $a$'s
(c) Set of strings with odd no. of $a$'s
(d) Empty language

**Q.24** Which of the following conversions is not possible?
(a) Regular grammar to context free grammar
(b) NFA to DFA
(c) Non deterministic PDA to deterministic PDA
(d) Non deterministic Turing machine to deterministic Turing machine

**Q.25** If $S = \{ab, ba\}$, which of the following is true?
(a) $S^*$ contains finite no of strings of infinite length.
(b) $S^*$ has no strings having 'aaa' or 'bbb' as substring.
(c) $S^*$ has no strings having aa as substring.
(d) If $T = \{a, b\}$, then $S^* \not\subseteq T^*$,

■■■■

## Answers Grammars, Languages & Automata

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1.** (b) | **2.** (b) | **3.** (a) | **4.** (a) | **5.** (34) | **6.** (c) | **7.** (a) | **8.** (d) | **9.** (c) |
| **10.** (d) | **11.** (c) | **12.** (d) | **13.** (d) | **14.** (c) | **15.** (c) | **16.** (b) | **17.** (3) | **18.** (d) |
| **19.** (b) | **20.** (d) | **21.** (b) | **22.** (c) | **23.** (a) | **24.** (c) | **25.** (b) | | |

## Explanations Grammars, Languages & Automata

**1. (b)**

$L_1 = \{10, 1\}$,
$L_2 = \{011, 11\}$
By concatenation of $L_1$ and $L_2$ we get
$L_1 \cdot L_2 = \{10011, 1011, 1011, 111\}$
Hence, 3 distinct elements are there.

**2. (b)**

Suppose, $S = aaab$, $|s| = 4$. The prefixes are $S_p = \{\lambda, a, aa, aaa, aaab\}$. Here aaab is not a proper prefix.

**Note:** The proper prefix of string $S$ is a prefix, which is not same as string $S$.

A string of length 4 has 4 proper prefixes. A string of length 5 has 5 proper prefixes. For a string of length $n$, therefore we can have '$n$' proper prefixes.

**3. (a)**

Let, $u = 1001$ and $v = 001$
$u.v = 1001001$ and $v.u = 001\ 1001$
$|u,v| = |v,u| = |u| + |v|$
But $u.v \neq v.u$

**4. (a)**

Palindromes can be represented by $\{WW^R \mid W \in \{a, b, c)^*\}\ U$
$\{WxW^R \mid W \in (a, b, c)^*, x \in (a, b, c)\}$
Since, we need to count the number of odd palindromes of length 11, the number of possible $W$'s of length 5 are $|\Sigma|^5$ i.e. $3^5$

Number of possible ways for $x = 3$
$\therefore$ Number of odd palindromes of length 11 = $3^5 \times 3 = 3^6$
Number of odd palindromes of length,

$$n = |\Sigma|^{\frac{n-1}{2}} \times |\Sigma| = |\Sigma|^{\frac{n+1}{2}}$$

**5. (34)**

Distinct subwords of

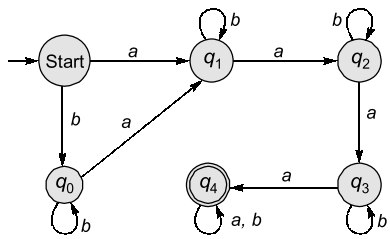
| | |
|---|---|
| Length 1 = 6 | Length 5 = 4 |
| Length 2 = 7 | Length 6 = 3 |
| Length 3 = 6 | Length 7 = 2 |
| Length 4 = 5 | Length 8 = 1 |

$\therefore$ Total = 34

**6. (c)**

See Chomoky Hierarchy languages, which are not recursively enumerable are not recognised by any machine.

**7. (a)**




Drawing the FA we have
we can clearly see that only (i) *aaaaa* and (ii) *aabbaabbbbb* are accepted.

**8. (d)**

(a) is false since a FA can accept only regular languages as it has finite memory only.

(b) is fase consider the grammar $\{S \rightarrow Sa\}$ which a recursive. It generates the empty languages i.e. $\phi$ which is finite.

(c) is false. To generate an infinite language, the grammar must have recusion.

(d) True DPDA cannot generate all CFLs. It generates a subset of CFLs called DCFLs. DPDA has less recognition power than a PDA.

**9. (c)**

The given grammer is Type 2 as every rule is restricted as:

$V \rightarrow (V\,UT)^*$

where $V$ is the set of non-terminals and T is set of terminals.

**10. (d)**

Since there is no string which can be generated from the grammar in finite number of steps as there is no termination, (d) is true.

**11. (c)**

If the sequence has even length say, $n = 2k$, selecting the first $k$ characters completely determines the palindrome since the remaining $k$ characters can be found by repeating the sequence in the reverse roler. Number of palindromes of even length atmost $n$ in alphabet with $x$ characters is

$$x^0 + x^1 + x^2 + \ldots x^k = \frac{-1+x^{k+1}}{x-1}.$$

Here, $x = 3$ and $k = 5$

$\therefore \dfrac{3^6-1}{2}$ is the number of palindromes of length atmost 10.

**12. (d)**

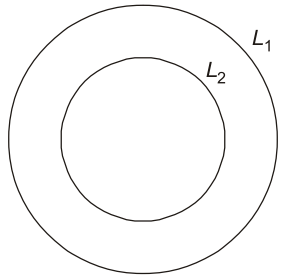
$L_1^* = \{\phi\}^* = \{\lambda\}$

$L_2^* = \{1\}^* = 1^*$

$L_1^*\, U L_2^*\, L_1^* = \{\lambda\} U \{\lambda\}.1^* = 1^*$

**13. (d)**

$L_1$ is the set of all strings where any number of $a$'s is followed by an equal number of $b$'s.




$L_2$ is the set of all strings where an even number of $a$'s is followed by an equal number of $b$'s.

$\therefore \quad L_2 \subseteq L_1$

$L_2 \cap L_1 = L_2$

$L_2 \cup L_1 = L_1$

$L_1 - L_2$ = (Set of all strings where an odd number of $a$'s is followed by an equal number of $b$'s)

$L_2 - L_1 = \phi$

**14. (c)**

$L_1 = \{a^n b^n c^n, n \geq 0\}$
$= \{\lambda, abc, a^2b^2c^2, \ldots\}$

$L_2 = \{a^{2n} b^{2n} c^{2n}, n \geq 0\}$
$= \{\lambda, a^2b^2c^2, a^4b^4c^4, \ldots\}$

$L_3 = \{a^{2n} b^{2n} c^n, n \geq 0\}$
$= \{\lambda, a^2b^2c, a^4b^4c^2, \ldots\}$

as we can easily see that

(i) $L_1$ contains all the words generated by $L_2$ and also it contains some extra strings.
$\therefore\ L_1 \supseteq L_2$. (or $L_2 \subseteq L_1$)

(ii) Since only $\lambda$ is common in $L_2$ and $L_3$
Hence $L_2 \not\subset L_3$.

**15. (c)**

$L^*$ is a combination of strings in $L$.

1. abaabaaabaa = ab aa baa ab aa belongs to $L^*$.
2. baaaaabaa = baa aa ab aa belongs to $L^*$.
3. baaaaabaaaab = baa aa ab aa aa b does not belong to $L^*$.
4. aaaabaaaa = aa aa baa aa belongs to $L^*$.

**16. (b)**

Both prefix and suffix consists of $\varepsilon$ and $L$.
However in case of binary alphabet, for instance, prefix ($L$) = suffix($L$)
$\therefore$ Prefix ($L$) $n$ suffix ($L$) $\supseteq \{\varepsilon_1 L\}$

**17. (3)**

$L_1$ can be represented by $a^*b^*$

$$L_1^* = (a^*b^*)^* = (a + b)^*$$
$$L_2 = (ba)$$
$$L_1^* \, n L_2 = [(a + b)^*] \, n \, (ba)$$
$$= (ba)$$
$$\text{Prefix}, (L_3) = (\varepsilon, b, ba)$$

**18. (d)**

(a) is false as 'aaa' is generated by the grammar.
(b) is false as 'aa' is generated.
(c) is false as 'aaa' is generated.
A generates the language represented by $a^*$ {0 or more $a$'s}
$S$ generate $aaa^*$

**19. (b)**

$L_1$ is the set of strings where zero or more $a$'s is followed by zero or more $b$'s.
$L_2$ is the set of strings where zero or more $b$'s is followed by zero or more $a$'s.
$L_1 \, n \, L_2$ - Set of strings of only $a$'s or only $b$'s including the NULL string $\lambda$.

$\therefore \quad L_1 \, n \, L_2 = \{a^* + b^*\}$

**Note:** $a^*b^* = a^+b^+ + a^* + b^*$
$b^*a^* = b^+a^+ + a^* + b^*$

**20. (d)**

$L = \{a^n b^m \mid n, m \geq 0\}$ i.e. the number of $a$'s and number of $b$'s are independent.

$\therefore$ $L$ is a regular language.

$$L_1 = \{\varepsilon, a, aa, aaa, ...\}$$
$$L_2 = \{\varepsilon, b, bb, bbb, ...\}$$
$$L_3 = L_1L_2 = \{\varepsilon, ab, abb, abbb, aab, ...\}$$

**21. (b)**

**1. False**

**Case (i)** $L$ is finite

We know that $\Sigma^*$ is infinite

$$\overline{L} = \Sigma^* - L$$

$\therefore$ $\overline{L}$ must be infinite as it is obtained by removing a finite number of string from an infinite set.

**Case (ii)** $L$ is infinite

$\Sigma^*$ is infinite

$$\overline{L} = \Sigma^* - L$$

$\therefore$ $\overline{L}$ may be finite or infinite

From above, in any case, both $L$ and $\overline{L}$ cannot be finite.

**2. False**

$$\lambda \in L^*$$
$$\Rightarrow \quad \lambda \notin \left(\overline{L^*}\right)$$

But $\left(\overline{L}\right)^*$ must contain $\lambda$.

$\therefore$ No language satisfies $\left(\overline{L^*}\right) = \left(\overline{L}\right)^*$

**3. True**

Let $u \in L_1$, $v \in L_2$

$$L_1L_2 = \{uv\}$$
$$(L_1L_2)^R = (uv)^R = v^Ru^R$$
$$= (L_2)^R(L_1)^R \, \forall u,v$$

**4. True**

For all $\Sigma$

(i) $L^* \subseteq (L^*)^*$. This is because $L^* = \{w_1, w_2, ...\}$ and therefore $\{w_1, w_2, ...\} \subseteq \{w_1, w_2, ...\}^*$.

(ii) $(L^*)^* \subseteq (L^*)$. For every $w \notin (L^*)^*$, we can decompose it as

$w = w_1w_2w_3... \, w_n$ such that each $w_i \in L^*$. Similarly we can decompose $w_i$ such that $w_i = w_{1i}w_{2i}w_{3i}...$ $w_{iNi}$ where $W_iN_i \in L$. So, $w \in L^*$

Now, $w = w_{11}w_{21}w_{31}....w_1NW_{12}....w_2N_2.....$

where $w_{ij} \notin L$

So $w \in L^*$

From (i) and (ii) $L^* = (L^*)^*$

[$L^*$ is the combination of strings in $L$]

**22. (c)**

$$L = \{\lambda, a, aa, aaa, ...\}$$

$L^2 = L,L = \{\lambda, a, aa, aaa, aaaa, ... \, a^n\}$

$\therefore$ $L^2$ is the set of all strings over $\Sigma$

**23. (a)**

For strings belonging to $L^5$, they should be a combination of exactly 5 strings $\in L$.

Since $L$ contains $\lambda$, the strings in $L^5$ should be a combination of atmost 5 non null strings which belong to $L$ as the remaining component could be the null string.

(a) 110010 = 1 10 01 0 does not belong to $L^5$
(b) 101001001 = 10 10 01 001 belong to $L^5$
(c) 100100 = 10 01 0 0 belongs to $L^5$
(d) 01101001 = 01 10 10 01 belongs to $L^5$

# CS8501 THEORY OF COMPUTATION

## MULTIPLE CHOICE QUESTIONS (MCQ)

**CS8501 THEORY OF COMPUTATION**

**MULTIPLE CHOICE QUESTIONS (MCQ)**

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## UNIT I AUTOMATA FUNDAMENTALS

### TOPIC 1 : Introduction to formal proof

**1. Assume the R is a relation on a set A, aRb is partially ordered such that a and b are _____**

a) reflexive
b) transitive
c) symmetric
d) reflexive and transitive

**Answer:** d
**Explanation:** A partially ordered relation refers to one which is Reflexive, Transitive and Antisymmetric.

**2. The non- Kleene Star operation accepts the following string of finite length over set A = {0,1} | where string s contains even number of 0 and 1**

a) 01,0011,010101
b) 0011,11001100
c) ε ,0011,11001100
d) ε ,0011,11001100

**Answer:** b
**Explanation:** The Kleene star of A, denoted by A*, is the set of all strings obtained by concatenating zero or more strings from A.

**3. A regular language over an alphabet ∑ is one that cannot be obtained from the basic languages using the operation**

a) Union
b) Concatenation
c) Kleene*
d) All of the mentioned

**Answer:** d
**Explanation:** Union, Intersection, Concatenation, Kleene*, Reverse are all the closure properties of Regular Language.

4. **Statement 1: A Finite automata can be represented graphically;**
   **Statement 2: The nodes can be its states;**
   **Statement 3: The edges or arcs can be used for transitions**
   **Hint: Nodes and Edges are for trees and forests too.**

**Which of the following make the correct combination?**

a) Statement 1 is false but Statement 2 and 3 are correct
b) Statement 1 and 2 are correct while 3 is wrong
c) None of the mentioned statements are correct
d) All of the mentioned

**Answer:** d
**Explanation:** It is possible to represent a finite automaton graphically, with nodes for states, and arcs for transitions.

5. **The minimum number of states required to recognize an octal number divisible by 3 are/is**

a) 1
b) 3
c) 5
d) 7

**Answer:** b
**Explanation:** According to the question, minimum of 3 states are required to recognize an octal number divisible by 3.

6. **Which of the following is a not a part of 5-tuple finite automata?**

a) Input alphabet
b) Transition function
c) Initial State
d) Output Alphabet

**Answer:** d
**Explanation:** A FA can be represented as FA= (Q, ∑, $\delta$ , q0, F) where Q=Finite Set of States, ∑=Finite Input Alphabet, $\delta$ =Transition Function, q0=Initial State, F=Final/Acceptance State).

7. **If an Infinite language is passed to Machine M, the subsidiary which gives a finite solution to the infinite input tape is _____**

a) Compiler
b) Interpreter
c) Loader and Linkers
d) None of the mentioned

**Answer:** a
**Explanation:** A Compiler is used to give a finite solution to an infinite phenomenon. Example of an infinite phenomenon is Language C, etc.

**8. The number of elements in the set for the Language L={x∈(∑r) *|length if x is at most 2} and ∑={0,1} is_____**
**a) 7**
**b) 6**
**c) 8**
**d) 5**
**Answer:** a
**Explanation:** ∑r={1,0} and a Kleene* operation would lead to the following set=COUNT{ ε ,0,1,00,11,01,10} =7.

**9. For the following change of state in FA, which of the following codes is an incorrect option?**
a) δ (m, 1) =n
b) δ (0, n) =m
c) δ (m,0)= ε
d) s: accept = false; cin >> char;
if char = "0" goto n;
**Answer:** b
**Explanation:** δ (QX∑)=Q1 is the correct representation of change of state. Here, δ is called the Transition function.

**10. Given: ∑= {a, b}**
**L= {x∈∑*|x is a string combination}**
**∑4 represents which among the following?**
a) {aa, ab, ba, bb}
b) {aaaa, abab, ε , abaa, aabb}
c) {aaa, aab, aba, bbb}
d) All of the mentioned
**Answer:** b
**Explanation:** ∑* represents any combination of the given set while ∑x represents the set of combinations with length x where x ∈ I.

**TOPIC 2: Finite Automata**
1. There are_____tuples in finite state machine.
a) 4
b) 5
c) 6
d) unlimited

SOLUTION

**Answer:** b

**Explanation:** States, input symbols,initial state,accepting state and transition function.

2. Transition function maps.

a) Σ * Q -> Σ
b) Q * Q -> Σ
c) Σ * Σ -> Q
d) Q * Σ -> Q

SOLUTION

**Answer:** d

**Explanation:** Inputs are state and input string output is states.

3. Number of states require to accept string ends with 10.

a) 3
b) 2
c) 1
d) can't be represented.

SOLUTION

**Answer:** a

**Explanation:** This is minimal finite automata.

4. Extended transition function is .

a) Q * Σ * -> Q
b) Q * Σ -> Q
c) Q* * Σ * -> Σ
d) Q * Σ -> Σ

SOLUTION

**Answer:** a

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

5. δ *(q,ya) is equivalent to .

a) δ ((q,y),a)
b) δ ( δ *(q,y),a)
c) δ (q,ya)
d) independent from δ notation

SOLUTION

**Answer:** b

**Explanation:** First it parse y string after that it parse a.

6. String X is accepted by finite automata if .

a) δ *(q,x) E A
b) δ (q,x) E A
c) δ *(Q0,x) E A
d) δ (Q0,x) E A

SOLUTION

**Answer:** c

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

7. Languages of a automata is

a) If it is accepted by automata

b) If it halts

c) If automata touch final state in its life time

d) All language are language of automata

SOLUTION

**Answer:** a

**Explanation:** If a string accepted by automata it is called language of automata.

8. Language of finite automata is.

a) Type 0

b) Type 1

c) Type 2

d) Type 3

SOLUTION

**Answer:** d

**Explanation:** According to Chomsky classification.

9. Finite automata requires minimum_____number of stacks.

a) 1

b) 0

c) 2

d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Finite automata doesn't require any stack operation .

10. Number of final state require to accept Φ in minimal finite automata.

a) 1

b) 2

c) 3

d) None of the mentioned

SOLUTION

**Answer:** d

**Explanation:** No final state requires.

11. 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 mentioned

SOLUTION

**Answer:** c

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

12. How many DFA's exits with two states over input alphabet {0,1} ?

a) 16
b) 26
c) 32
d) 64

SOLUTION

**Answer:** d

**Explanation:** Number of DFA's = 2n * n(2*n).

13. The basic limitation of finite automata is that

a) It can't remember arbitrary large amount of information.
b) It sometimes recognize grammar that are not regular.
c) It sometimes fails to recognize regular grammar.
d) All of the mentioned

SOLUTION

**Answer:** a

Explanation:Because there is no memory associated with automata.

14. Number of states require to simulate a computer with memory capable of storing '3' words each of length '8'.

a) 3 * 28
b) 2(3*8)
c) 2(3+8)
d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** 2(m*n) states requires .

15. 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 mentioned

SOLUTION

**Answer:** a

**Explanation:** Use them as a flip flop output .

**TOPIC 3: Deterministic Finite Automata**

1. Which of the following not an example Bounded Information?

a) fan switch outputs {on, off}
b) electricity meter reading
c) colour of the traffic light at the moment
d) none of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Bounded information refers to one whose output is limited and it cannot be said what were the recorded outputs previously until memorized.

2. A Language for which no DFA exist is a_____

a) Regular Language
b) Non-Regular Language
c) May be Regular
d) Cannot be said

SOLUTION

**Answer:** b

**Explanation:** A language for which there is no existence of a deterministic finite automata is always Non Regular and methods like Pumping Lemma can be used to prove the same.

3. A DFA cannot be represented in the following format

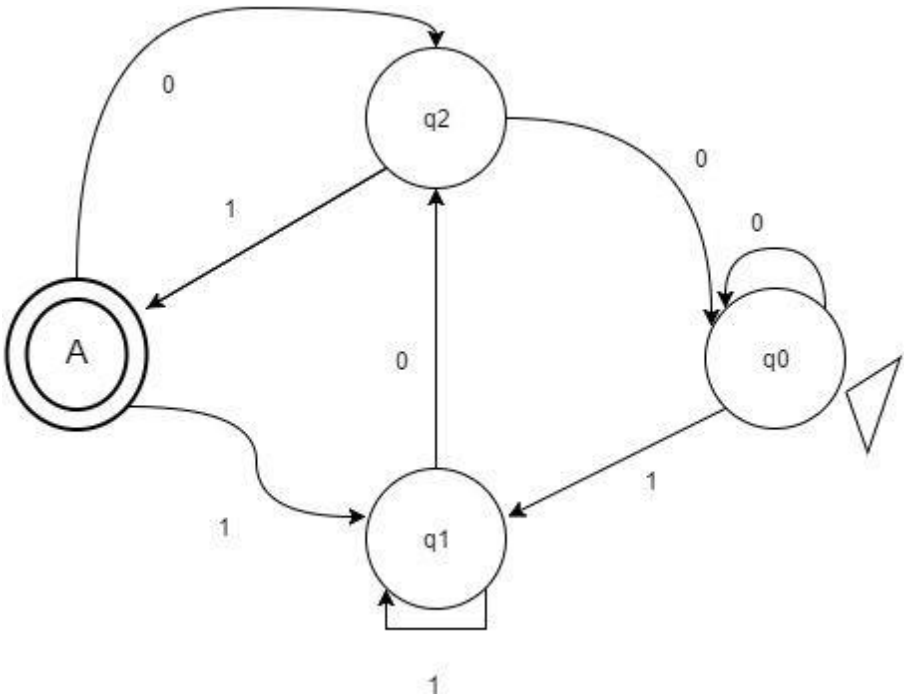
a) Transition graph
b) Transition Table
c) C code
d) None of the mentioned

SOLUTION

**Answer:** d

**Explanation:** A DFA can be represented in the following formats: Transition Graph, Transition Table, Transition tree/forest/Any programming Language.

4. What the following DFA accepts?



a) x is a string such that it ends with ‘101’
b) x is a string such that it ends with ‘01’
c) x is a string such that it has odd 1’s and even 0’s
d) x is a strings such that it has starting and ending character as 1

SOLUTION

**Answer:** a

**Explanation:** Strings such as {1101,101,10101} are being accepted while {1001,11001} are not. Thus, this conclusion leads to option a.

5. When are 2 finite states equivalent?

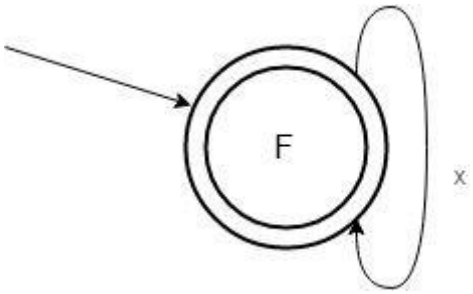
a) Same number of transitions
b) Same number of states
c) Same number of states as well as transitions
d) Both are final states

SOLUTION

**Answer:** c

**Explanation:** Two states are said to be equivalent if and only if they have same number of states as well as transitions.

6. What does the following figure most correctly represents?



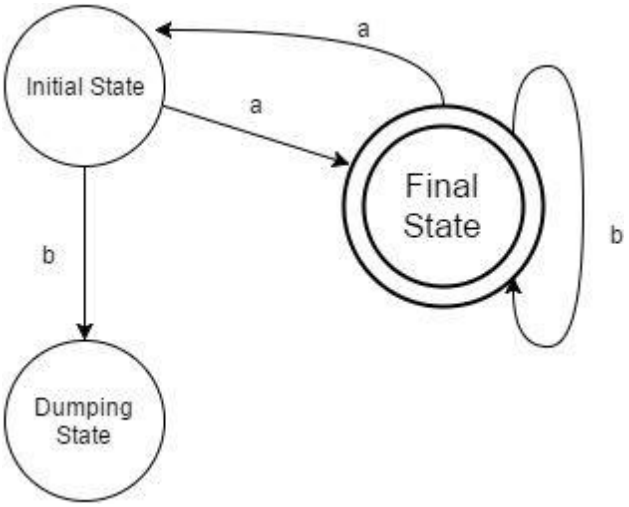

a) Final state with loop x
b) Transitional state with loop x
c) Initial state as well as final state with loop x
d) Insufficient Data

SOLUTION

**Answer:** c

**Explanation:** The figure represents the initial as well as the final state with an iteration of x.

7. Which of the following will not be accepted by the following DFA?



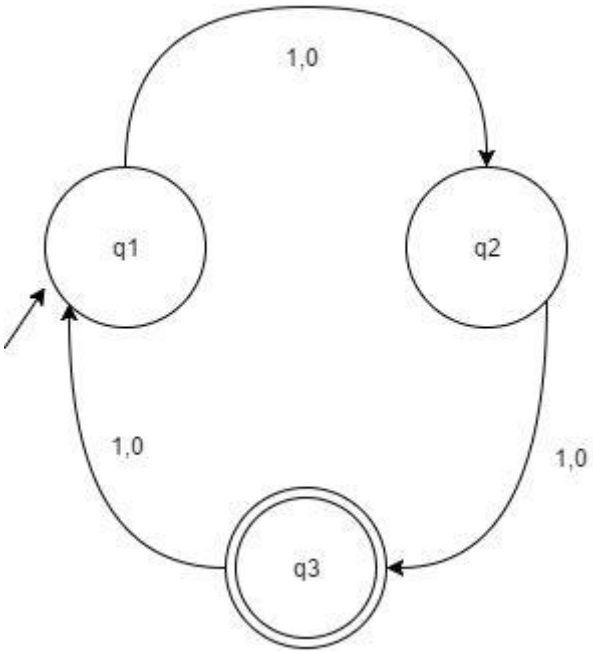

a) ababaabaa
b) abbbaa
c) abbbaabb
d) abbaabbaa

SOLUTION

**Answer:** a

**Explanation:** All the Strings are getting accepted except 'ababaabaa' as it is directed to dumping state. Dumping state also refers to the reject state of the automata.

8. Which of the following will the given DFA won't accept?




a) $\varepsilon$
b) 11010
c) 10001010
d) String of letter count 11

SOLUTION

**Answer:** a

**Explanation:** As the initial state is not made an acceptance state, thus $\varepsilon$ will not be accepted by the given DFA. For the automata to accept $\varepsilon$ as an entity, one should make the initial state as also the final state.

9. Can a DFA recognize a palindrome number?

a) Yes
b) No
c) Yes, with input alphabet as $\sum^*$
d) Can't be determined

SOLUTION

**Answer:** b

**Explanation:** Language to accept a palindrome number or string will be non-regular and thus, its DFA cannot be obtained. Though, PDA is possible.

10. Which of the following is not an example of finite state machine system?

a) Control Mechanism of an elevator
b) Combinational Locks
c) Traffic Lights
d) Digital Watches

SOLUTION

**Answer:** d

**Explanation:** Proper and sequential combination of events leads the machines to work in hand which includes The elevator, Combinational Locks, Traffic Lights, vending machine, etc. Other applications of Finite machine state system are Communication Protocol Design, Artificial Intelligence Research, A Turnstile, etc.

## TOPIC 4: Non-deterministic Finite Automata

1. Which of the following options is correct?

Statement 1: Initial State of NFA is Initial State of DFA.
Statement 2: The final state of DFA will be every combination of final state of NFA.

a) Statement 1 is true and Statement 2 is true
b) Statement 1 is true and Statement 2 is false
c) Statement 1 can be true and Statement 2 is true
d) Statement 1 is false and Statement 2 is also false

SOLUTION

**Answer:** a

**Explanation:** Statement 1 and 2 always true for a given Language.

2. Given Language: L= {ab U aba}*

If X is the minimum number of states for a DFA and Y is the number of states to construct the NFA,

|X-Y|=?

a) 2
b) 3
c) 4
d) 1

SOLUTION

**Answer:** a

**Explanation:** Construct the DFA and NFA individually, and the attain the difference of states.

3. An automaton that presents output based on previous state or current input:

a) Acceptor
b) Classifier
c) Transducer
d) None of the mentioned.

SOLUTION

**Answer:** c

**Explanation:** A transducer is an automaton that produces an output on the basis of what input has been given currently or previous state.

4. If NFA of 6 states excluding the initial state is converted into DFA, maximum possible number of states for the DFA is ?

a) 64
b) 32
c) 128
d) 127

SOLUTION

**Answer:** c

**Explanation:** The maximum number of sets for DFA converted from NFA would be not greater than 2n.

5. NFA, in its name has 'non-deterministic' because of :

a) The result is undetermined
b) The choice of path is non-deterministic
c) The state to be transited next is non-deterministic
d) All of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Non deterministic or deterministic depends upon the definite path defined for the transition from one state to another or undefined(multiple paths).

6. Which of the following is correct proposition?

Statement 1: Non determinism is a generalization of Determinism.
Statement 2: Every DFA is automatically an NFA

a) Statement 1 is correct because Statement 2 is correct
b) Statement 2 is correct because Statement 2 is correct
c) Statement 2 is false and Statement 1 is false

d) Statement 1 is false because Statement 2 is false

SOLUTION

**Answer:** b

**Explanation:** DFA is a specific case of NFA.

7. Given Language L= {x∈ {a, b}*|x contains aba as its substring}

Find the difference of transitions made in constructing a DFA and an equivalent NFA?

a) 2

b) 3

c) 4

d) Cannot be determined.

SOLUTION

**Answer:** a

**Explanation:** The individual Transition graphs can be made and the difference of transitions can be determined.

8. The construction time for DFA from an equivalent NFA (m number of node)is:

a) O(m2)

b) O(2m)

c) O(m)

d) O(log m)

SOLUTION

**Answer:** b

**Explanation:** From the coded NFA-DFA conversion.

9. If n is the length of Input string and m is the number of nodes, the running time of DFA is x that of NFA.Find x?

a) 1/m2

b) 2m

c) 1/m

d) log m

SOLUTION

**Answer:** a

**Explanation:** Running time of DFA: O(n) and Running time of NFA =O(m2n).

10. Which of the following option is correct?

a) NFA is slower to process and its representation uses more memory than DFA

b) DFA is faster to process and its representation uses less memory than NFA

c) NFA is slower to process and its representation uses less memory than DFA

d) DFA is slower to process and its representation uses less memory than NFA

SOLUTION

**Answer:** c

**Explanation:** NFA, while computing strings, take parallel paths, make different copies of input and goes along different paths in order to search for the result. This creates the difference in processing speed of DFA and NFA.

**TOPIC 5: Finite Automata with Epsilon Transitions**

1. According to the given transitions, which among the following are the epsilon closures of q1 for the given NFA?

Δ (q1, ε ) = {q2, q3, q4}
Δ (q4, 1) =q1
Δ (q1, ε ) =q1

a) q4
b) q2
c) q1
d) q1, q2, q3, q4

SOLUTION

**Answer:** d

**Explanation:** The set of states which can be reached from q using ε -transitions, is called the ε -closure over state q.

2. State true orfalse?

Statement: An NFA can be modified to allow transition without input alphabets, along with one or more transitions on input symbols.

a) True
b) False

SOLUTION

**Answer:** a

**Explanation:** It is possible to construct an NFA with ε -transitions, presence of no input symbols, and that is called NFA with ε -moves.

3. State true orfalse?

Statement: ε (Input) does not appears on Input tape.

a) True
b) False

**Answer:** a

SOLUTION

**Explanation:** ε does not appears on Input tape, ε transition means a transition without scanning a symbol i.e. without moving the read head.

4. Statement 1: ε - transition can be called as hidden non-determinism.

Statement 2: δ (q, ε ) = p means from q it can jump to p with a shift in read head.

Which among the following options is correct?

a) Statement 1 and 2, both are correct
b) Statement 1 and 2, both are wrong
c) Statement 1 is correct while Statement 2 is wrong
d) Statement 1 is wrong while Statement 2 is correct

SOLUTION

**Answer:** c

**Explanation:** The transition with ε leads to a jump but without any shift in read head. Further, the method can be called one to introduce hidden non-determinism.

5. $\varepsilon$ - closure of q1 in the given transition graph:

a) {q1}
b) {q0, q2}
c) {q1, q2}
d) {q0, q1, q2}

SOLUTION

**Answer:** c

**Explanation:** $\varepsilon$ -closure is defined as the set of states being reached through $\varepsilon$ -transitions from a starting state.

6. Predict the total number of final states after removing the $\varepsilon$ -moves from the given NFA?

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

SOLUTION

**Answer:** c

**Explanation:** The NFA which would result after eliminating $\varepsilon$ -moves can be shown diagramatically.

7. For NFA with $\varepsilon$ -moves, which among the following is correct?

a) $\Delta : Q \times (\sum \cup \{\varepsilon\}) \rightarrow P(Q)$
b) $\Delta : Q \times (\sum) \rightarrow P(Q)$
c) $\Delta : Q \times (\sum^*) \rightarrow P(Q)$
d) All of the mentioned

SOLUTION

**Answer:** a

**Explanation:** Due to the presence of $\varepsilon$ symbol, or rather an epsilon-move, the input alphabets unites with it to form a set including $\varepsilon$ .

8. Which among the following is false?

$\varepsilon$ -closure of a subset S of Q is:

a) Every element of $S \in Q$
b) For any $q \in \varepsilon(S)$, every element of $\delta(q, \varepsilon)$ is in $\varepsilon(S)$
c) No other element is in $\varepsilon(S)$
d) None of the mentioned

SOLUTION

**Answer:** d

**Explanation:** All the mentioned are the closure properties of $\varepsilon$ and encircles all the elements if it satisfies the following options:

a) Every element of $S \in Q$
b) For any $q \in \varepsilon(S)$, every element of $\delta(q, \varepsilon)$ is in $\varepsilon(S)$
c) No other element is in $\varepsilon(S)$

9. The automaton which allows transformation to a new state without consuming any

input symbols:
a) NFA
b) DFA
c) NFA-l
d) All of the mentioned
SOLUTION
**Answer:** c
**Explanation:** NFA-l or e-NFA is an extension of Non deterministic Finite Automata which are usually called NFA with epsilon moves or lambda transitions.

10. e-transitions are
a) conditional
b) unconditional
c) input dependent
d) none of the mentioned
SOLUTION
**Answer:** b
**Explanation:** An epsilon move is a transition from one state to another that doesnt require any specific condition.

11. The_____of a set of states, P, of an NFA is defined as the set of states reachable from any state in P following e-transitions.
a) e-closure
b) e-pack
c) Q in the tuple
d) None of the mentioned
SOLUTION
**Answer:** a
**Explanation:** The e-closure of a set of states, P, of an NFA is defined as the set of states reachable from any state in P following e-transitions.

12. The e-NFA recognizable languages are not closed under :
a) Union
b) Negation
c) Kleene Closure
d) None of the mentioned
SOLUTION
**Answer:** d
**Explanation:** The languages which are recognized by an epsilon Non deterministic automata are closed under the following operations:
a) Union
b) Intersection
c) Concatenation
d) Negation
e) Star

f) Kleene closure

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## UNIT II REGULAR EXPRESSIONS AND LANGUAGES

### TOPIC 1: Regular Expressions

1. L is a regular Language if and only If the set of_____classes of IL is finite.

a) Equivalence
b) Reflexive
c) Myhill
d) Nerode

SOLUTION

**Answer:** a

**Explanation:** According to Myhill Nerode theorem, the corollary proves the given statement correct for equivalence classes.

2. A language can be generated from simple primitive language in a simple way if and only if

a) It is recognized by a device of infinite states
b) It takes no auxiliary memory
c) Both are correct
d) Both arewrong

SOLUTION

**Answer:** b

**Explanation:** A language is regular if and only if it can be accepted by a finite automaton. Secondly, It supports no concept of auxiliary memory as it loses the data as soon as the device is shut down.

3. Which of the following does not represents the given language?

Language: {0,01}

a) 0+01
b) {0} U {01}
c) {0} U {0}{1}
d) {0} ^ {01}

SOLUTION

**Answer:** d

**Explanation:** The given option represents {0, 01} in different forms using set operations and Regular Expressions. The operator like ^, v, etc. are logical operation and they form invalid regular expressions when used.

4. According to the given language, which among the following expressions does it corresponds to?

Language L={x∈{0,1}|x is of length 4 or less} a) (0+1+0+1+0+1+0+1)4
b) (0+1)4

c) (01)4
d) (0+1+ $\varepsilon$ )4
SOLUTION

**Answer:** d

**Explanation:** The extended notation would be (0+1)4 but however, we may allow some or all the factors to be $\varepsilon$ . Thus $\varepsilon$ needs to be included in the given regular expression.

5. Which among the following looks similar to the given expression?

((0+1). (0+1)) *
a) {x$\in$ {0,1} *|x is all binary number with even length}
b) {x$\in$ {0,1} |x is all binary number with even length}
c) {x$\in$ {0,1}*|x is all binary number with odd length}
d) {x$\in$ {0,1} |x is all binary number with odd length} SOLUTION

**Answer:** a

**Explanation:** The given regular expression corresponds to a language of binary strings which is of even length including a length of 0.

6. If R represents a regular language, which of the following represents the Venn-diagram most correctly?

a) An Irregular Set
b) R*
c) R complement
d) R reverse
SOLUTION

**Answer:** b

**Explanation:** The given diagram represents the Kleene operation over the Regular Language R in which the final states become the initial and the initial state becomes final.

7. The given NFA corresponds to which of the following Regular expressions?

a) (0+1) *(00+11) (0+1) *
b) (0+1) *(00+11) *(0+1) *
c) (0+1) *(00+11) (0+1)
d) (0+1) (00+11) (0+1) *
SOLUTION

**Answer:** a

**Explanation:** The transition states shown are the result of breaking down the given regular expression in fragments. For dot operation, we change a state, for union (plus) operation, we diverge into two transitions and for Kleene Operation, we apply a loop.

8. Concatenation Operation refers to which of the following set operations:

a) Union
b) Dot
c) Kleene
d) Two of the options are correct

SOLUTION

**Answer:** b

**Explanation:** Two operands are said to be performing Concatenation operation AB = A•B = {xy: x ∈ A & y ∈ B}.

9. Concatenation of R with Φ outputs:

a) R
b) Φ
c) R.Φ
d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** By distributive property (Regular expression identities), we can prove the given identity to be Φ.

10. RR* can be expressed in which of the forms:

a) R+
b) R-
c) R+ U R-
d) R

SOLUTION

**Answer:** a

**Explanation:** RR*=R+ as R+ means the occurrence to be at least once.

**TOPIC 2: FA and Regular Expressions**

1. What kind of expressions do we used for pattern matching?

a) Regular Expression
b) Rational Expression
c) Regular & Rational Expression
d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** In automata theory, Regular Expression(sometimes also called the Rational Expression ) is a sequence or set of characters that define a search pattern, mainly for the use in pattern matching with strings or string matching.

2. Which of the following do Regexps do not find their use in?

a) search engines
b) word processors
c) sed
d) none of the mentioned

SOLUTION

**Answer:** d

**Explanation:** Regexp processors are found in several search engines, seach and replace mechanisms, and text processing utilities.

3. Which of the following languages have built in regexps support?

a) Perl
b) Java
c) Python
d) C++

SOLUTION

**Answer:** a

**Explanation:** Many languages come with built in support of regexps like Perl, Javascript, Ruby etc. While some provide support using standard libraries like .NET, Java, Python, C++, C and POSIX.

4. The following is/are an approach to process a regexp:

a) Contruction of NFA and subsequently, a DFA.
b) Thompson's Contruction Algorithm
c) Both (a) and (b)
d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** A regexp processor translates the syntax into internal representation which can be executed and matched with a string and that internal representation can have several approaches like the ones mentioned.

5. Are the given two patterns equivalent?

(1) gray|grey
(2) gr(a|e)y

a) yes
b) no

SOLUTION

**Answer:** a

**Explanation:** Paranthesis can be used to define the scope and precedence of operators. Thus, both the expression represents the same pattern.

6. Which of the following are not quantifiers?

a) Kleene plus +
b) Kleene star *
c) Question mark ?
d) None of the mentioned

SOLUTION

**Answer:** d

**Explanation:** A quantifier after a token specifies how often the preceding element is allowed to occur. ?, *, +, {n}, {min, }, {min, max} are few quantifiers we use in regexps

implementations.

7. Which of the following cannot be used to decide whether and how a given regexp matches a string:

a) NFA to DFA
b) Lazy DFA algorithm
c) Backtracking
d) None of the mentioned

SOLUTION

**Answer:** d

**Explanation:** There are at least three algorithms which decides for us, whether and how a regexp matches a string which included the transformation of Non deterministic automaton to deterministic finite automaton, The lazy DFA algorithm where one simulates the NFA directly, building each DFA on demand and then discarding it at the next step and the process of backtracking whose running time is exponential.

8. What does the following segment of code output?

```
$string1 = "Hello World\n";
if ($string1 =~ m/(H..).(l..)/) {
  print "We matched '$1' and '$2'.\n";

}
```

a) We matched 'Hel' and 'ld'
b) We matched 'Hel' and 'lld'
c) We matched 'Hel' and 'lo '
d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** () groups a series of pattern element to a single element.
When we use pattern in parenthesis, we can use any of '$1', '$2' later to refer to the previously matched pattern.

9. Given segment of code:

```
$string1 = "Hello\nWorld\n";
if ($string1 =~ m/d\n\z/) {
print "$string1 is a string ";
  print "that ends with 'd\\n'.\n";

}
```

What does the symbol /z does?

a) changes line
b) matches the beginning of a string
c) matches the end of a string
d) none of the mentioned

SOLUTION

**Answer:** c
**Explanation:** It matches the end of a string and not an internal line.The given segment of code outputs:
Hello
World
is a string that ends with 'd\n'

10. Conversion of a regular expression into its corresponding NFA :
a) Thompson's Construction Algorithm
b) Powerset Construction
c) Kleene's algorithm
d) None of the mentioned
SOLUTION
**Answer:** a
**Explanation:** Thompson construction algorithm is an algorithm in automata theory used to convert a given regular expression into NFA. Similarly, Kleene algorithm is used to convert a finite automaton to a regular expression.

**TOPIC 3: Proving Languages not to be regular**

1. Relate the following statement:
Statement: All sufficiently long words in a regular language can have a middle section of words repeated a number of times to produce a new word which also lies within the same language.
a) Turing Machine
b) Pumping Lemma
c) Arden's theorem
d) None of the mentioned
SOLUTION
**Answer:** b
**Explanation:** Pumping lemma defines an essential property for every regular language in automata theory. It has certain rules which decide whether a language is regular or not.

2. While applying Pumping lemma over a language, we consider a string w that belong to L and fragment it into_____parts.
a) 2
b) 5
c) 3
d) 6
SOLUTION
**Answer:** c
**Explanation:** We select a string w such that w=xyz and |y|>0 and other conditions. However, there exists an integer n such that |w|>=n for any wÎL.

3. If we select a string w such that w∈L, and w=xyz. Which of the following portions cannot be an empty string?
a) x
b) y
c) z
d) all of the mentioned
SOLUTION
**Answer:** b
**Explanation:** The lemma says, the portion y in xyz cannot be zero or empty i.e. |y|>0, this condition needs to be fulfilled to check the conclusion condition.

4. Let w= xyz and y refers to the middle portion and |y|>0.What do we call the process of repeating y 0 or more times before checking that they still belong to the language L or not?
a) Generating
b) Pumping
c) Producing
d) None of the mentioned
SOLUTION
**Answer:** b
**Explanation:** The process of repeatation is called pumping and so, pumping is the process we perform before we check whether the pumped string belongs to L or not.

5. There exists a language L. We define a string w such that w∈L and w=xyz and |w| >=n for some constant integer n.What can be the maximum length of the substring xy i.e. |xy|<=?
a) n
b) |y|
c) |x|
d) none of the mentioned
SOLUTION
**Answer:** a
**Explanation:** It is the first conditional statement of the lemma that states that |xy|<=n, i.e. the maximum length of the substring xy in w can be n only.

6. Fill in the blank in terms of p, where p is the maximum string length in L.
Statement: Finite languages trivially satisfy the pumping lemma by having n = _____
a) p*1
b) p+1
c) p-1
d) None of the mentioned
SOLUTION
**Answer:** b
**Explanation:** Finite languages trivially satisfy the pumping lemma by having n equal to the maximum string length in l plus 1.

7. Answer in accordance to the third and last statement in pumping lemma:
For all_____xyiz ∈L
a) i>0
b) i<0
c) i<=0
d) i>=0
SOLUTION
**Answer:** d
**Explanation:** Suppose L is a regular language . Then there is an integer n so that for any x∈L and |x|>=n, there are strings u,v,w so that
x= uvw
|uv|<=n
|v|>0
for any m>=0, uvmw ∈L.
8. If d is a final state, which of the following is correct according to the given diagram?

a) x=p, y=qr, z=s
b) x=p, z=qrs
c) x=pr, y=r, z=s
d) All of the mentioned
SOLUTION
**Answer:** a
**Explanation:** The FSA accepts the string pqrs. In terms of pumping lemma, the string pqrs is broken into an x portion an a, a y portion qr and a z portion s.
9. Let w be a string and fragmented by three variable x, y, and z as per pumping lemma. What does these variables represent?
a) string count
b) string
c) both (a) and (b)
d) none of the mentioned
SOLUTION
**Answer:** a
**Explanation:** Given: w =xyz. Here, xyz individually represents strings or rather substrings which we compute over conditions to check the regularity of the language.
10. Which of the following one can relate to the given statement:
Statement: If n items are put into m containers, with n>m, then atleast one container must contain more than one item.
a) Pumping lemma
b) Pigeon Hole principle
c) Count principle
d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Pigeon hole principle states the following example: If there exists n=10 pigeons in m=9 holes, then since 10>9, the pigeonhole principle says that at least one hole has more than one pigeon.

**TOPIC 4: Proving Languages not to be regular (Pumping Lemma)**

1. Relate the following statement:

Statement: All sufficiently long words in a regular language can have a middle section of words repeated a number of times to produce a new word which also lies within the same language.

a) Turing Machine
b) Pumping Lemma
c) Arden's theorem
d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Pumping lemma defines an essential property for every regular language in automata theory. It has certain rules which decide whether a language is regular or not.

2. While applying Pumping lemma over a language, we consider a string w that belong to L and fragment it into_____parts.

a) 2
b) 5
c) 3
d) 6

SOLUTION

**Answer:** c

**Explanation:** We select a string w such that w=xyz and |y|>0 and other conditions. However, there exists an integer n such that |w|>=n for any wÎL.

3. If we select a string w such that w∈L, and w=xyz. Which of the following portions cannot be an empty string?

a) x
b) y
c) z
d) all of the mentioned

SOLUTION

**Answer:** b

**Explanation:** The lemma says, the portion y in xyz cannot be zero or empty i.e. |y|>0, this condition needs to be fulfilled to check the conclusion condition.

4. Let w= xyz and y refers to the middle portion and |y|>0.What do we call the process of repeating y 0 or more times before checking that they still belong to the language L or not?
a) Generating
b) Pumping
c) Producing
d) None of the mentioned
SOLUTION
**Answer:** b
**Explanation:** The process of repeatation is called pumping and so, pumping is the process we perform before we check whether the pumped string belongs to L or not.
5. There exists a language L. We define a string w such that w∈L and w=xyz and |w| >=n for some constant integer n.What can be the maximum length of the substring xy i.e. |xy|<=?
a) n
b) |y|
c) |x|
d) none of the mentioned
SOLUTION
**Answer:** a
**Explanation:** It is the first conditional statement of the lemma that states that |xy|<=n, i.e. the maximum length of the substring xy in w can be n only.
6. Fill in the blank in terms of p, where p is the maximum string length in L.
Statement: Finite languages trivially satisfy the pumping lemma by having n = _____
a) p*1
b) p+1
c) p-1
d) None of the mentioned
SOLUTION
**Answer:** b
**Explanation:** Finite languages trivially satisfy the pumping lemma by having n equal to the maximum string length in l plus 1.
7. Answer in accordance to the third and last statement in pumping lemma:
For all_____xyiz ∈L
a) i>0
b) i<0
c) i<=0
d) i>=0
SOLUTION
**Answer:** d
**Explanation:** Suppose L is a regular language . Then there is an integer n so that for any x∈L and |x|>=n, there are strings u,v,w so that

x= uvw
|uv|<=n
|v|>0
for any m>=0, uvmw ∈L.

8. If d is a final state, which of the following is correct according to the given diagram?

a) x=p, y=qr, z=s
b) x=p, z=qrs
c) x=pr, y=r, z=s
d) All of the mentioned

SOLUTION

**Answer:** a

**Explanation:** The FSA accepts the string pqrs. In terms of pumping lemma, the string pqrs is broken into an x portion an a, a y portion qr and a z portion s.

9. Let w be a string and fragmented by three variable x, y, and z as per pumping lemma. What does these variables represent?

a) string count
b) string
c) both (a) and (b)
d) none of the mentioned

SOLUTION

**Answer:** a

**Explanation:** Given: w =xyz. Here, xyz individually represents strings or rather substrings which we compute over conditions to check the regularity of the language.

10. Which of the following one can relate to the given statement:

Statement: If n items are put into m containers, with n>m, then atleast one container must contain more than one item.

a) Pumping lemma
b) Pigeon Hole principle
c) Count principle
d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Pigeon hole principle states the following example: If there exists n=10 pigeons in m=9 holes, then since 10>9, the pigeonhole principle says that at least one hole has more than one pigeon.

**TOPIC 4: Closure Properties of Regular Languages**

1. If L1, L2 are regular and op(L1, L2) is also regular, then L1 and L2 are said to be _____under an operation op.

a) open
b) closed

c) decidable
d) none of the mentioned
SOLUTION
**Answer:** b
**Explanation:** If two regular languages are closed under an operation op, then the resultant of the languages over an operation op will also be regular.

2. Suppose a regular language L is closed under the operation halving, then the result would be:
a) 1/4 L will be regular
b) 1/2 L will be regular
c) 1/8 L will be regular
d) Al of the mentioned
SOLUTION
**Answer:** d
**Explanation**: At first stage 1/2 L will be regular and subsequently, all the options will be regular.

3. If L1′ and L2′ are regular languages, then L1.L2 will be
a) regular
b) non regular
c) may be regular
d) none of the mentioned
SOLUTION
**Answer:** a
**Explanation:** Regular language is closed under complement operation. Thus, if L1′ and L2′ are regular so are L1 and L2. And if L1 and L2 are regular so is L1.L2.

4. If L1 and L2′ are regular languages, L1 ∩ (L2′ U L1′)’ will be
a) regular
b) non regular
c) may be regular
d) none of the mentioned
SOLUTION
**Answer:** a
**Explanation:** If L1 is regular, so is L1′ and if L1′ and L2′ are regular so is L1′ U L2′. Further, regular languages are also closed under intersection operation.

5. If A and B are regular languages, !(A’ U B’) is:
a) regular
b) non regular
c) may be regular
d) none of the mentioned
SOLUTION
**Answer:** a
**Explanation:** If A and B are regular languages, then A Ç B is a regular language and A

∩ B is equivalent to !(A' U B').

6. Which among the following are the boolean operations that under which regular languages are closed?

a) Union
b) Intersection
c) Complement
d) All of the mentioned

SOLUTION

**Answer:** d

**Explanation:** Regular languages are closed under the following operations:
a) Regular expression operations
b) Boolean operations
c) Homomorphism
d) Inverse Homomorphism

7. Suppose a language L1 has 2 states and L2 has 2 states. After using the cross product construction method, we have a machine M that accepts L1 ∩ L2. The total number of states in M:

a) 6
b) 4
c) 2
d) 8

SOLUTION

**Answer:** 4

**Explanation:** M is defined as: (Q, S, d, q0, F)
where Q=Q1*Q2 and F=F1*F2

8. If L is a regular language, then (L')' U L will be :

a) L
b) L'
c) f
d) none of the mentioned

SOLUTION

**Answer:** a

**Explanation:** (L')' is equivalent to L and L U L is subsequently equivalent to L.

9. If L is a regular language, then (((L')r)')* is:

a) regular
b) non regular
c) may be regular
d) none of the mentioned

SOLUTION

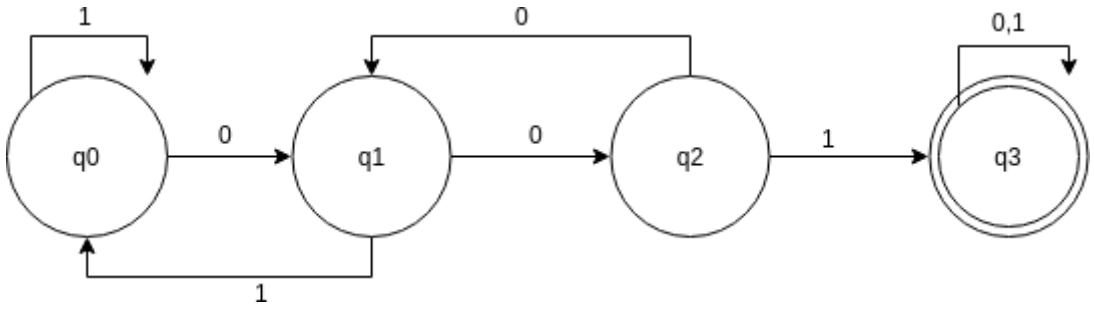
**Answer:** a

**Explanation:** If L is regular so is its complement, if L' is regular so is its reverse, if (L')r is regular so is its Kleene.

10. Which among the following is the closure property of a regular language?
a) Emptiness
b) Universality
c) Membership
d) None of the mentioned
SOLUTION
**Answer:** d
**Explanation:** All the following mentioned are decidability properties of a regular language. The closure properties of a regular language include union, concatenation, intersection, Kleene, complement , reverse and many more operations.

**TOPIC 5: Equivalence and Minimization of Automata**

1. Which of the following is same as the given DFA?




a) (0+1)*001(0+1)*
b) 1*001(0+1)*
c) (01)*(0+0+1)(01)*
d) None of the mentioned
SOLUTION
**Answer:** a
**Explanation:** There needs to be 001 together in the string as an essential substring. Thus, the other components can be anything, 0 or 1 or e.

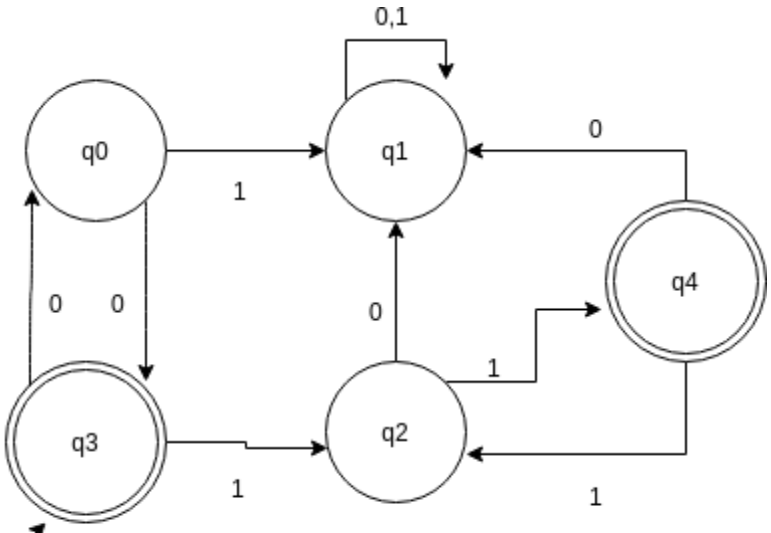
2. Which of the following statements is not true?
a) Every language defined by any of the automata is also defined by a regular expression
b) Every language defined by a regular expression can be represented using a DFA
c) Every language defined by a regular expression can be represented using NFA with e moves
d) Regular expression is just another representation for any automata definition
SOLUTION
**Answer:** b
**Explanation:** Using NFA with e moves, we can represent all the regular expressions as an automata. As regular expressions include e, we need to use e moves.

3. The total number of states required to automate the given regular expression (00)*(11)*

a) 3
b) 4
c) 5
d) 6

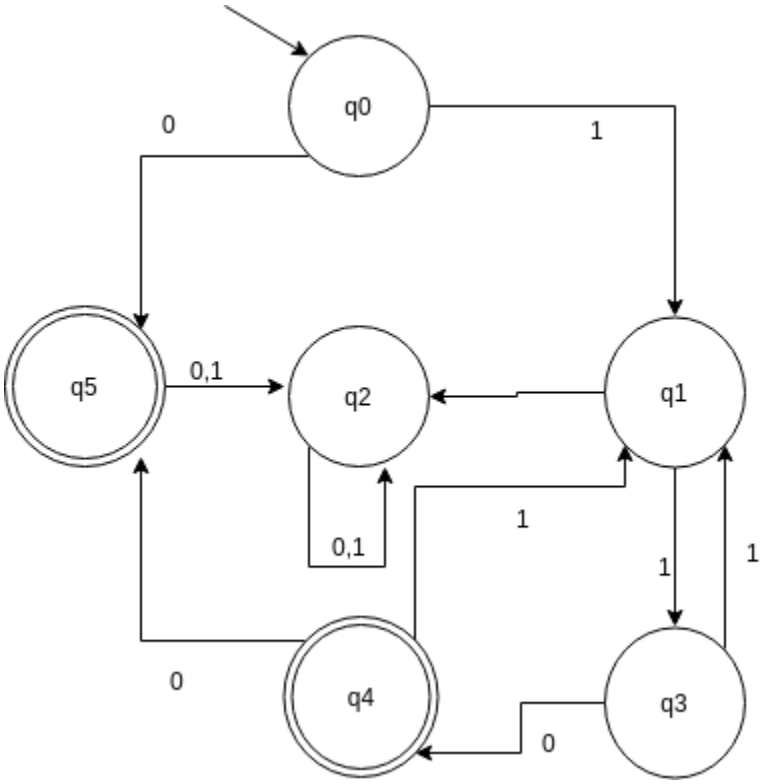
SOLUTION

**Answer:** c




**Explanation:**

4. Which of the given regular expressions correspond to the automata shown?




a) (110+1)*0
b) (11+110)*1
c) (110+11)*0
d) (1+110)*1

SOLUTION

**Answer:** c

**Explanation:** There is no state change for union operation, but has two different paths while for concatenation or dot operation, we have a state change for every element of the string.

5. Generate a regular expression for the following problem statement:

Password Validation: String should be 8-15 characters long. String must contain a number, an Uppercase letter and a Lower case letter.

a) ^(?=.*[a-z])(?=.*[A-Z])(?=.*\d).{8,15}$
b) ^(?=.*[a-z])(?=.*[A-Z])(?=.*\d).{9,16}$
c) ^(?=.[a-z])(?=.[A-Z])(?=.\d).{8,15}$
d) None of the mentioned

SOLUTION

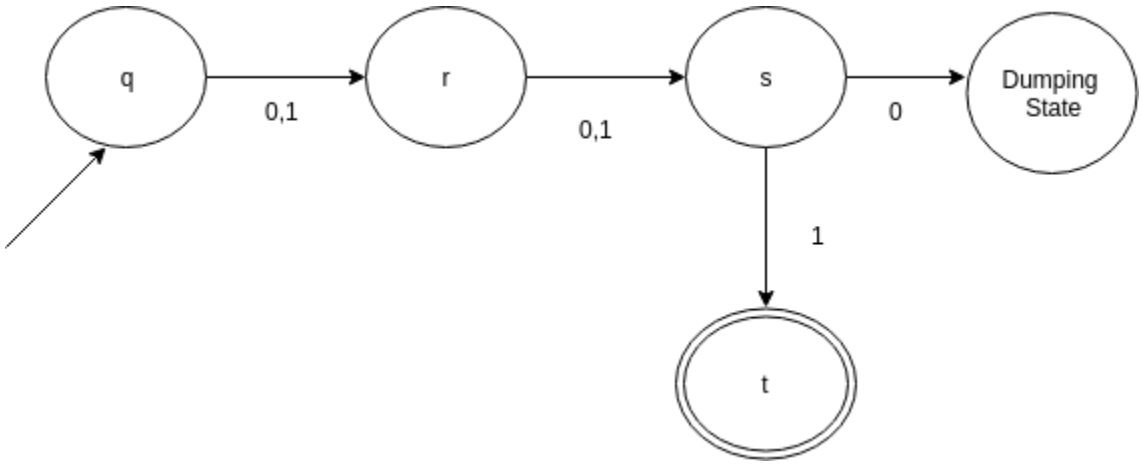
**Answer:** a

**Explanation:** Passwords like abc123, 123XYZ, should not be accepted . If one also wants to include special characters as one of the constraint, one can use the following regular expression:

^(?=.*[a-z])(?=.*[A-Z])(?=.*\d)(?=.*[^\da-za-Z]).{8,15}$

6. Generate a regular expression for the following problem statement:
P(x): String of length 6 or less for å={0,1}*
a) (1+0+e)6
b) (10)6
c) (1+0)(1+0)(1+0)(1+0)(1+0)(1+0)
d) More than one of the mentioned is correct
SOLUTION
**Answer:** a
**Explanation:** As the input variables are under Kleene Operation, we need to include e,thus option c is not correct,thereby option (a) is the right answer.

7. The minimum number of states required in a DFA (along with a dumping state) to check whether the 3rd bit is 1 or not for |n|>=3
a) 3
b) 4
c) 5
d) 1
SOLUTION
**Answer:** c
Explanation:




8. Which of the regular expressions corresponds to the given problem statement:
P(x): Express the identifiers in C Programming language
l=letters
d=digits
a) (l+_)(d+_)*
b) (l+d+_)*
c) (l+_)(l+d+_)*
d) (_+d)(l+d+_)*
SOLUTION
**Answer:** c
**Explanation:** Identifiers in C Programming Language follows the following identifiers rule:

a) The name of the identifier should not begin with a digit.
b) It can only begin with a letter or a underscore.
c) It can be of length 1 or more.

9. Generate a regular expression for the given language:l
L(x): {xÎ{0,1}*| x ends with 1 nd does not contain a substring 01}
a) (0+01)*
b) (0+01)*1
c) (0+01)*(1+01)
d) All of the mentioned

SOLUTION

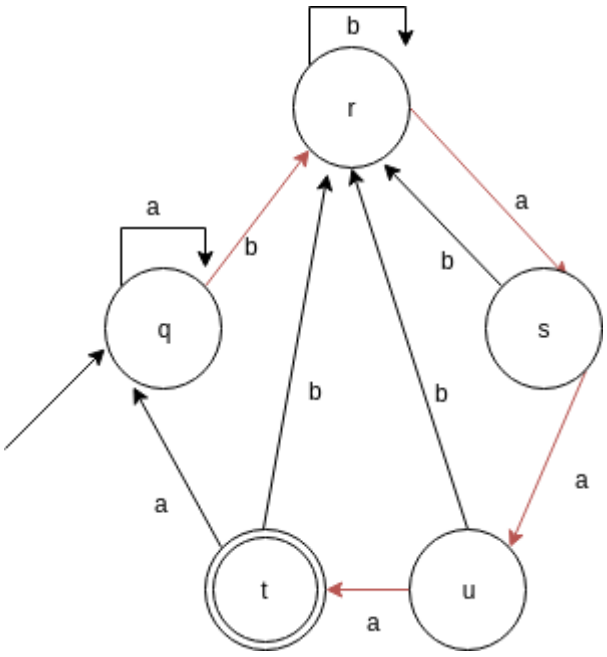
**Answer:** c

**Explanation:** (a) and (b) are the general cases where we restrict the acceptance of a string witrh substring 00 but we ignore the case where the string needs to end with 1 which therby, does not allows the acceptance of e.

10. The minimum number of transitions to pass to reach the final state as per the following regular expression is:
{a,b}*{baaa}
a) 4
b) 5
c) 6
d) 3

SOLUTION

**Answer:** a




**Explanation:**

# UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES

## TOPIC 1: CFG

1. The entity which generate Language is termed as:

a) Automata
b) Tokens
c) Grammar
d) Data

SOLUTION

**Answer:** c

**Explanation:** The entity which accepts a language is termed as Automata while the one which generates it is called Grammar. Tokens are the smallest individual unit of a program.

2. Production Rule: aAb->agb belongs to which of the following category?

a) Regular Language
b) Context free Language
c) Context Sensitive Language
d) Recursively Ennumerable Language

SOLUTION

**Answer:** c

**Explanation:** Context Sensitive Language or Type 1 or Linearly Bounded Non deterministic Language has the production rule where the production is context dependent i.e. aAb->agb.

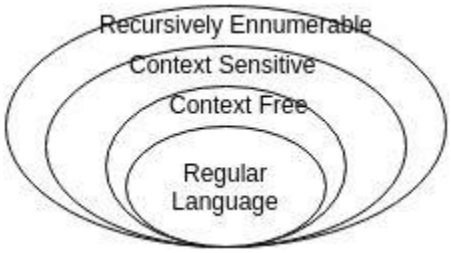
3. Which of the following statement is false?

a) Context free language is the subset of context sensitive language
b) Regular language is the subset of context sensitive language
c) Recursively ennumerable language is the super set of regular language
d) Context sensitive language is a subset of context free language

SOLUTION

**Answer:** d

**Explanation:** Every regular language can be produced by context free grammar and context free language can be produced by context sensitive grammar and so on.




4. The Grammar can be defined as: G=(V, ∑, p, S)

In the given definition, what does S represents?

a) Accepting State
b) Starting Variable
c) Sensitive Grammar

d) None of these

SOLUTION

**Answer:** b

**Explanation:** G=(V, ∑, p, S), here V=Finite set of variables, ∑= set of terminals, p= finite productions, S= Starting Variable.

5. Which among the following cannot be accepted by a regular grammar?

a) L is a set of numbers divisible by 2

b) L is a set of binary complement

c) L is a set of string with odd number of 0

d) L is a set of 0n1n

SOLUTION

**Answer:** d

**Explanation:** There exists no finite automata to accept the given language i.e. 0n1n. For other options, it is possible to make a dfa or nfa representing the language set.

6. Which of the expression is appropriate?

For production p: a->b where a∈V and b∈_____

a) V

b) S

c) (V+∑)*

d) V+ ∑

SOLUTION

**Answer:** c

**Explanation:** According to the definition, the starting variable can produce another variable or any terminal or a variable which leads to terminal.

7. For S->0S1|e for ∑={0,1}*, which of the following is wrong for the language produced?

a) Non regular language

b) 0n1n | n>=0

c) 0n1n | n>=1

d) None of the mentioned

SOLUTION

**Answer:** d

**Explanation:** L={e, 01, 0011, 000111, ……0n1n }. As epsilon is a part of the set, thus all the options are correct implying none of them to be wrong.

8. The minimum number of productions required to produce a language consisting of palindrome strings over ∑={a,b} is

a) 3

b) 7

c) 5

d) 6

SOLUTION

**Answer:** c

**Explanation:** The grammar which produces a palindrome set can be written as:
S-> aSa | bSb | e | a | b
L={e, a, b, aba, abbbaabbba…..}

9. Which of the following statement is correct?
a) All Regular grammar are context free but not vice versa
b) All context free grammar are regular grammar but not vice versa
c) Regular grammar and context free grammar are the same entity
d) None of the mentioned

SOLUTION

**Answer:** a
**Explanation:** Regular grammar is a subset of context free grammar and thus all regular grammars are context free.

10. Are ambiguous grammar context free?
a) Yes
b) No

SOLUTION

**Answer:** a
**Explanation:** A context free grammar G is ambiguous if there is atleast one string in L(G) which has two or more distinct leftmost derivations.

**TOPIC 2: Parse Trees**

1. The most suitable data structure used to represent the derivations in compiler:
a) Queue
b) Linked List
c) Tree
d) Hash Tables

SOLUTION

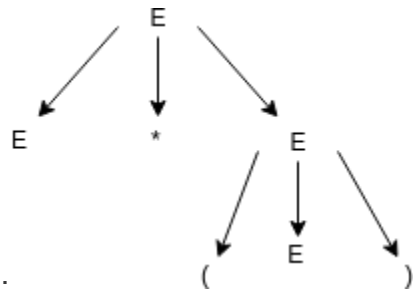
**Answer:** c
**Explanation:** The tree, known as “Parse tree” when used in a compiler, is the data structure of choice to represent the source program.

2. Which of the following statement is false in context of tree terminology?
a) Root with no children is called a leaf
b) A node can have three children
c) Root has no parent
d) Trees are collection of nodes, with a parent child relationship

SOLUTION

**Answer:** a
**Explanation:** A node has atmost one parent, drawn above the node, and zero or more children drawn below. Lines connect parents to children. There is one node, one root, that has no parent; this node appears to be at the top of the tree. Nodes with no children are called leaves. Nodes that are not leaves are called interior nodes.

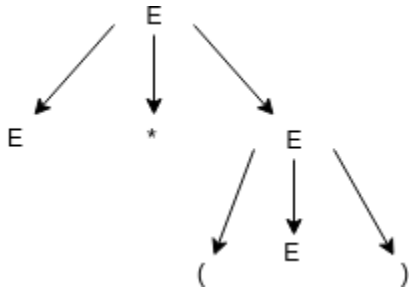
3. In which order are the children of any node ordered?
a) From the left
b) From the right
c) Arbitrarily
d) None of the mentioned
SOLUTION
**Answer:** a
**Explanation:** The children of a node are ordered from the left and drawn so. If N is to the left of node M, then all the descendents of N are considered to be to the left of all the descendents of M.
4. Which among the following is the root of the parse tree?
a) Production P
b) Terminal T
c) Variable V
d) Starting Variable S
SOLUTION
**Answer:** d
**Explanation:** The root is labelled by the start symbol. All the leaves are either labelled by a a terminal or with e.
5. For the expression E*(E) where * and brackets are the operation, number of nodes in the respective parse tree are:
a) 6
b) 7
c) 5
d) 2
SOLUTION
**Answer:** b
Explanation:




6. The number of leaves in a parse tree with expression E*(E) where * and () are operators
a) 5
b) 2
c) 4
d) 3

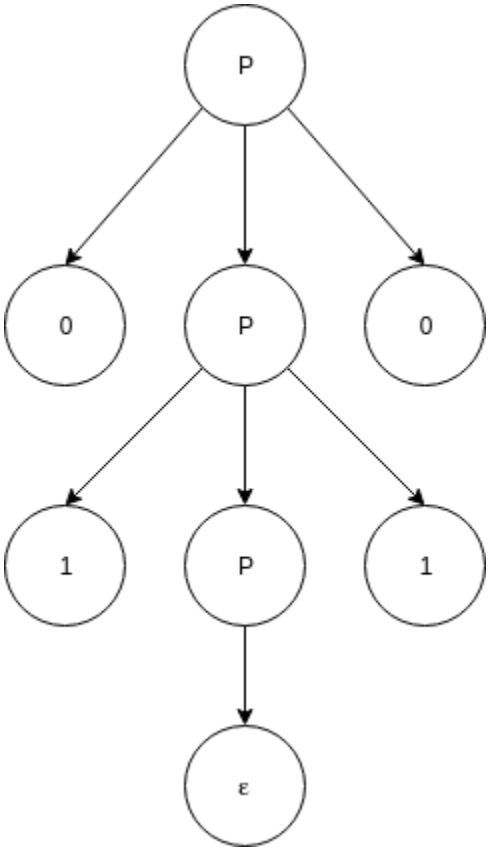
SOLUTION

**Answer:** a




**Explanation:**

7. Which of the following does the given parse tree correspond to?




a) P->1100
b) P->0110
c) P->1100 ε
d) P->0101

SOLUTION

**Answer:** b

**Explanation**: The following is a parse tree for the production 0110 over {0,1}*.

8. A grammar with more than one parse tree is called:

a) Unambiguous
b) Ambiguous

c) Regular
d) None of the mentioned
SOLUTION
**Answer:** b
**Explanation:** A context free grammar G is ambiguous if there is at least one string in L(G) having two or more distinct derivation trees or equivalently, two or more distinct leftmost derivations.

9. _____is the acyclic graphical representation of a grammar.
a) Binary tree
b) Oct tree
c) Parse tree
d) None of the mentioned
SOLUTION
**Answer:** c
**Explanation:** In order to graphically represent a derivation of a grammar we need to use parse trees.

10. Grammar is checked by which component of compiler
a) Scanner
b) Parser
c) Semantic Analyzer
d) None of the mentioned
SOLUTION
**Answer:** Parser or syntax analyzer is the one responsible for checking the grammar and reporting errors. In this phase, parse tree is generated and syntax is analyzed.

**TOPIC 3: Ambiguity in Grammars and Languages**

1. Which of the following is not a notion of Context free grammars?
a) Recursive Inference
b) Derivations
c) Sentential forms
d) All of the mentioned
SOLUTION
**Answer:** d
**Explanation:** The following are the notions to express Context free grammars:
a) Recursive Inferences
b) Derivations
c) Sentential form
d) Parse trees

2. State true orfalse:
Statement: The recursive inference procedure determines that string w is in the language of the variable A, A being the starting variable.
a) true
b) false

SOLUTION

**Answer:** a

**Explanation:** We apply the productions of CFG to infer that certain strings are in the language of a certain variable.

3. Which of the following is/are the suitable approaches for inferencing?

a) Recursive Inference
b) Derivations
c) Both Recursive Inference and Derivations
d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** Two inference approaches:

1. Recursive inference, using productions from body to head
2. Derivations, using productions from head to body

4. If w belongs to L(G), for some CFG, then w has a parse tree, which defines the syntactic structure of w. w could be:

a) program
b) SQL-query
c) XML document
d) All of the mentioned

SOLUTION

**Answer:** d

**Explanation:** Parse trees are an alternative representation to derivations and recursive inferences. There can be several parse trees for the same string.

5. Is the following statement correct?

Statement: Recursive inference and derivation are equivalent.

a) Yes
b) No

SOLUTION

**Answer:** a

**Explanation:** Yes, they are equivalent. Both the terminologies represent the two approaches of recursive inferencing.

6. A->aA| a| b

The number of steps to form aab:

a) 2
b) 3
c) 4
d) 5

SOLUTION

**Answer:** b

**Explanation:** A->aA=>aaA=>aab

7. An expression is mentioned as follows. Figure out number of incorrect notations or

symbols, such that a change in those could make the expression correct.
L(G)={w in T*|S→*w}
a) 0 Errors
b) 1 Error
c) 2 Error
d) Invalid Expression
SOLUTION

**Answer:** a

**Explanation:** For the given expression, L(G)={w in T*|S→*w}, If G(V, T, P, S) is a CFG, the language of G, denoted by L(G), is the set of terminal strings that have derivations from the start symbol.

8. The language accepted by Push down Automaton:
a) Recursive Language
b) Context free language
c) Linearly Bounded language
d) All of the mentioned
SOLUTION

**Answer:** b

**Explanation:** Push down automata accepts context free language.

9. Which among the following is the correct option for the given grammar?
G->X111|G1,X->X0|00
a) {0a1b|a=2,b=3}
b) {0a1b|a=1,b=5}
c) {0a1b|a=b}
d) More than one of the mentioned is correct
SOLUTION

**Answer:** a

**Explanation:** Using the recursive approach, we can conclude that option a is the correct answer, and its not possible for a grammar to have more than one language.

10. Which of the following the given language belongs to?
L={ambmcm| m>=1}
a) Context free language
b) Regular language
c) Both (a) and (b)
d) None of the mentioned
SOLUTION

**Answer:** d

**Explanation:** The given language is neither accepted by a finite automata or a push down automata. Thus, it is neither a context free language nor a regular language.

11. Choose the correct option:
Statement: There exists two inference approaches:
a) Recursive Inference

b) Derivation
a) true
b) partially true
c) false
d) none of the mentioned
SOLUTION
**Answer:** a
**Explanation:** We apply the productions of a CFG to infer that certain strings are in a language of certain variable.
12. Choose the correct option:
Statement 1: Recursive Inference, using productions from head to body.
Statement 2: Derivations, using productions from body to head.
a) Statement 1 is true and Statement 2 is true
b) Statement 1 and Statement 2, both are false
c) Statement 1 is true and Statement 2 is false
d) Statement 2 is true and Statement 1 is true
SOLUTION
**Answer:** b
**Explanation:** Both the statements are false. Recursive Inference, using productions from body to head. Derivations, using productions from head to body.
13. Which of the following statements are correct for a concept called inherent ambiguity in CFL?
a) Every CFG for L is ambiguous
b) Every CFG for L is unambiguous
c) Every CFG is also regular
d) None of the mentioned
SOLUTION
**Answer:** a
**Explanation:** A CFL L is said to be inherently ambiguous if every CFG for L is ambiguous.
14. Which of the theorem defines the existence of Parikhs theorem?
a) Parikh's theorem
b) Jacobi theorem
c) AF+BG theorem
d) None of the mentioned
SOLUTION
**Answer:** a
**Explanation:** Rohit Parikh in 1961 proved in his MIT research paper that some context free language can only have ambiguous grammars.

**TOPIC 4: Definition of the Pushdown Automata**

1. The production of the form A->B , where A and B are non terminals is called

a) Null production
b) Unit production
c) Greibach Normal Form
d) Chomsky Normal Form

SOLUTION

**Answer:** b

**Explanation:** A-> $\varepsilon$ is termed as Null production while A->B is termed as Unit production.

2. Halting states are of two types. They are:

a) Accept and Reject
b) Reject and Allow
c) Start and Reject
d) None of the mentioned

SOLUTION

**Answer:** a

**Explanation:** Halting states are the new tuple members introduced in turing machine and is of two types: Accept Halting State and Reject Halting State.

3. A push down automata can be represented as:

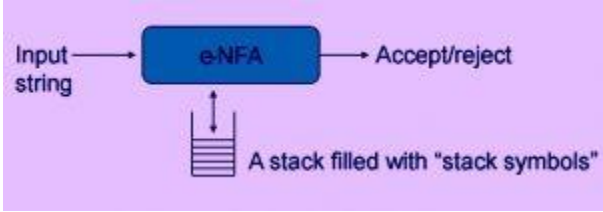
PDA= $\varepsilon$ -NFA +[stack] State true or false:

a) true
b) false

SOLUTION

**Answer:** a

Explanation:




4. A pushdown automata can be defined as: (Q, ∑, G, q0, z0, A, d)

What does the symbol z0 represents?

a) an element of G
b) initial stack symbol
c) top stack alphabet
d) all of the mentioned

SOLUTION

**Answer:** d

**Explanation:** z0 is the initial stack symbol, is an element of G. Other symbols like d represents the transition function of the machine.

5. Which of the following correctly recognize the symbol '|-' in context to PDA?

a) Moves
b) transition function

c) or/not symbol
d) none of the mentioned
SOLUTION
**Answer:** a
**Explanation:** Using this notation, we can define moves and further acceptance of a string by the machine.

6. Which among the following is true for the given statement?
Statement :If there are strings R and T in a language L so that R is prefix of T and R is not equivalent to T.
a) No DPDA can accept L by empty stack
b) DPDA can accept L by an empty stack
c) L is regular
d) None of the mentioned
SOLUTION
**Answer:** a
**Explanation:** If M is a DPDA accepting L by an empty stsck, R and T are distinct strings in L, and R is a prefix of T, then the sequence of moves M must make in order to accept R leaves the stack empty, since R∈L. But then T cannot be accepted, since M cant move with an empty stack.

7. Which of the following can be accepted by a DPDA?
a) The set of even length palindrome over {a,b}
b) The set of odd length palindrome over {a,b}
c) {xxc| where c stands for the complement,{0,1}}
d) None of the mentioned
SOLUTION
**Answer:** d
**Explanation:** Theorem: The language pal of palindromes over the alphabet {0,1} cannot be accepted by any finite automaton , and it is therefore not regular.

8. For a counter automaton, with the symbols A and Z0, the string on the stack is always in the form of _____
a) A
b) AnZ0, n>=0
c) Z0An, n>=0
d) None of the mentioned
SOLUTION
**Answer:** b
Explanation:The possible change in the stack contents is a change in the number of A's on the stack.

9. State true orfalse:
Statement: Counter Automaton can exist for the language L={0i1i|i>=0}
a) true
b) false

SOLUTION

**Answer:** a

**Explanation:** The PDA works as follows. Instead of saving excess 0's or 1's on the stack, we save *'s and use two different states to indicate which symbol there is currently a surplus of. The state q0 is the initial state and the only accepting state.

10. Let ∑={0,1}* and the grammar G be:

S-> ε

S->SS

S->0S1|1S0

State which of the following is true for the given

a) Language of all and only Balanced strings

b) It contains equal number of 0's and 1's

c) Ambiguous Grammar

d) All of the mentioned

SOLUTION

**Answer:** d

**Explanation:** A string is said to be balanced if it consist of equal number of 0's and 1's.

**TOPIC 5: Languages of a Pushdown Automata**

1. Context free grammar is called Type 2 grammar because of _____ hierarchy.

a) Greibach

b) Backus

c) Chomsky

d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** Chomsky hierarchy decide four type of language :Type 3- Regular Language, Type 2-Context free language, Type 1-Context Sensitive Language, Type 0- Unrestricted or Recursively Ennumerable language.

2. a→b

Restriction: Length of b must be atleast as much length of a.

Which of the following is correct for the given assertion?

a) Greibach Normal form

b) Context Sensitive Language

c) Chomsky Normal form

d) Recursively Ennumerable language

SOLUTION

**Answer:** b

**Explanation:** A context-sensitive grammar (CSG) is a formal grammar in which the left-hand sides and right-hand sides of any production rules may be surrounded by a context of terminal and non terminal symbols. Context-sensitive grammars are more

general than context-free grammars, in the sense that there are some languages that cannot be described by context-free grammars, but can be described by CSG.

3. From the definition of context free grammars,
G=(V, T, P,S)
What is the solution of VÇT?
a) Null
b) Not Null
c) Cannot be determined, depends on the language
d) None of the mentioned

SOLUTION

**Answer:** a

**Explanation:** V is the set of non terminal symbols while T is the st of terminal symbols, their intersection would always be null.

4. If P is the production, for the given statement, state true or false.
P: V->(V∑T)* represents that the left hand side production rule has no right or left context.
a) true
b) false

SOLUTION

**Answer:** a

**Explanation:** Here the production P is from the definition of Context free grammar and thus, has no right or left context.

5. There exists a Context free grammar such that:
X->aX
Which among the following is correct with respect to the given assertion?
a) Left Recursive Grammar
b) Right Recursive Grammar
c) Non Recursive Grammar
d) None of the mentioned

SOLUTION

**Answer:** b

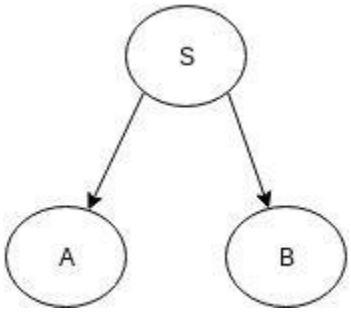
**Explanation:** The grammar with right recursive production is known as Right recursive grammar. Right recursive production is of the form X->aX where a is a terminal and X is a non terminal.

6. If the partial derivation tree contains the root as the starting variable, the form is known as:
a) Chomsky hierarchy
b) Sentential form
c) Root form
d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Example: For any grammar, productions be:
S->AB
A->aaA| ^
B->Bb|^
The partial derivation tree can be drawn as:




Since it has the root as S, this can be said to be in sentential form.

7. Find a regular expression for a grammar which generates a language which states :
L contains a set of strings starting wth an a and ending with a b, with something in the middle.
a) a(a*Ub*)b
b) a*(aUb)b*
c) a(a*b*)b
d) None of the mentioned

SOLUTION

**Answer:** a
**Explanation:** The grammar for the same language can be stated as :
(1) S → aMb
(2) M → A
(3) M → B
(4) A → e
(5) A → aA
(6) B → e
(7) B → bB

8. Which of the following is the correct representation of grammar for the given regular expression?
a(aUb)*b
a) (1) S → aMb
(2) M → e
(3) M → aM
(4) M → bM
b) (1) S → aMb
(2) M → Mab
(3) M → aM
(4) M → bM

c) (1) S →aMb
(2) M →e
(3) M→aMb
(4) M→bMa
d) None of the mentioned
SOLUTION
**Answer:** a
Explanation:
The basic idea of grammar formalisms is to capture the structure of string by
a) using special symbols to stand for substrings of a particular structure
b) using rules to specify how the substrings are combined to form new substrings.

9. A CFG consist of the following elements:
a) a set of terminal symbols
b) a set of non terminal symbols
c) a set of productions
d) all of the mentioned
SOLUTION
**Answer:** d
**Explanation:** A CFG consists of:
a) a set of terminals, which are characters of alphabets that appear in the string generated by the grammar.
b) a set of non terminals, which are placeholders for patterns of terminal symbols that can be generated by the nonterminal symbols.
c) a set of productions, which are set of rules to transit from one state to other forming up the string
d) a start symbol, a special non terminal symbol that appears in the initial string generated in the grammar.

10. A CFG for a program describing strings of letters with the word “main” somewhere in the string:
a) -> m a i n
-> | epsilon
-> A | B | … | Z | a | b … | z
b) –> m a i n
–>
–> A | B | … | Z | a | b … | z
c) –> m a i n
–> | epsilon
–> A | B | … | Z | a | b … | z
d) None of the mentioned
SOLUTION
**Answer:** a
**Explanation:** None.

**TOPIC 6: Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.**

1. The transition a Push down automaton makes is additionally dependent upon the:
a) stack
b) input tape
c) terminals
d) none of the mentioned

SOLUTION

**Answer:** a

**Explanation:** A PDA is a finite machine which has an additional stack storage. Its transitions are based not only on input and the correct state but also on the stack.

2. A PDA machine configuration (p, w, y) can be correctly represented as:
a) (current state, unprocessed input, stack content)
b) (unprocessed input, stack content, current state)
c) (current state, stack content, unprocessed input)
d) none of the mentioned

SOLUTION

**Answer:** a

**Explanation:** A machine configuration is an element of $K \times \Sigma^* \times \Gamma^*$.
$(p,w,\gamma) =$ (current state, unprocessed input, stack content).

3. |-* is the_____closure of |-
a) symmetric and reflexive
b) transitive and reflexive
c) symmetric and transitive
d) none of the mentioned

SOLUTION

**Answer:** b

**Explanation:** A string w is accepted by a PDA if and only if (s,w, e) |-* (f, e, e)

4. With reference of a DPDA, which among the following do we perform from the start state with an empty stack?
a) process the whole string
b) end in final state
c) end with an empty stack
d) all of the mentioned

SOLUTION

**Answer:** d

**Explanation:** The empty stack in the end is our requirement relative to finite state automatons.

5. A DPDA is a PDA in which:
a) No state p has two outgoing transitions
b) More than one state can have two or more outgoing transitions
c) Atleast one state has more than one transitions

d) None of the mentioned

SOLUTION

**Answer:** a

**Explanation:** A Deterministic Push Down Automata is a Push Down Automata in which no state p has two or more transitions.

6. State true or false:

Statement: For every CFL, G, there exists a PDA M such that L(G) = L(M) and vice versa.

a) true

b) false

SOLUTION

**Answer:** a

**Explanation:** There exists two lemma's such that:

a) Given a grammar G, construct the PDA and show the equivalence

b) Given a PDA, construct a grammar and show the equivalence

7. If the PDA does not stop on an accepting state and the stack is not empty, the string is:

a) rejected

b) goes into loop forever

c) both (a) and (b)

d) none of the mentioned

SOLUTION

**Answer:** a

**Explanation:** To accept a string, PDA needs to halt at an accepting state and with a stack empty, else it is called rejected. Given a PDA M, we can construct a PDA M' that accepts the same language as M, by both acceptance criteria.

8. A language accepted by Deterministic Push down automata is closed under which of the following?

a) Complement

b) Union

c) Both (a) and (b)

d) None of the mentioned

SOLUTION

**Answer:** a

**Explanation:** Deterministic Context free languages(one accepted by PDA by final state), are drastically different from the context free languages. For example they are closed under complementation and not union.

9. Which of the following is a simulator for non deterministic automata?

a) JFLAP

b) Gedit

c) FAUTO

d) None of the mentioned

SOLUTION

**Answer:** a

**Explanation:** JFLAP is a software for experimenting with formal topics including NFA, NPDA, multi-tape turing machines and L-systems.

10. Finite-state acceptors for the nested words can be:

a) nested word automata
b) push down automata
c) ndfa
d) none of the mentioned

SOLUTION

**Answer:** a

**Explanation:** The linear encodings of languages accepted by finite nested word automata gives the class of 'visibly pushdown automata'.

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## UNIT IV PROPERTIES OF CONTEXT FREE LANGUAGES

### TOPIC 1: Normal Forms for CFG

1. The format: A->aB refers to which of the following?

a) Chomsky Normal Form
b) Greibach Normal Form
c) Backus Naur Form
d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** A context free grammar is in Greibach Normal Form if the right hand sides of all the production rules start with a terminal, optionally followed by some variables.

2. Which of the following does not have left recursions?

a) Chomsky Normal Form
b) Greibach Normal Form
c) Backus Naur Form
d) All of the mentioned

SOLUTION

**Answer:** b

**Explanation:** The normal form is of the format:

A->aB where the right hand side production tends to begin with a terminal symbo, thus having no left recursions.

3. Every grammar in Chomsky Normal Form is:

a) regular
b) context sensitive
c) context free
d) all of the mentioned

SOLUTION

**Answer:** c

**Explanation:** Conversely, every context frr grammar can be converted into Chomsky Normal form and to other forms.

4. Which of the production rule can be accepted by Chomsky grammar?

a) A->BC
b) A->a
c) S->e
d) All of the mentioned

SOLUTION

**Answer:** d

**Explanation:** in CNF, the production rules are of the form:
A->BC
A-> a
S->e

5. Given grammar G:

(1) S->AS
(2) S->AAS
(3) A->SA
(4) A->aa

Which of the following productions denies the format of Chomsky Normal Form?

a) 2,4
b) 1,3
c) 1, 2, 3, 4
d) 2, 3, 4

SOLUTION

**Answer:** a

**Explanation:** The correct format: A->BC, A->a, X->e.

6. Which of the following grammars are in Chomsky Normal Form:

a) S->AB|BC|CD, A->0, B->1, C->2, D->3
b) S->AB, S->BCA|0|1|2|3
c) S->ABa, A->aab, B->Ac
d) All of the mentioned

SOLUTION

**Answer:** a

**Explanation:** We can eliminate the options on the basis of the format we are aware of: A->BC, B->b and so on.

7. With reference to the process of conversion of a context free grammar to CNF, the number of variables to be introduced for the terminals are:

S->ABa
A->aab
B->Ac

a) 3
b) 4
c) 2
d) 5

SOLUTION

**Answer:** a

**Explanation:** According to the number of terminals present in the grammar, we need the corresponding that number of terminal variables while conversion.

8. In which of the following, does the CNF conversion find its use?

a) CYK Algorithm
b) Bottom up parsing
c) Preprocessing step in some algorithms
d) All of the mentioned

SOLUTION

**Answer:** d

**Explanation:** Besides the theoretical significance of CNF, it conversion scheme is helpful in algorithms as a preprocessing step, CYK algorithms and the bottom up parsing of context free grammars.

9. Let G be a grammar. When the production in G satisfy certain restrictions, then G is said to be in_____.

a) restricted form
b) parsed form
c) normal form
d) all of the mentioned

SOLUTION

**Answer:** c

**Explanation:** When the production in G satisfy certain restrictions, then G is said to be in 'normal form'.

10. Let G be a grammar: S->AB|e, A->a, B->b
Is the given grammar in CNF?

a) Yes
b) No

SOLUTION

**Answer:** a

**Explanation:** e is allowed in CNF only if the starting variable does not occur on the right hand side of the derivation.

**TOPIC 2: Pumping Lemma for CFL**

1. Which of the following is called Bar-Hillel lemma?

a) Pumping lemma for regular language
b) Pumping lemma for context free languages
c) Pumping lemma for context sensitive languages
d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** In automata theory, the pumping lemma for context free languages, also kmown as the Bar-Hillel lemma, represents a property of all context free languages.

2. Which of the expressions correctly is an requirement of the pumping lemma for the context free languages?

a) uvnwxny

b) uvnwnxny

c) uv2nwx2ny

d) All of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Let L be a CFL. Then there is an integer n so that for any u that belong to language L satisfying |t| >=n, there are strings u, v, w, x, y and z satisfying

t=uvwxy

|vx|>0

|vwx|<=n For any m>=0, uvnwxny ∈ L

3. Let L be a CFL. Then there is an integer n so that for any u that belong to language L satisfying

|t|>=n, there are strings u, v, w, x, y and z satisfying

t=uvwxy.

Let p be the number of variables in CNF form of the context free grammar. The value of n in terms of p :

a) 2p

b) 2p

c) 2p+1

d) p2

SOLUTION

**Answer:** c

**Explanation:** This inequation has been derived from derivation tree for t which must have height at least p+2(It has more than 2p leaf nodes, and therefore its height is >p+1).

4. Which of the following gives a positive result to the pumping lemma restrictions and requirements?

a) {aibici|i>=0}

b) {0i1i|i>=0}

c) {ss|s∈{a,b}*}

d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** A positive result to the pumping lemma shows that the language is a

CFL and ist contradiction or negative result shows that the given language is not a Context Free language.

5. Using pumping lemma, which of the following cannot be proved as 'not a CFL'?

a) {aibici|i>=0}
b) {ss|s∈{a,b}*}
c) The set legal C programs
d) None of the mentioned

SOLUTION

**Answer:** d

**Explanation:** There are few rules in C that are context dependent. For example, declaration of a variable before it can be used.

6. State true or false:

Statement: We cannot use Ogden's lemma when pumping lemma fails.

a) true
b) false

SOLUTION

**Answer:** b

**Explanation:** Although the pumping lemma provides some information about v and x that are pumped, it says little about the location of these substrings in the string t. It can be used whenever the pumping lemma fails. Example: {apbqcrds|p=0 or q=r=s}, etc.

7. Which of the following cannot be filled in the blank below?

Statement: There are CFLs L1 nad L2 so that_____is not a CFL.

a) L1∩L2
b) L1′
c) L1*
d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** A set of context free language is closed under the following operations:
a) Union
b) Concatenation
c) Kleene

8. The pumping lemma is often used to prove that a language is:

a) Context free
b) Not context free
c) Regular
d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** The pumping lemma is often used to prove that a given language L is non-context-free, by showing that arbitrarily long strings s are in L that cannot be

"pumped" without producing strings outside L.

9. What is the pumping length of string of length x?

a) x+1
b) x
c) x-1
d) x2

SOLUTION

**Answer:** a

**Explanation:** There exists a property of all strings in the language that are of length p, where p is the constant-called the pumping length .For a finite language L, p is equal to the maximum string length in L plus 1.

10. Which of the following does not obey pumping lemma for context free languages ?

a) Finite languages
b) Context free languages
c) Unrestricted languages
d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** Finite languages (which are regular hence context free ) obey pumping lemma where as unrestricted languages like recursive languages do not obey pumping lemma for context free languages.

**TOPIC 3: Closure Properties of CFL**

1. The context free languages are closed under:

a) Intersection
b) Complement
c) Kleene
d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** Context free languages are closed under the following operation: union, kleene and concatenation. For regular languages, we can add intersection and complement to the list.

2. Given Grammar G1:

S->aSb
S->e

Grammar G2:

R->cRd
R->e

If L(G)=L(G1) U L(G2), the number of productions the new starting variable would have:

a) 2
b) 3

c) 4
d) 1
SOLUTION

**Answer:** a
Explanation:
T->S|R
S->aSb
S->e
R->cRd
R->e

3. Context free languages are not closed under:
a) Intersection
b) Intersection with Regular Language
c) Complement
d) All of the mentioned
SOLUTION

**Answer:** d
**Explanation:** It is a theorem which states that, Context free languages are not closed under operations like intersection and complement.

4. Which of the following is incorrect?
There exists algorithms to decide if:
a) String w is in CFL L
b) CFL L is empty
c) CFL L is infinite
d) All of the mentioned
SOLUTION

**Answer:** d
**Explanation:** These properties are termed as decision properties of a CFL and include a set of problems like infiniteness problem, emptiness problem and membership problem.

5. If the start symbol is one of those symbols which produce no terminal through any sequence, the CFL is said to be
a) nullable
b) empty
c) eliminated
d) none of the mentioned
SOLUTION

**Answer:** b
**Explanation:** In the process of removing useless symbols, if the starting symbol is also a part, the CFL can be then termed as empty; otherwise not.

6. Using the pumping constant n, If there is a string in the language of length between _____and____then the language is infite else not.

a) n, 2n-1
b) 2n, n
c) n+1, 3n+6
d) 0, n+1

SOLUTION

**Answer:** a

**Explanation:** If there is a string in the language of length between n and 2n-1 then the language is infite else not. The idea is essentially the same for regular languages.

7. Which of the following is/are CFL not closed under?

a) Reverse
b) Homomorphism
c) Inverse Homomorphism
d) All of the mentioned

SOLUTION

**Answer:** d

**Explanation:** CFL is closed under union, kleene and concatenation along with the properties reversal,homomorphism and inverse homomorphism but not difference and intersection.

8. If L1 and L2 are context free languages, L1-L2 are context free:

a) always
b) sometimes
c) never
d) none of the mentioned

SOLUTION

**Answer:** c

**Explanation:** Context free languages are not closed under difference, intersection and complement operations.

9. A_____is context free grammar with atmost one non terminal in the right handside of the production.

a) linear grammar
b) linear bounded grammar
c) regular grammar
d) none of the mentioned

SOLUTION

**Answer:** a

**Explanation:** A simple linear grammar is G with N = {S}, Σ = {a, b}, P with start symbol S and rules

$S \rightarrow aSb$

$S \rightarrow \varepsilon$

10. There is a linear grammar that generates a context free grammar

a) always
b) never

c) sometimes
d) none of the mentioned
SOLUTION

**Answer:** c

**Explanation:** Linear grammar is a subset of context free grammar which has atmost one non terminal symbol in the right hand side of the production.Thus, there exists some languages which are generated by Linear grammars.

**TOPIC 4: Turing Machines**

1. A turing machine is a
a) real machine
b) abstract machine
c) hypothetical machine
d) more than one option is correct
SOLUTION

**Answer:** d

**Explanation:** A turing machine is abstract or hypothetical machine thought by mathematician Alan Turing in 1936 capable of simulating any algorithm, however complicated it is.

2. A turing machine operates over:
a) finite memory tape
b) infinite memory tape
c) depends on the algorithm
d) none of the mentioned
SOLUTION

**Answer:** b

**Explanation:** The turing machine operates on an infinite memory tape divided into cells. The machine positions its head over the cell and reads the symbol.

3. Which of the functions are not performed by the turing machine after reading a symbol?
a) writes the symbol
b) moves the tape one cell left/right
c) proceeds with next instruction or halts
d) none of the mentioned
SOLUTION

**Answer:** d

**Explanation:** After the read head reads the symbol from the input tape, it performs the following functions:
a) writes a symbol(some model allow symbol erasure/no writing)
b) moves the tape left or right (some models allows no motion)
c) proceeds with subsequent instruction or goes either into accepting halting state or rejecting halting state.

4. 'a' in a-machine is:
a) Alan
b) arbitrary
c) automatic
d) None of the mentioned
SOLUTION
**Answer:** c
**Explanation:** The turing machine was invented by Alan turing in 1936. He named it as a-machine(automatic machine).
5. Which of the problems were not answered when the turing machine was invented?
a) Does a machine exists that can determine whether any arbitrary machine on its tape is circular.
b) Does a machine exists that can determine whether any arbitrary machine on its tape is ever prints a symbol
c) Hilbert Entscheidungs problem
d) None of the mentioned
SOLUTION
**Answer:** d
**Explanation:** Invention of turing machine answered a lot of questions which included problems like decision problem, etc.) . Alan was able to prove the properties of computation using such model.
6. The ability for a system of instructions to simulate a Turing Machine is called _____
a) Turing Completeness
b) Simulation
c) Turing Halting
d) None of the mentioned
SOLUTION
**Answer:** a
**Explanation:** Turing Completeness the ability for a system of instructions to simulate a Turing machine. A programming language that is Turing complete is theoretically capable of expressing all tasks accomplishable by computers; nearly all programming languages are Turing complete.
7. Turing machine can be represented using the following tools:
a) Transition graph
b) Transition table
c) Queue and Input tape
d) All of the mentioned
SOLUTION
**Answer:** d
**Explanation:** We can represent a turing machine, graphically, tabularly and diagramatically.

8. Which of the following is false for an abstract machine?
a) Turing machine
b) theoretical model of computer
c) assumes a discrete time paradigm
d) all of the mentioned
SOLUTION
**Answer:** d
**Explanation:** A n abstract machine also known as abstract computer, is a theoretical model of computer or hardware system in automata theory. Abstraction in computing process usually assumes a discrete time paradigm.
9. Fill in the blank with the most appropriate option.
Statement: In theory of computation, abstract machines are often used in _____ regarding computability or to analyze the complexity of an algorithm.
a) thought experiments
b) principle
c) hypothesis
d) all of the mentioned
SOLUTION
**Answer:** d
**Explanation:** A thought experiment considers some hypothesis, theory or principle for the purpose of thinking through its consequences.
10. State true or false:
Statement: RAM model allows random access to indexed memory locations.
a) true
b) false
SOLUTION
**Answer:** a
**Explanation:** In computer science, Random access machine is an abstract machine in the general class of register machines. Random access machine should not be confused with Random access memory.

**TOPIC 5: Programming Techniques for TM.**
This set of Automata Theory Multiple Choice Questions & Answers (MCQs) focuses on "Programming Techniques-Storage and Subroutines".
1. A turing machine has _____ number of states in a CPU.
a) finite
b) infinte
c) May be finite
d) None of the mentioned
SOLUTION
**Answer:** a
**Explanation:** A turing machine has finite number of states in its CPU. However the

states are not small in number. Real computer consist of registers which can store values (fixed number of bits).

2. Suppose we have a simple computer with control unit holding a PC with a 32 bit address + Arithmetic unit holding one double length 64 bit Arithmetic Register. The number of states the finite machine will hold:

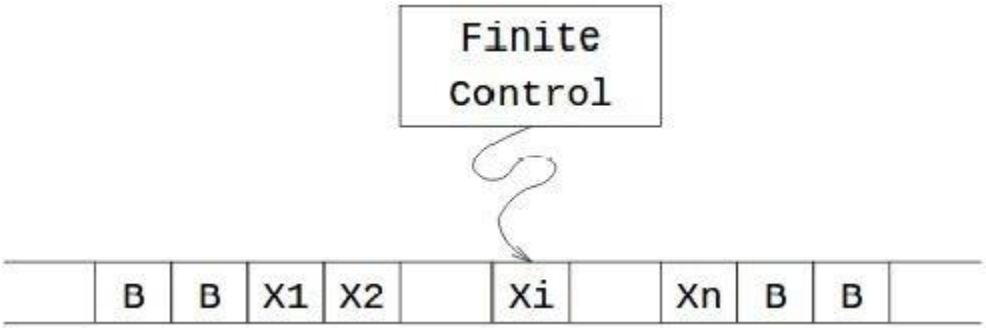
a) 2(32*64)
b) 296
c) 96
d) 32

SOLUTION

**Answer:** b

**Explanation:** According to the statistics of the question, we will have a finite machine with 2^96 states.

3. In one move a turing machine will:




a) Change a state
b) Write a tape symbol in the cell scanned
c) Move the tape head left or right
d) All of the mentioned

SOLUTION

**Answer:** d

**Explanation:** A move of a turing machine is the function of the state of finite control and the tape symbol just scanned.

4. State true orfalse:

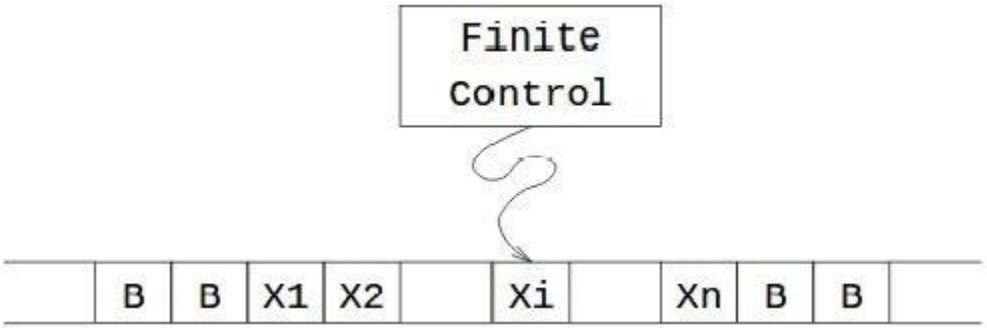
Statement: We can use the finite control of turing machine to hold a finite amount of data.

a) true
b) false

SOLUTION

**Answer:** a

Explanation:




The finite control not only contains state q but also three data, A, B, C. The following technique requires no extension to the Turing Machine model. Shaping states this way allows to describe transitions in more systematic way and often to simplify the strategy of the program.

5. Statement 1: Multitrack Turing machine.

Statement 2: Gamma is Cartesian product of a finite number of finite sets.

Which among the following is the correct option?

a) Statement 1 is the assertion and Statement 2 is the reason

b) Statement 1 is the reason and Statement 2 is the assertion

c) Statement 1 and Statement 2 are independent from each other

d) None of the mentioned

SOLUTION

**Answer:** a

**Explanation**: Cartesian product works like a struct in C/C++. For Example: Computer tape storage is something like 8 or 9 bits in each cell. One can recognize a multi track tape machine by looking at the transitions because each will have tuples as the read and write symbols.

6. A multi track turing machine can described as a 6-tuple (Q, X, S, d, q0, F) where X represents:

a) input alphabet

b) tape alphabet

c) shift symbols

d) none of the mentioned

SOLUTION

**Answer:** b

**Explanation:** The 6-tuple (Q, X, S, d, q0, F) can be explained as:

Q represents finite set of states,

X represents the tape alphabet,

S represents the input alphabet

d represents the relation on states and the symbols

q0 represents the initial state

F represents the set of final states.

7. Which of the following statements are false?

a) A multi track turing machine is a special kind of multi tape turing machine

b) 4-heads move independently along 4-tracks in standard 4-tape turing machine
c) In a n-track turing machine, n head reads and writes on all the tracks simultaneously.
d) All of the mentioned

SOLUTION

**Answer:** c

**Explanation:** In a n-track turing machine, one head reads and writes on all the tracks simultaneously.

8. State true orfalse:

Statement: Two track turing machine is equivalent to a standard turing machine.

a) true
b) false

SOLUTION

**Answer:** a

**Explanation:** This can be generalized for n- tracks and can be proved equivalent using ennumerable languages.

9. Which of the following is/are not true for recursively ennumerable language?

a) partially decidable
b) Turing acceptable
c) Turing Recognizable
d) None of the mentioned

SOLUTION

**Answer:** d

**Explanation:** In automata theory, a formal language is called recursively ennumerable language or partially decidable or semi decidable or turing acceptable or turing recognizable if there exists a turing machine which will ennumerate all valid strings of the language.

10. According to Chomsky hierarchy, which of the following is adopted by Recursively Ennumerable language?

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

SOLUTION

**Answer:** a

**Explanation:** Recursively Ennumerable languages are type 0 languages in the Chomsky hierarchy. All regular, context free, context sensitive languages are recursivelyennumerable language.

# UNIT V UNDECIDABILITY

## TOPIC 1: Non Recursive Enumerable (RE) Language

1. Which of the following technique is used to find whether a natural language isnt recursive ennumerable?
a) Diagonalization
b) Recursive Induction
c) Both (a) and (b)
d) None of the mentioned
SOLUTION
**Answer:** a
**Explanation:** To find a non recursively ennumerable language, we use the technique of diagonalization.
2. Diagonalization can be useful in:
a) To find a non recursively ennumerable language
b) To prove undecidablility of haltig problem
c) Both (a) and (b)
d) None of the mentioned
SOLUTION
**Answer:** c
**Explanation:** Diagonalization is a technique we use for the following operations:
a) To find a non recursively ennumerable language.
b) To prove undecidablility of halting problem.
3. Which of the following are undecidable problems?
a) Determining whether two grammars generate the same language
b) Determining whether a grammar is ambiguous
c) Both (a) and (b)
d) None of the mentioned
SOLUTION
**Answer:** c
**Explanation:** In contrast we can put up an algorithm for checking whether two FA's are equivalent and this program can be implemented as a program.
4. Which of the following are incorrect options?
a) Informally, problem is a yes/no question about an infinite set of possible instances
b) Formally, a problem is a language
c) Both (a) and (b)
d) None of the mentioned
SOLUTION
**Answer:** d
**Explanation:** Example: Does a graph G has a Hamilton cycle?
=>Each undirected graph is an instance of Hamilton cycle problem.
5. If a problem has an algorithm to answer it, we call it _____

a) decidable
b) solved
c) recognizable
d) none of the mentioned
SOLUTION
**Answer:** a
**Explanation:** An algorithm is a TM that halts on all inputs,accepted or not. Putting other way, decidable problems are recursive languages.

6. Which of the following are decidable problems?
a) Can a particular line of code in a program ever be executed?
b) Do two given CFG's generate the same language
c) Is a given CFG ambiguous?
d) None of the mentioned
SOLUTION
**Answer:** d
**Explanation:** All of the mentioned problems are undecidable.

7. Which one of the following is true for the given?
A={(M,w)|M is a turing machine that accepts string w}
a) A concrete undecidable problem
b) A is recognizable but not decidable
c) -A is not recognizable
d) All of the mentioned
SOLUTION
**Answer:** d
**Explanation:** We can proof A to be undecidable using the contradiction method.

8. Which of the following are correct statements?
a) TMs that always halt are known as Decidable problems
b) TMs that are guaranteed to halt only on acceptance are recursive ennumerable.
c) Both (a) and (b)
d) None of the mentioned
SOLUTION
**Answer:** c
**Explanation:** There are two types of TMs on the basis of halting: Recursive and Recursively Ennumerable(TM may or may not halt,could loop forever).

9. Statement: If L id R.E., Lc needs to be R.E. Is it correct?
a) Yes
b) No
c) Maybe
d) Cannot predict
SOLUTION
**Answer:** b
**Explanation:** Any recursive ennumerable language is not closed under

complementation.

10. Which of the following is true for The Halting problem?

a) It is recursively ennumerable
b) It is undecidable
c) Both (a) and (b)
d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** Halting problem: Does a given Turing machine M halt on a given input w?

11. With reference to binary strings, state true or false:

Statement: For any turing machine, the input alphabet is restricted to {0,1}.

a) true
b) false

SOLUTION

**Answer:** a

**Explanation:** When turing machines are coded as Binary strings, we are restricted to take any input alphabet except {0,1}.

12. With reference ti enumeration of binary strings, the conversion of binary strings to integer is possible by treating the resulting string as a base____integer.

a) 2
b) 8
c) 16
d) All of the mentioned

SOLUTION

**Answer:** a

**Explanation:** It makes sense to talk about the i-th binary string" and about "the i-th Turing machine. If i makes no sense as a TM, assume the i-th TM accepts nothing.

**TOPIC 2: Undecidable Problem with RE**

1. The decision problem is the function from string to _____

a) char
b) int
c) boolean
d) none of the mentioned

SOLUTION

**Answer:** c

**Explanation:** The decision problem requires checking of input (string) has some property or not. That is a string to boolean transaction.

2. A language L is said to be_____if there is a turing machine M such that L(M)=L and M halts at every point.

a) Turing acceptable

b) decidable
c) undecidable
d) none of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Decidability refers to the decision problem and existence of a effective method for determining membership, and return true and false accordingly rather that going into a loop forever.

3. Which aong the following are undecidable theories?

a) The first order theory of boolean algebra
b) The first order theory of Euclidean geomentry
c) The first order theory of hyperbolic geometry
d) The first order theory of the natural number with addition, multiplication, and equality

SOLUTION

**Answer:** d

**Explanation:** Tarski and Mostowski in 1949, established that the first order theory of natural numbers with addition, multiplication, and equality is an undecidable theory. Others mentioned are decidable theories.

4. Rec-DFA = { | M is a DFA and M recognizes input w}.

Fill in the blank:

Rec-DFA is _____

a) Undecidable
b) Decidable
c) Non finite
d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Under decidablity of regular language properties we have the following lemma which states that A DFA which recognizes an input w is decidable.

5. Which among the following are semi decidable?

a) Empty-DFA
b) Rec-NFA
c) Infinite-DFA
d) All of the mentioned

SOLUTION

**Answer:** d

**Explanation:** All are the properties of regular languages and all are decidable languages.

6. The language accepted by a turing machine is called _____

a) Recursive Ennumerable
b) Recursive

c) Both (a) and (b)
d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** The language accepted by Turing machines are called recursively ennumerable (RE), and the subset of RE languages that are accepted by a turing machine that always halts are called recursive.

7. Decidable can be taken as a synonym to:

a) recursive
b) non recursive
c) recognizable
d) none of the mentioned

SOLUTION

**Answer:** a

**Explanation:** We can refer to languages as 'recursive' and problems as 'decidable'. If a language is not recursive , then we call the problem expressed by that language undecidable.

8. The problems which have no algorithm, regardless of whether or not they are accepted by a turing machine that fails to halts on some input are referred as:

a) Decidable
b) Undecidable
c) Computable
d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** The problems that can be solved by a turing machine can divided into two classes:

a) Those that have an algorithm
b) Intractable problems: Those that are only solved by a turing machine that may run forever on inputs they do not accept.

9. An algorithm is called efficient if it runs in_____time on a serial computer.

a) polynomial
b) non polynomial
c) logarithmic
d) none of the mentioned

SOLUTION

**Answer:** a

**Explanation:** Example: Runtimes of efficient algorithms
O(n), O(nlogn), O(n3log2n)
Runtimes of inefficient algorithms
O(2n), O(n!)

10. A problem is called_____if its has an efficient algorithm for itself.

a) tractable
b) intractable
c) computational
d) none of the mentioned

SOLUTION

**Answer:** a

**Explanation:** A problem is called intractable iff there is an efficient (i.e. polynomial time) algorithm that solves it. A problem is called intractable iff there exists no efficient algorithm that solves it.

11. A formal language is recursive if :

a) a total turing machine exists
b) a turing machine that halts for every input
c) turing machine rejects if the input does not belong to the language
d) all of the mentioned

SOLUTION

**Answer:** d

**Explanation:** A formal language is called recursive if it is a recursive subset of the set of all possible finite sequences over the alphabet of the language.

12. Recursive languages are also known as:

a) decidable
b) undecidable
c) sometimes decidable
d) none of the mentioned

SOLUTION

**Answer:** a

**Explanation:** A language is recursive if there exists a turing machine such that it halts i.e. accepts if the input belongs to the language else rejects. It is better called Turing decidable language.

13. The class of recursive language is known as:

a) R
b) RC
c) RL
d) All of the mentioned

SOLUTION

**Answer:** a

**Explanation:** R is the set of all recursive languages, a class of decision problems solvable by turing machines. Although, R is also used for the class RP.

14. Which of the following was not a part of Chomsky hierarchy ?

a) Context sensitive grammar
b) Unrestricted grammar
c) Recursive grammar
d) None of the mentioned

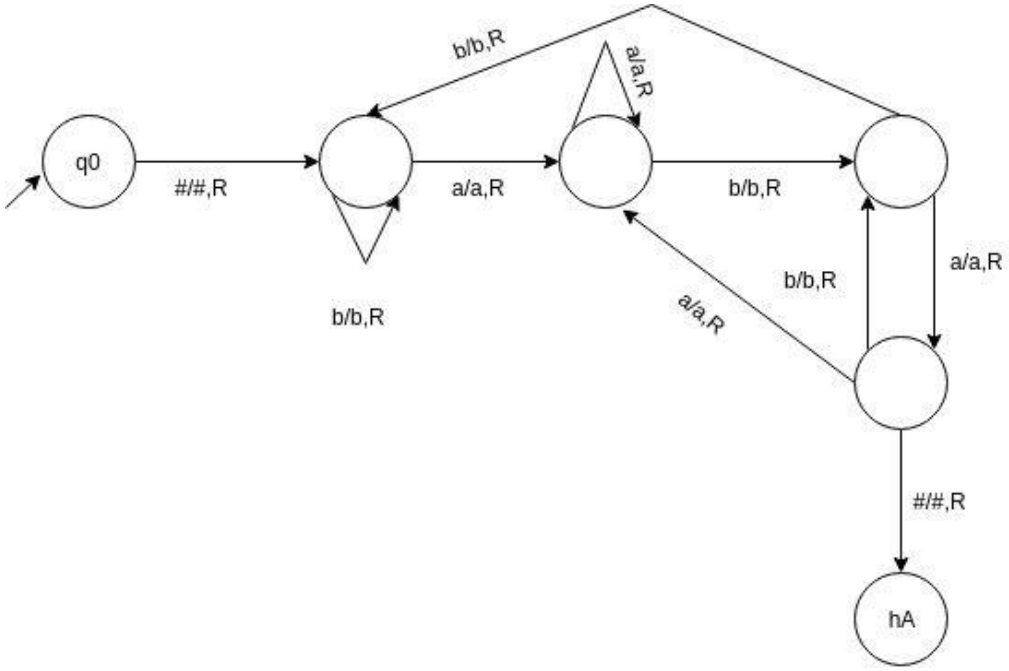
SOLUTION

**Answer:** c

**Explanation:** All recursive languages are recursively enumerable. All regular, context free and context sensitive languages are recursive.

**TOPIC 3: Undecidable Problems about T M**

1. Which of the following regular expression resembles the given diagram?



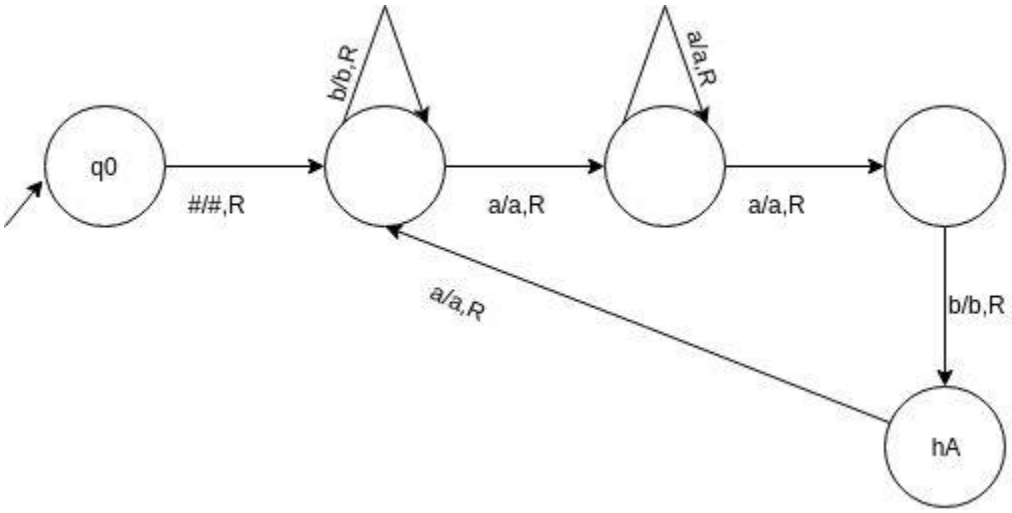

a) {a}*{b}*{a,b}
b) {a,b}*{aba}
c) {a,b}*{bab}
d) {a,b}*{a}*{b}*

SOLUTION

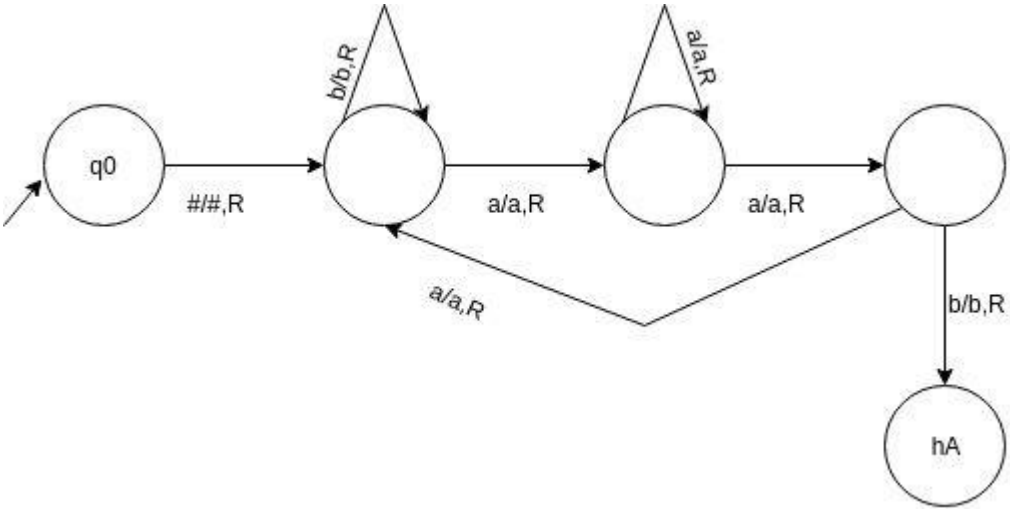
**Answer:** b

**Explanation:** The given diagram is a transition graph for a turing machine which accepts the language with the regular expression {a,b}*{aba}.

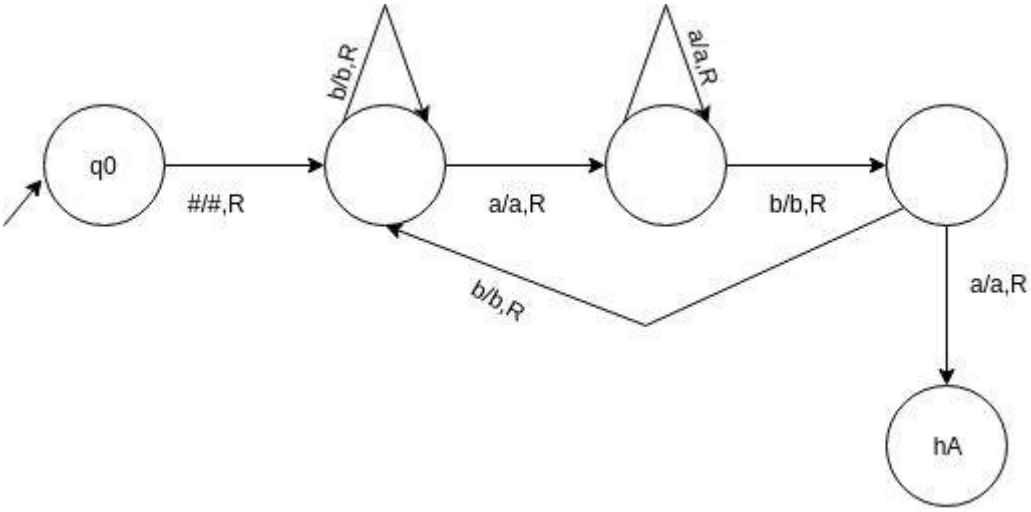
2. Construct a turing machine which accepts a string with ‘aba’ as its substring.



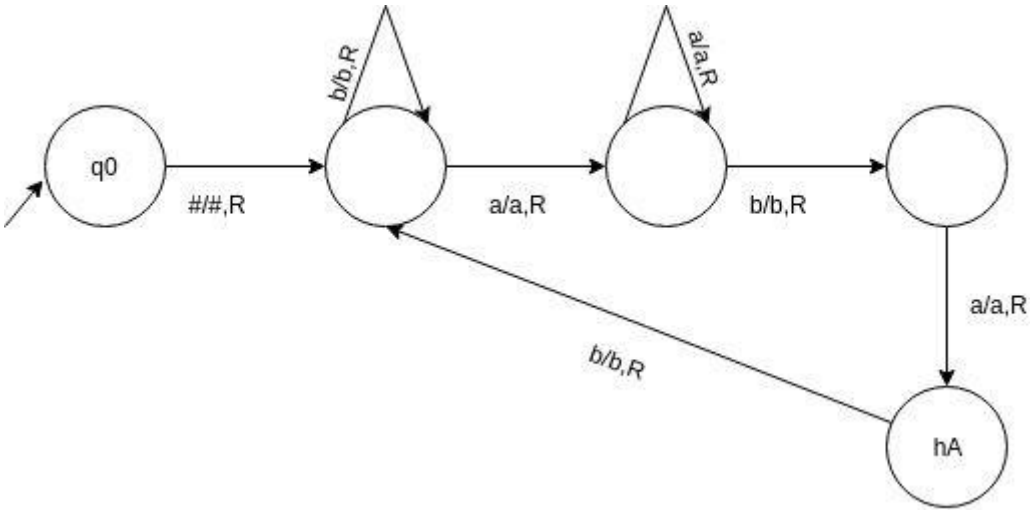

a)




b)




c)

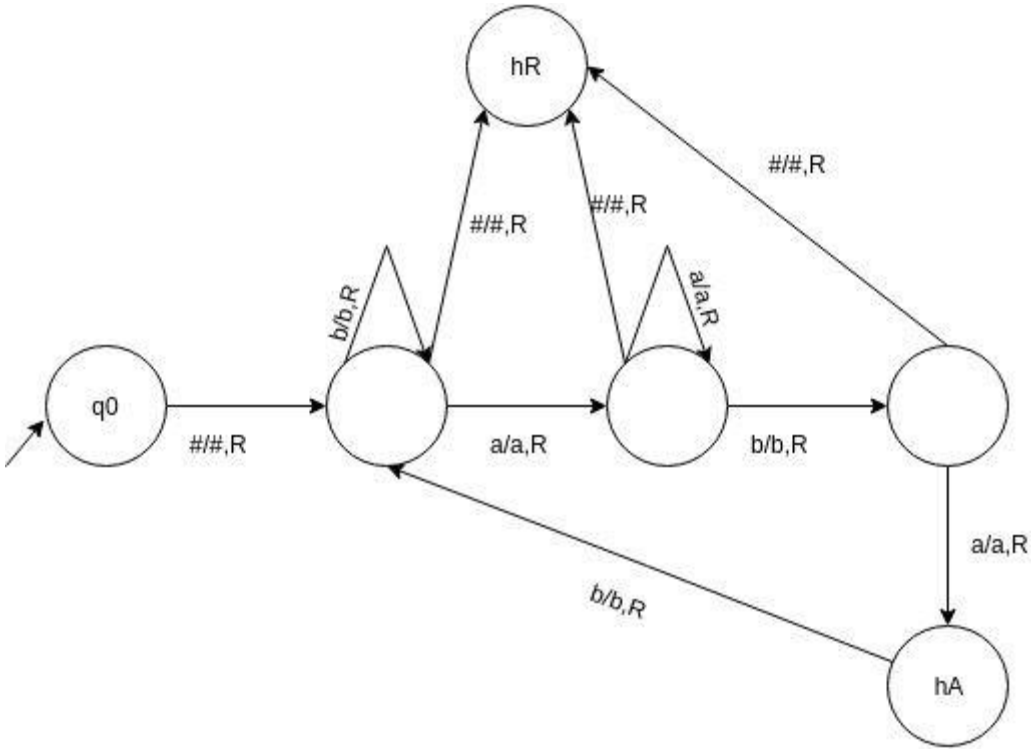



d)

SOLUTION

**Answer:** c

**Explanation:** The language consist of strings with a substring 'aba' as fixed at its end and the left part can be anything including epsilon. Thus the turing machine uses five states to express the language excluding the rejection halting state which if allowed can modify the graph as:




3. The number of states required to automate the last question i.e. {a,b}*{aba}{a,b}* using finite automata:

a) 4

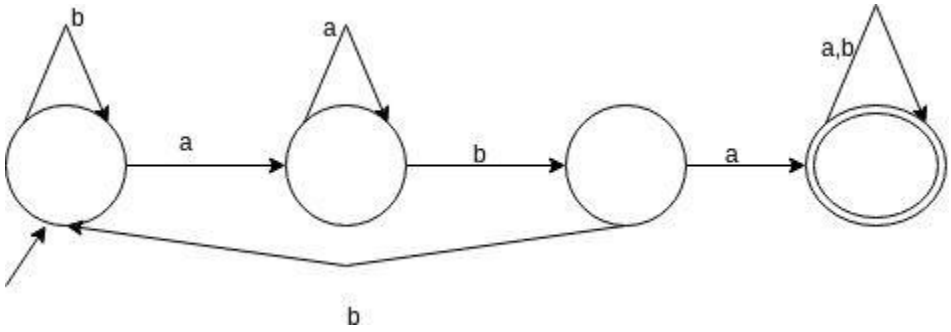
b) 3

c) 5
d) 6

SOLUTION

**Answer:** a

**Explanation:** The finite automata can be represented as:




4. The machine accept the string by entering into hA or it can:

a) explicitly reject x by entering into hR
b) enter into an infinte loop
c) Both (a) and (b)
d) None of the mentioned

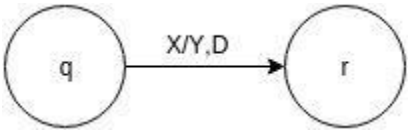
SOLUTION

**Answer:** c

**Explanation:** Three things can occur when a string is tested over a turing machine:

a) enter into accept halting state
b) enter into reject halting state
c) goes into loop forever

5. d(q,X)=(r,Y,D) where D cannot be:




a) L
b) R
c) S
d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** D represents the direction in which automata moves forward as per the queue which surely cannot be a starting variable.

6. Which of the following can accept even palindrome over {a,b}

a) Push down Automata
b) Turing machine
c) NDFA
d) All of the mentioned

SOLUTION

**Answer:** c

**Explanation:** A language generating strings which are palindrome is not regular, thus cannot b represented using a finite automaton.

7. Which of the functions can a turing machine not perform?

a) Copying a string
b) Deleting a symbol
c) Accepting a pal
d) Inserting a symbol

SOLUTION

**Answer:** d

**Explanation:** Different turing machines exist for operations like copying a string, deleting a symbol, inserting a symbol and accepting palindromes.

8. If T1 and T2 are two turing machines. The composite can be represented using the expression:

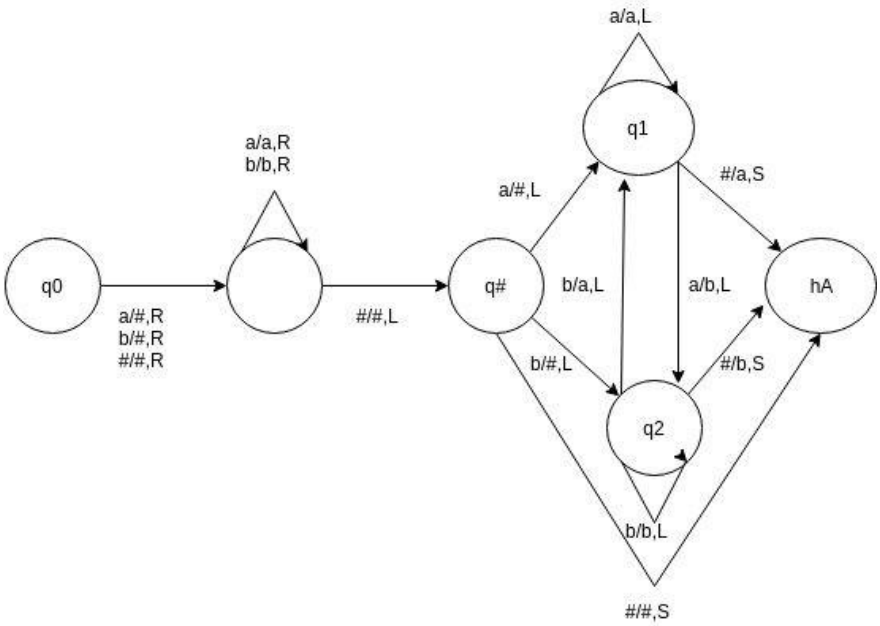
a) T1T2
b) T1 U T2
c) T1 X T2
d) None of the mentioned

SOLUTION

**Answer:** a

**Explanation:** If T1 and T2 are TMs, with disjoint sets of non halting states and transition function d1 and d2, respectively, we write T1T2 to denote this composite TM.

9. The following turing machine acts like:



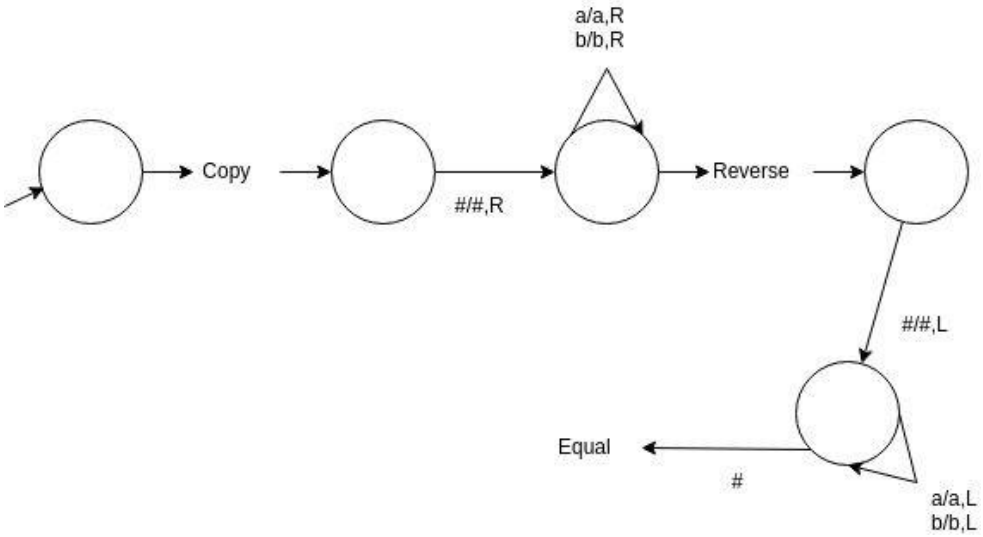

a) Copies a string

b) Delete a symbol
c) Insert a symbol
d) None of the mentioned
SOLUTION

**Answer:** b

**Explanation:** A turing machine does the deletion by changing the tape contents from yaz to yz, where y belongs to (S U {#})*.

10. What does the following transition graph shows:




a) Copies a symbol
b) Reverses a string
c) Accepts a pal
d) None of the mentioned
SOLUTION

**Answer:** c

**Explanation:** The composite TM accepts the language of palindromes over {a, b} by comparing the input string to its reverse and accepting if and only if the two are equal.

**TOPIC 4: Post's Correspondence Problem**

1. According to the rice's theorem, If P is a non trivial property, Lp is :
a) infinite
b) decidable
c) undecidable
d) none of the mentioned
SOLUTION

**Answer:** c

**Explanation:** Rice's theorem states that 'Any non trivial property about the language recognized by a turing machine is undecidable'.

2. Fill in the blank with reference to Rice's theorem.
For any non-trivial property of_____no general or effective method can decide

whether an algorithm computes it with that property.
a) partial functions
b) piecewise functions
c) both (a) and (b)
d) none of the mentioned
SOLUTION
**Answer:** a
**Explanation:** A property of partial functions is called trivial if it holds for all partial computable functions or for none, and an effective decision method is called general if it decides correctly for every algorithm.

3. Which of the following is incorrect according to rice theorem?
Let S be a set of language hat is non trivial:
a) there exists a TM that recognizes the language in S
b) there exists a TM that recognizes the language not in S
c) both (a) and (b)
d) none of the mentioned
SOLUTION
**Answer:** c
**Explanation:** According to rice theorem, it is undecidable to determine whether the language recognized by an arbitrary turing machine lies in S.

4. Which of the following set of computable functions are decidable?
a) The class of computable functions that are constant, and its complement
b) The class of indices for computable functions that are total
c) The class of indices for recursively enumerable sets that are cofinite
d) All of the mentioned
SOLUTION
**Answer:** d
**Explanation:** According to Rice's theorem, if there exists atleast one computable function in a particular class C of computable functions and another computable function not in C then the problem deciding whether a particular program computes a function in C is undecidable.

5. Which of the following statements are undecidable?
For a given Turing Machine M,
a) does M halt on an empty input tape
b) does M halt for anly inputs at all?
c) is L(M) regular? Context free? Turing decidable?
d) all of the mentioned
SOLUTION
**Answer:** d
**Explanation:** All of the following mentioned are immediate results of Rice's theorem and thus, undecidable.

6. Post Correspondence problem is

a) decidable decision problem
b) undecidable decision problem
c) not a decision problem
d) none of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Post Correspondence problem is an undecidable decision problem that was introduced by Emil Post in 1946. Being simpler than halting problem, it can be used in proofs of undecidability.

7. State true or false:

Statement: The difference between PCP and MPCP is that in MPCP, a solution is required to start with the first string on each list.

a) true
b) false

SOLUTION

**Answer:** a

**Explanation:** The MPCP is : Given lists A and B of K strings ,say A = w1 ,w2, …wk and B= x1, x2,…..xk does there exists a sequence of integers i1,i2,…ir such that w1wi1wi2…..wir = x1xi1xi2…xir?

8. PCP stands for?

a) Post Correspondence Problem
b) Post Corresponding Problem
c) Pre Correspondence problem
d) None of the mentioned

SOLUTION

**Answer:** a

**Explanation:** PCP or Post Correspondence problem is an undecidable decision problem.

9. Can a Modified PCP problem be reduced to PCP?

a) yes
b) no

SOLUTION

**Answer:** a

**Explanation:** Yes, it can be. There exists a theorem and as well as its proof which supports the assertion.

10. Consider three decision problem A, B, C. A is decidable and B is not. Which of the following is a correct option?

a) C is undecidable if C is reducible to B
b) C is undecidable if B is reducible to C
c) C is decidable if A is reducible to C
d) C is decidable if C is reducible to B's complement.

SOLUTION

**Answer:** b

**Explanation:** As B is undecidable and it can be reduced to C, C is also an undecidable problem.

**TOPIC 5.1: The Class P Problem**

1. If the number of steps required to solve a problem is O(nk), then the problem is said to be solved in:

a) non-polynomial time
b) polynomial time
c) infinite time
d) none of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Most of the operations like addition, subtraction, etc as well as computing functions including powers, square roots and logarithms can be performed in polynomial time. In the given question, n is the complexity of the input and k is some non negative integer.

2. The value of constants like p and e can be calculated in:

a) polynomial time
b) non-polynomial time
c) cannot be calculated
d) none of the mentioned

SOLUTION

**Answer:** a

**Explanation:** The value of such constants can be calculated using algorithms which have time complexity in terms if O(nk) i.e polynomial time.

3. Which of the following cannot be solved using polynomial time?

a) Linear Programming
b) Greatest common divisor
c) Maximum matching
d) None of the mentioned

SOLUTION

**Answer:** d

**Explanation:** In graph theory, a matching or independent edge set in a graph G is a set of edges without common vertices. Given a graph (V, E), a matching M in G is a set of pairwise non adjacent edges i.e. no two edges share a common vertex.

4. The complexity class P consist of all the decision problems that can be solved by _____using polynomial amount of computation time.

a) Push Down automata
b) DFA
c) NDFA
d) Deterministic Turing machine

SOLUTION

**Answer:** d

**Explanation:** All the decision problems that can be solved using a Deterministic turing machine using polynomial time to compute, all belong to the complexity class P.

5. A generalization of P class can be:

a) PTIME
b) DTIME
c) NP
d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** P is a specific case of NP class, which is the class of decidable problems decidable by a non deterministic turing machine that runs in polynomial time.

6. Which of the following options are correct with reference to P-complete problems?

a) used for the problems which are difficult to solve in limited space
b) every problem in P can be reduced to it using proper reductions
c) complete problem for complexity class P
d) all of the mentioned

SOLUTION

**Answer:** d

Explanation:

The notion of P-complete decision problems is useful in the analysis of:

a) which problems are tough to parallelize effectively
b) which problems are difficult to solve in limited space

7. A problem X belongs to P complexity class if there exist_____algorithm to solve that problem, such that the number of steps of the algorithms bounded by a polynomial in n, where n is the length of the input.

a) 1
b) 2
c) 3
d) all of the mentioned

SOLUTION

**Answer:** d

**Explanation:** A problem X belongs to P complexity class if there exist atleast 1 algorithm to solve that problem, such that the number of steps of the algorithms bounded by a polynomial in n, where n is the length of the input. Thus, all the options are correct.

8. Which of the following is a P-complete type of problem?

a) Circuit Value problem
b) Linear programming
c) Context free grammar membership
d) All of the mentioned

SOLUTION

**Answer:** d

**Explanation:** Given a context free grammar and a string, can the string be generated by the grammar? Such problems fall in the category of P-complete.

9. State true orfalse?

Statement: Given a turing machine, an input for the machine, and a number T(unary), does that machine halt on that input within the first T-steps?

The given problem is P-complete.

a) true

b) false

SOLUTION

**Answer:** a

**Explanation:** If we can parallelize a general simulation of a sequential computer, then we will be able to parallelize any program that runs on that computer. If this problem is in NC, then so every other problem in P.

10. In the above problem, if the input is binary, the class the problem belongs?

a) EXPSPACE

b) DLOGTIME

c) EXPTIME-complete

d) All of the mentioned

SOLUTION

**Answer:** c

**Explanation:** It is the set of all decision problems that have exponential run time i.e. solvable by deterministic turing machine in O(2p(n)) time, where p(n) is a polynomial function of n.

**TOPIC 5.2: The Class NP Problem**

1. What does NP stands for in complexity classes theory?

a) Non polynomial

b) Non-deterministic polynomial

c) Both (a) and (b)

d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** NP is said to be one of the most fundamental complexity classes. NP is an acronym for Non deterministic polynomial time.

2. The hardest of NP problems can be:

a) NP-complete

b) NP-hard

c) P

d) None of the mentioned

SOLUTION

**Answer:** a

**Explanation:** NP class contains many important problems, the hardest of which is NP-complete, whose solution is sufficient to deal with any other NP problem in polynomial time.

3. Which of the following contains NP?

a) PSPACE
b) EXPSPACE
c) Both (a) and (b)
d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** It is sufficient to construct a PSPACE machine that loops over all proof strings and feeds each one to a polynomial time verifier. It is also contained in EXPTIME, since the same algorithm operates in exponential time.

4. Travelling sales man problem belongs to which of the class?

a) P
b) NP
c) Linear
d) None of the mentioned

SOLUTION

**Answer:** b

**Explanation:** Travelling Salesman Problem: Given an input matrix of distances between n cities, this problem is to determine if there is a route visiting all cities with total distance less than k.

5. State true or false?

Statement: If a problem X is in NP and a polynomial time algorithm for X could also be used to solve problem Y in polynomial time, then Y is also in NP.

a) true
b) false

SOLUTION

**Answer:** a

**Explanation:** This is just a commutative property of NP complexity class where a problem is said to be in NP if it can be solved using an algorithm which was used to solve another NP problem in polynomial amount of time.

6. A problem which is both_____and_____is said to be NP complete.

a) NP, P
b) NP, NP hard
c) P, P complete
d) None of the mentioned

SOLUTION

**Answer:** a

**Explanation:** A problem is said to be NP Hard if an algorithm for solving the problem

can be translated from for solving any other problem. It is easier to show a problem NP than showing it Np Hard.

7. Which of the following is incorrect for the given phrase

Phrase :'solvable by non deterministic algorithms in polynomial time'

a) NP Problems

b) During control flow, non deterministic algorithm may have more than one choice

c) If the choices that non deterministic algorithm makes are correct, the amount of time it takes is bounded by polynomial time.

d) None of the mentioned

SOLUTION

**Answer:** d

**Explanation:** Primality testing is a simple example. To decide whether a number is prime or not, one simply selects non deterministically a number checks whether factors exist for the number or not.

8. In terms of NTIME, NP problems are the set of decision problems which can be solved using a non deterministic machine in_____time.

a) O(n)

b) O(n1/2)

c) O(nk), k∈N

d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** The complexity class NP can be defined in terms of NTIME as:

NP=O(nk) for k ∈N.

9. Which of the following can be used to define NP complexity class?

a) Verifier

b) Polynomial time

c) Both (a) and (b)

d) None of the mentioned

SOLUTION

**Answer:** c

**Explanation:** NP can be defined using deterministic turing machines as verifiers.

10. Which of the following are not in NP?

a) All problems in P

b) Boolean Satisfiability problems

c) Integer factorization problem

d) None of the mentioned

SOLUTION

**Answer:** d

**Explanation:** This is a list of some problems which are in NP:

a) All problems in P

b) Decision version of Integer factorization method

c) Graph Isomorphism Problem
d) All NP complete problems, etc.

11. Which of the following does not belong to the closure properties of NP class?
a) Union
b) Concatenation
c) Reversal
d) Complement

SOLUTION

**Answer:** d

**Explanation:** It is unknown about the closure property-complement for the complexity class NP. The question is so called NP versus co-NP problem.

~OoO~

# Tutorial No. 9
# Turing Machine

1. Define Following Terms: (CO1)
    a) Turing Machine.
    b) Acceptance of a string in Turing Machine.
    c) Configuration of Turing Machine
    d) Computing a function by Turing Machine.

2. Design Turing machine for following (assume Σ = {a,b}): (CO6)
    a) L = { x| length of x is odd} and show acceptance of string “aba” & “aabba”
    b) Replace every ‘a’ in the string by ‘A’ and show conversion of string “aabb”
    c) L = {xx | x ϵ Σ*} and show acceptance of string “abaaba”
    d) (a+b)*ab
    e) (a+b)*aba(a+b)*
    f) Turing Machine to compute N mod 2

3. Show encoding of “Turing machine to accept odd length strings” (CO6)