BANNARI AMMAN INSTITUTE OF TECHNOLOGY Stay Ahead	BANNARI AMMAN INSTITUTE OF TECHNOLOGY (An Autonomous Institution Affiliated to Anna University, Chennai) SATHYAMANGALAM - 638 401
	Discourse Questions 22CS501/22CD501 - THEORY OF COMPUTATION

1. Question

Predict the element of finite automaton.

a) A finite set of states
b) An input alphabet only
c) A transition function is not applicable
d) A transition can't done to predict the output

Answer

a) A finite set of states (1 mark)

2. Question

Identify the reason that the string WWR is not recognized by any FSM

a) An FSM cannot remember arbitrarily large amount of information
b) An FSM cannot fix the midpoint
c) An FSM cannot match W with WR
d) An FSM cannot remember first and last inputs

Answer

a) An FSM cannot fix the midpoint (1 mark)

3. Question

In a finite state machine, Identify the process of transition function.

a) Maps states to outputs
b) Maps inputs to outputs
c) Maps a state and input to the next state
d) Maps outputs to states

Answer

c) Maps a state and input to the next state (1 mark)

4. Question

Identify the meaning for a set of symbols

a) Strings
b) Language
c) Statement
d) Alphabet

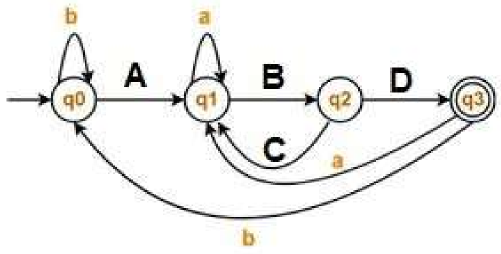
Answer

d) Alphabet (1 mark)

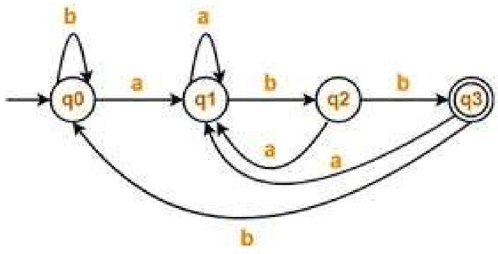
5. Question

Consider the elevator control, one of the applications of finite automata.
States: Finite set of states to present the possible requested floors from the current position
Inputs: Finite set of input depending upon the number of floors the building has
Outputs: Finite set of output depending upon the user's request
Based on the construction of Finite Automata, answer the following question

The DFA for the vending machine that accept all the strings ending with "abb" over the alphabet {a,b} is given below. Find the Missing Component A, B, C, D in the given DFA.



Answer



A - a (1 Mark)
B - b (1 Mark)
C - b (1 Mark)
D - a (1 Mark)

6. Question

Calculate the length of the string |0010|

a) 2
b) 4
c) 3
d) Null

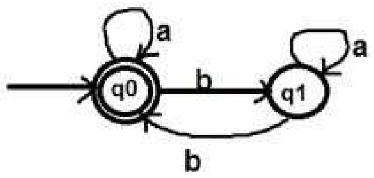
Answer

b) 4 (1 mark)

7. Question

The Mathematical model for construction of the word of the language L_1 is given below. Using the given state transition function, checkwhich string is the word of the L_1

1. string 1=aabba and
2. string 2=aba.



Answer

String 1=aabba (2 Marks)

= δ(q0, aabba)
= δ(q0, abba)
= δ(q0, bba)
= δ(q1, ba)
= δ(q0, a)
= qo which is the final state. So the string 1 = aabba is recognized by the language L_1

String 2=aba (2 Marks)

= δ(q0, aba)
= δ(q0, ba)
= δ(q1, a)
= q1which is not the final state. So the string 2 = aba is not recognized by the language L_1

8. Question

Consider the elevator control, one of the applications of finite automata. Figure shows the operations as state transition diagram

States: Finite set of states to present the possible requested floors from the current position

Inputs: Finite set of input depending upon the number of floors the building has

Outputs: Finite set of output depending upon the user's request

Based on the construction of Finite Automata, answer the following question

For the FA M, Complete the transaction table to test whether the strings 101101, 11111 are accepted by M.

δ	a	b
$\rightarrow *q_0$	q_0	q_1
q_1	?	?
q_2	?	?
q_3	?	?

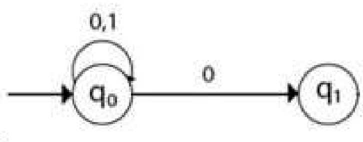
Answer

δ	a	b	
$\rightarrow *q_0$	q_0	q_1	
q_1	q_3	q_0	(1 Mark)
q_2	q_0	q_3	(1 Mark)
q_3	q_1	q_2	(1 Mark)

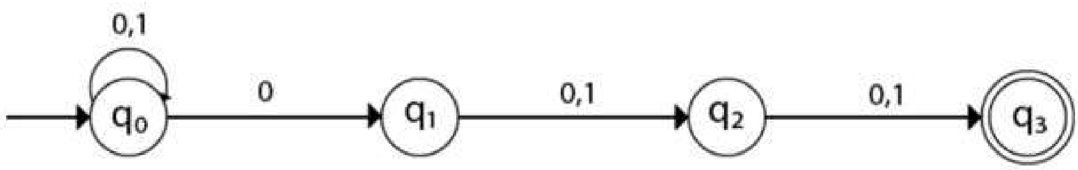
9. Question

Construct the machine where states with single path to accept the string in which the third symbol from the right end is always "0" to buy the crayons.

The partial construction is given below. Identify the remaining components and complete the diagram to design the above mentioned DFA.



Answer



1- Identify the remaining state (2 Marks)
2-Identify the transition with label (2 Marks)
3-Identify the final state (1 Mark)

10. Question

Identify the meaning for a set of symbols

a) Strings
b) Language
c) Statement
d) Alphabet

Answer

d) Alphabet (1 mark)

11. Question

Consider the elevator control, one of the applications of finite automata. Figure titled as "DFA" shows the operations as state transition diagram

States: Finite set of states to present the possible requested floors from the current position

Inputs: Finite set of input depending upon the number of floors the building has

Outputs: Finite set of output depending upon the user's request

Based on the construction of Finite Automata, answer the following question

Complete the following transition table with respect to the transition diagram and mention the initial and final state

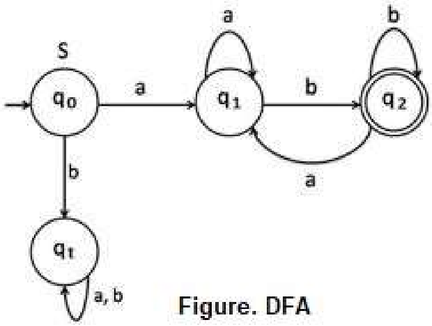


Figure. DFA

States	a	b
q_0	q1	?
q_1	?	?
q_2	?	q2
q_t	?	-

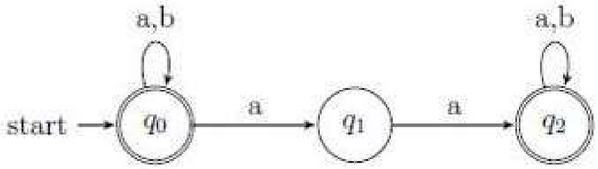
.

Answer

States	a	b	
q_0	q_1	q_t	(1 Mark)
q_1	q_1	q_2^*	(1 Mark)
q_2^*	q_1	q_2^*	(1 Mark)
q_t	-	-	(1 Mark)

12. Question

The Non deterministic Finite Automata is given below, check whether the given NFA accepts the string "bababab" or not.



Answer

= δ(q0, bababab) (1 Mark)
= δ(q0, ababab) (1 Mark)
= δ(q0, babab)
= δ(q0, abab) (1 Mark)
= δ(q1, bab) (1 Mark)

13. Question

Which of the following grammars is in Greibach Normal Form?

a) S->aA | bB

b) S->a | A

c)S->aAB | bC

d)S->a | ε

Answer

a) S->aA | bB (1 mark)

14. Question

Identify which of the following is a null production.

a)S->A
b)A->B
c)B->ε
d)B->0

Answer

c)B->ε (1 mark)

15. Question

Consider the following CFG
S→ XY | Xn | p
X → mX | m
Y → Xn | o
After converting the given CFG to GNF, identify the valid and invalid productions of GNF from the following.
a)S → XY
b)X→ mX | m
c)Y→ oM
d)O → o

Answer

a)Invalid (1 mark)
b)Valid (1 mark)
c)Invalid (1 mark)
d)Valid (1 mark)

16. Question

Consider the step by step procedure to convert a grammar into Chomsky normal form as below:

1. Ensure all productions have at most two non-terminals on the right-hand side or a single terminal.
2. Confirm that all productions are in CNF form.
3. Remove non-terminals and productions that do not contribute to generating any strings of the language.
4. Remove all ε-productions (productions that produce the empty string), except for the start symbol if it can produce ε.
5. Remove unit productions (productions where a non-terminal produces another single non-terminal).
6. Ensure that each production is in the form A → BC or A → a, where a is a terminal symbol.

Rearrange the above steps in to a correct order.

Answer

4 (1 mark)
5 (1 mark)
3 (1 mark)
1 (1 mark)
6 (1 mark)
2 (1 mark)

17. Question

Identify the data structure used in the syntax analysis phase of a compiler.

a)Tree
b)stack
c)List
d)Queue

Answer

a)Tree (1 mark)

18. Question

The steps to eliminate ε productions are given below.

Step 1: First find out all nullable non-terminal variable which derives ε.

Step 2: For each production A → a, construct all production A → x, where x is obtained from a by removing one or more non-terminal from step 1.

Step 3: Now combine the result of step 2 with the original production and remove ε productions.

Consider the following CFG

S -> AB

A->aA | ϵ

B -> b | ϵ

The non terminals after removing epsilon productions are

S-> ....

A-> ....

B-> ....

Answer

S→AB|A|B (1 mark)

A→ aA | a (1 mark)

B → bB | b (1 mark)

19. Question

Which of the following is a necessary condition for a grammar to be in Greibach Normal Form?

a)The grammar must be in Chomsky Normal Form (CNF).

b)Every production rule must start with a terminal symbol.

c)There must be at least one production rule for each non-terminal symbol.

d)The grammar must be unambiguous.

Answer

b)Every production rule must start with a terminal symbol. (1 mark)

20. Question

Consider the following set of production rules and identify the productions which are in Chomsky normal form.

S-> aAD

A->aB

A->AD

B->DS

A->bAB

B->b

D->d

Answer

A->AD (1 mark)

B->DS (1 mark)

B->b (1 mark)

D->d (1 mark)

21. Question

Normal forms play an important role in the context of Context Free Grammars.-Justify the statement.

Answer

Normal forms such as Chomsky Normal Form (CNF) and Greibach Normal Form (GNF) are fundamental in the context of Context-Free Grammars (CFGs) because they simplify parsing, enable efficient parsing algorithms, facilitate grammar transformations and theoretical analysis, and ensure a standardized and consistent representation of grammars. By converting grammars into these normal forms, we can leverage powerful algorithms and theoretical results, making it easier to handle, analyze, and process context-free languages. (2 marks)

22. Question

Which of the following statements are true about derivation trees?

a) A derivation tree shows the structure of a string according to a grammar.
b) Each node in a derivation tree represents a single symbol in the string.
c) Derivation trees can be used to determine if a string is generated by a grammar.
d) The root of a derivation tree represents a terminal symbol in the string.

Answer

a,c (1 mark)

23. Question

Chomsky Normal Form requires that all non-terminal symbols have a right-hand side consisting of exactly one terminal symbol or exactly two non-terminals.Say True or False.

Answer

True (1 mark)

24. Question

Consider the scenario in which a programming language compiler needs to parse source code efficiently. The grammar used to define the language includes several unit productions, which can complicate the parsing process. The goal is to convert the grammar into a more manageable form by removing unit productions.The unit productions are the productions in which one non-terminal gives another non-terminal. The format of unit production is X -> Y. Identify the valid and invalid unit productions from the following set of rules.

S → 0A
S → C
A → 0S
B → 1
C → B

Answer

Invalid (1 mark)
Valid (1 mark)
Invalid (1 mark)
Invalid (1 mark)
Valid (1 mark)

25. Question

In the Pumping Lemma for CFLs, which parts of the string w=uvxyzw can be "pumped" or repeated?

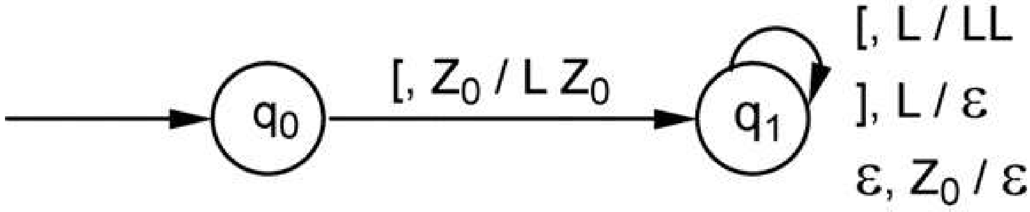
a) u and z
b) v and y
c) v and x
d) x and z

Answer

b) v and y

26. Question

Determine CFG for PDA that accepts strings of balanced square brackets by empty stack. The PDA is constructed for your reference below:



Using the PDA determine the CFG.

Answer

The productions are

S ® [q0, Z0, q1] (2 Marks)
[q0, Z0, q1] ® [[q1, L, q1] [q1, Z0, q1]
[q1, L, q1] ® [[q1, L, q1] [q1, L, q1]
[q1, L, q1] ®]
[q1, Z0, q1] ® e

The variables are renamed as [q0, Z0, q1] = A, [q1, L, q1] = B, [q1, Z0, q1] = C and the productions are rewritten as,

S ® A (2 Marks)
A ® [BC
B ® [BB |]

C ® e

27. Question

Consider the following steps that are used to convert CFG to PDA. Rearrange them in the correct order. The first step is already in the correct order.

a) Convert the CFG productions into GNF.
b) Add the following rule for each terminal symbol:
δ(q, a, a) = (q, ε) for every terminal symbol
c) The CFG's first symbol will also be the PDA's initial symbol.
d) There will only be one state, "q," on the PDA.
e) Include the following rule for non-terminal symbols:
δ(q, ε, A) = (q, α), Where the production rule is A → α
e) Add the following rule for each terminal symbol:
δ(q, a, a) = (q, ε) for every terminal symbol

Answer

Answer: (b,c- 1 Mark and (d,e- 1 Mark)
a) Convert the CFG productions into GNF.
b) There will only be one state, "q," on the PDA.
c) The CFG's first symbol will also be the PDA's initial symbol.
d) Include the following rule for non-terminal symbols:
δ(q, ε, A) = (q, α), Where the production rule is A → α
e) Add the following rule for each terminal symbol:
δ(q, a, a) = (q, ε) for every terminal symbol

28. Question

The CFG is as follows :
S->aSa
S->aSa
S->c
Design a Pushdown automata to accept the string "abbccbba". First four steps are given for your reference in PDA construction:
1.S(q0, ε, ε)=(q0, ε)
2.S(q0, ε,S)=(q0,aSa)
3.S(q0, ε,S)=(q0,bsb)
4.(q0, ε,S)=(q0,c)

Answer

PDA conversion: (2 Marks)
5.S(q0,a,a)=(q1, ε)
6.S(q1,b,b)=(q2, ε)

7.S(q2,c,c)=(q3, ε)
string acceptance: (4 Marks)

Sno	State	Unread input	Stack	Transition
1	q0	abbccbba	E	1 (1 Mark)
2	q0	abbcbba	S	1
3	q0	abbcbba	aSa	2
4	q1	bbcbba	Sa	5 (1 Mark)
5	q0	bbcbba	bSba	3
6	q2	bcbba	Sba	6
7	q0	bcbba	bsbba	3 (1 Mark)
8	q2	cbba	Sbba	6
9	q0	cbba	cbba	4
10	q3	bba	bba	7 (1 Mark)
11	q2	ba	ba	6
12	q1	ε	ε	5

29. Question

Consider the CFG:
S → aSb
S → a | b | ε
Generate an equivalent PDA for the given CFG by completing the steps(R3-R5):
The PDA can be given as:
P = {(q), (a, b), (S, a, b, z0), δ, q, z0, q}
The mapping function δ will be:
R1: δ(q, ε, S) = {(q, aSb)}
R2: δ(q, ε, S) = {(q, a) | (q, b) | (q, ε)}
R3 :---
R4: --
R5: ______________________________

Answer

R3: δ(q, a, a) = {(q, ε)} (1 Mark)
R4: δ(q, b, b) = {(q, ε)} (1 Mark)
R5: δ(q, ε, z0) = {(q, ε)} (1 Mark)

30. Question

Select which of the following is NOT a component of an instantaneous description of a PDA:
a) Current state of the automaton.
b) Remaining input string.
c) Contents of the stack.
d) Input alphabet.

Answer

d) Input alphabet.

31. Question

Scenario:

Pumping lemma for context free language (CFL) is used to prove that a language is not a Context free language

Assume L is context free language

Then there is a pumping length n such that any string w εL of length>=n can be written as follows −

|w|>=n

We can break w into 5 strings, w=uvxyz, such as the ones given below

|vxy| >=n

|vy| # ε

For all k>=0, the string $uv^kxy^yz \in L$

The steps are used to prove that the language is not a context free.

Question:

Let L be the language $\{0^k 1^k 2^k \mid k \geq 1\}$. Show that this language is NOT a CFL using the Pumping Lemma.

Answer

Suppose that L is a CFL. Then some **integer p exists and we pick $z = 0^p1^p2^p$.** (1 Mark)

Since z=uvwxy and |vwx| ≤ p, we know that **the string vwx must consist of either: – all zeros – all ones – all twos – a combination of 0's and 1's – a combination of 1's and 2's** (2 Marks)

The string vwx cannot contain 0's, 1's, and 2's because the string is not large enough to span all three symbols.

Now "pump down" **where i=0. This results in the string uwy and can no longer contain an equal number of 0's, 1's, and 2**'s because the strings v and x contain at most two of these three symbols. Therefore the result is not in L and therefore L is not a CFL. (2 Marks)

[Note: The answer given for sample value of I. Student may substitute any value for I and prove]

32. Question

Description:

The following transition function defines a PDA that accept strings of balanced parenthesis.

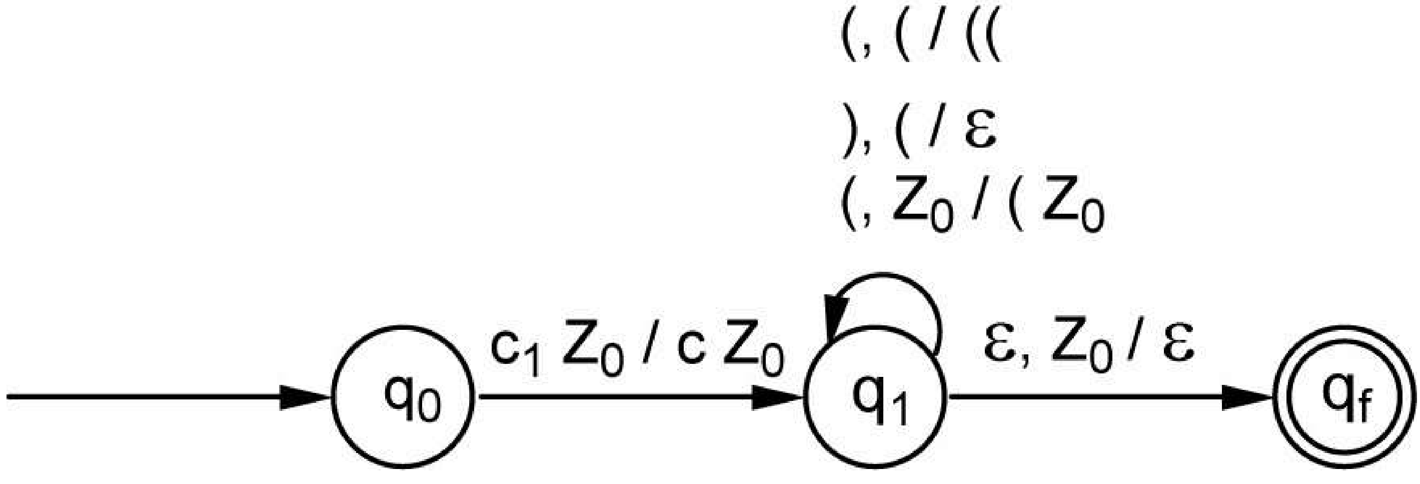
Transition function:

$$d(q_0, (, Z_0) = (q_1, (Z_0)$$
$$d(q_1, (, () = (q_1, (()$$
$$d(q_1,), () = (q_1, e)$$
$$d(q_1, (, Z_0) = (q_1, , (Z_0)$$
$$d(q_1, e, Z_0) = (q_f, e)$$

Question :

Convert the give given transition function to an equivalent PDA transition diagram.

Answer



33. Question

In the conversion of a CFG to a PDA, what is the primary function of the stack?

a) To store input symbols

b) To maintain the order of terminals and non-terminals

c) To keep track of the sequence of production rules

d) To store state transitions

Answer
b) To maintain the order of terminals and non-terminals

34. Question
Choose in which form must a CFG be converted to efficiently construct a corresponding PDA.
a) Chomsky Normal Form (CNF)
b) Greibach Normal Form (GNF)
c) Backus-Naur Form (BNF)
d) Kuroda Normal Form (KNF)

Answer
a) Chomsky Normal Form (CNF)

35. Question
According to the Pumping Lemma for CFLs, any sufficiently long string in a context-free language can be decomposed into which form?
a) w=uvxy
b) w=uvxyz
c) w=uvwxy
d) w=uvwxyyz

Answer
b) w=uvxyz

36. Question
Select the method which is used to convert a PDA to a CFG.
a) Eliminating ε-moves
b) Constructing a grammar by analyzing the transitions
c) Converting the PDA to a finite state machine first
d) Removing non-determinism from the PDA

Answer
b) Constructing a grammar by analyzing the transitions

37. Question
If a Turing Machine enters an infinite loop, what will be its behavior?
a) The machine will eventually halt
b) The tape will overflow
c) The machine will never halt
d) The machine will terminate with an error

Answer
c) The machine will never halt

38. Question
When designing a Turing machine to recognize a language L, the halting state ________________
a) Must be reached for all strings in L
b) Must not be reached for strings in L
c) Should not be present in the Turing machine
d) Must be non-deterministic

Answer
a) Must be reached for all strings in L

39. Question

In constructing a Turing machine, the tape alphabet ____________
a) Must be the same as the input alphabet
b) Includes the input alphabet along with a special blank symbol
c) Can be any arbitrary set of symbols
d) Must contain only binary symbols

Answer

b) Includes the input alphabet along with a special blank symbol

40. Question

Consider the following Turing Machine M = ({$q_{0\,q}$ d, q_1, B, {q_2})

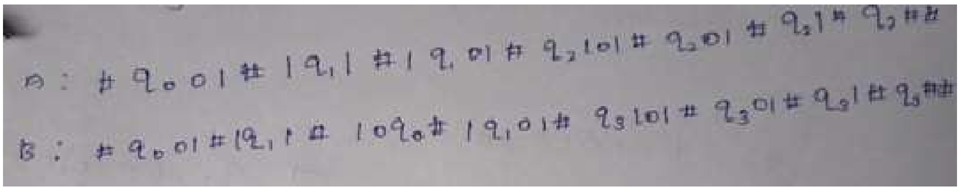
	0	1	B
q_0	q_1, 1, R	q_1, 0, L	q_1, 1, L
q_1	q_2, 0, L	q_0, 0, R	q_1, 0, R
q_2	Halt		

Rules for transformation of productions

List A	List B	Rules
qX	Yp	d(q,X)=(p,Y,R))
ZqX	pZY	d(q,X)=(p,Y,L))
q#	Yp#	d(q,B)=(p,Y,R))
Zq#	pZY#	d(q,B)=(p,Y,L))
Reduce all combinations of final state with final state itself		

Using the above information, trace the moves of the Turing Machine for the acceptance of the string w=01.

Answer



A : # q_0 01 # 1 q_1 1 # 1 q_1 01 # q_2 101 # q_2 01 # q_2 1 # q_2 ##

B : # q_0 01 # 1 q_1 1 # 10 q_0 # 1 q_1 01 # q_3 101 # q_3 01 # q_3 1 # q_3 ##

For A (3 Marks)
For B (3 Marks)

41. Question

A Turing machine can be formally described as seven tuples
M = (Q,X, Σ, δ,q0,B,F)
Fill the missing values of the tuples for M:
a) Q is a finite set of states
b) X- ____________________
c) Σ is the input alphabet
d) δ is a transition function: δ:QxX→QxXx{left shift, right shift}
e) q0 - ____________________
f) B-______________________
g) F is the final state.

Answer

b) X is the tape alphabet (1 Mark)
e) q0 is the initial state (1 Mark)
f) B is the blank symbol (1 Mark)

42. Question

From the following options select how you can determine whether a problem is solvable by a Turing Machine:
a) Check if the machine runs in polynomial time
b) Check if the machine halts for all inputs
c) Check if the machine never halts
d) Check if the machine always accepts the input

Answer

a) Check if the machine runs in polynomial time

43. Question

Consider the following transition table of Turing machine for computing 2's complement of a binary number in unary representation

The unary representation will be as follows

1 -0

2- 00

3 – 000 etc.,

(Hint: Twos complement of a binary number can be done by the adding one to the ones complement of the number)

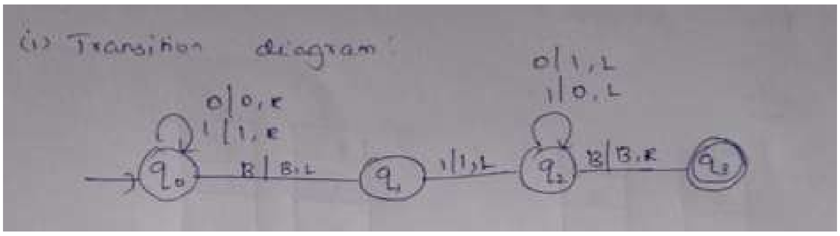
state	1	0	B
q_0	$q_{0,}$ 1, R	$q_{0,}$ 0, R	$q_{1,}$ B, L
q_1	$q_{2,}$ 1, L		
q_2	$q_{2,}$ 0, L	$q_{2,}$ 1, L	$q_{3,}$ B, L
q_3	Halt		

i. Draw the transition diagram for the above table

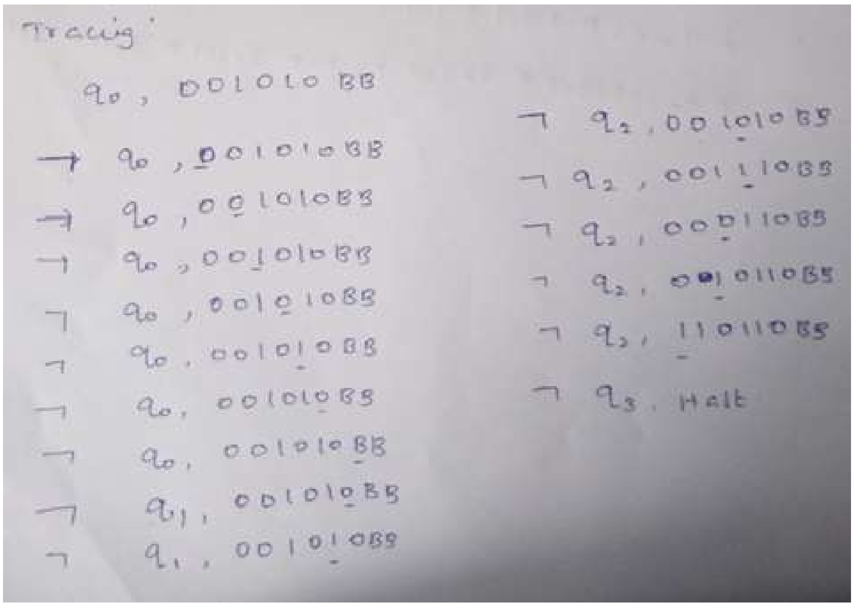
ii. Trace the acceptance of the 001010 using the above transition table

Answer

Transition Diagram : (2 Marks)



Input Processing : (3 Marks)



44. Question

Draw a Turing machine to find 1's complement of a binary number.

1's complement of a binary number is another binary number obtained by toggling all bits in it, i.e., transforming the 0 bit to 1 and the 1 bit to 0.

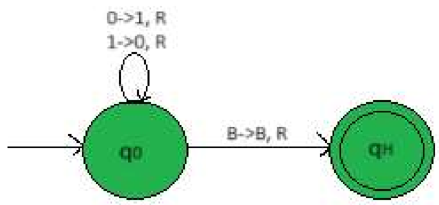
The process for generating the complement involves the following steps:

Steps:

Step-1. Convert all 0's into 1's and all 1's into 0's and if B is found go to right.

Step-2. Stop the machine.

Answer

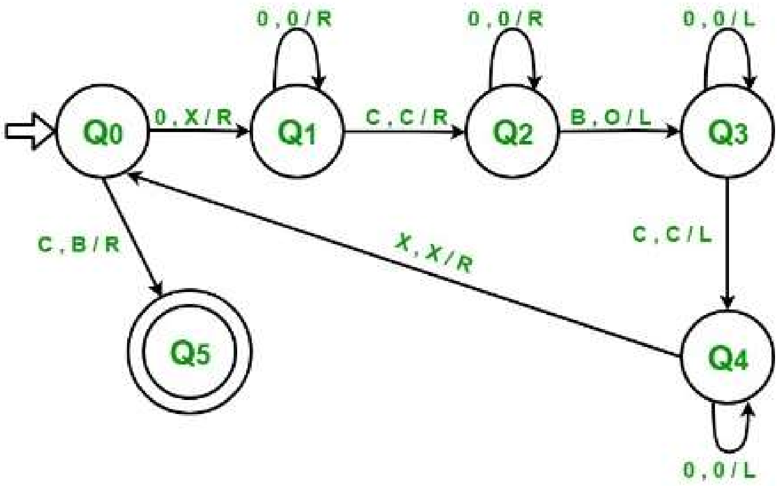


Identifying states - 1 Mark
Transition function - 1 Mark

45. Question

A Turing machine can be designed to perform addition by using its tape to represent the numbers to be added and its states to control the addition process.
For adding 2 numbers using a Turing machine, both these numbers are given as input to the Turing machine separated by a "c".
Example – (2 + 3) will be given as 0 0 c 0 0 0:
Input : 0 0 c 0 0 0 // 2 + 3
Output : 0 0 0 0 0 // 5
With reference to the given process, draw the transition diagram of the Turing machine for the addition of two numbers.

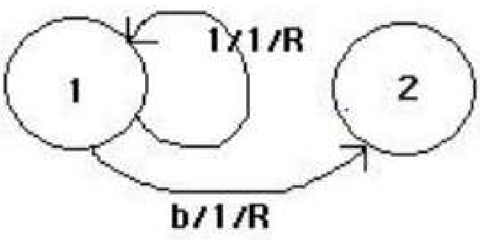
Answer



Identifying the state transitions (2 Marks)
Specifying the transition symbols (2 Marks)
Constructing the states along with final states (2 Marks)

46. Question

Consider the following Turing machine in the given Figure:



Identify the type of operation performed by the Turing machine.

Answer

The Turing machine performs unary increment operation(2 Mark)

47. Question

If a Turing Machine enters an infinite loop, what will be its behavior?
a) The machine will eventually halt
b) The machine will never halt
c) The tape will overflow
d) The machine will terminate with an error

Answer

b) The machine will never halt

48. Question

Identify how can a Turing Machine be used to determine the complexity of an algorithm:
a) By counting the states in the machine
b) By checking the length of the tape used
c) By analyzing time taken for halting
d) By analyzing the number of transitions

Answer

d) By analyzing the number of transitions

49. Question

If a problem is NP-complete, it can be verified in polynomial time, but finding a solution may take longer.
Say true or false

Answer

True.   (1 mark)

50. Question

A problem that is recursively enumerable but not recursive, is undecidable because reducing the problem Lu to another problem T can be used to show there is no algorithm to solve T, regardless of whether or not T is RE.
It can be shown by prove the statement "Lu is RE but not recursive."

Find the Missing porting the following theorem.
Already proved that Lu is ______A________.
Assume Lu is recursive. By the closure property is also ____B_______.
Suppose A is an algorithm recognizing Lu. can be summarized as follows:

1. Given the string w in (0 + 1)*, the value of i such that _____C___________
2. Given the input < Mi, wi> to algorithm A and ______D______.
3. Thus, the constructed algorithm accepts w iff _____E______. This algorithm is constructed for Ld.

But no such algorithm exists and our assumption of an algorithm A for Lu exists is false. Hence Lu is RE but not recursive.

Answer

A. Recursively Enumerable. (1 Mark)
B. Recursive. (1 Mark)
C. w = wi. Integer i in binary is the corresponding code for some Mi. (1 Mark)
D. accept w iff Mi accepts wi (1 Mark)
E. w = wi which is in L(Mi) (1 Mark)

51. Question

Imagine you are a project manager overseeing multiple tasks that need to be completed within a tight deadline. Each task requires a certain amount of resources (like time, manpower, and budget), and some tasks depend on the completion of others.

Represent the following closure properties using two recursive languages L1 and L2.

A)Concatenation

B) Kleen Closure

C)Intersection

D)Complement

Answer

A)L1 dot L2 (1 mark)
B)L1* (1 mark)
C) L1 ? L2 (1 mark)
D) ! L1 (1 mark)

52. Question

What is the significance of the P vs NP question in computer science?
a) It defines the limits of algorithm efficiency
b) It determines the solvability of all computational problems
c) It differentiates between deterministic and non-deterministic machines
d) It establishes the relationship between random algorithms and deterministic algorithms

Answer

a) It defines the limits of algorithm efficiency

53. Question

A school needs to schedule classes for a set of teachers and students in a way that maximizes the use of resources (like classrooms) while ensuring that no student or teacher has overlapping classes. We need to compute a schedule that allocates classrooms to subjects without conflicts.

Based on this scenario, identify the computable and non computable problems from the below list of problems.
A)Determining the halting of a program.
B)Computing the greatest common divisor of a pair of integers.
C) Checking the consistency of a theory.
D) Finding the shortest path between a pair of nodes in a finite graph.

Answer

A)Non computable problem (1 mark)
B)Computable problem (1 mark)
C)Non computable problem (1 mark)
D)Computable problem (1 mark)

54. Question

Two different teams designed two different Turing machines (machine 1 & machine 2) with infinite input tape. The team leader assigned the same kind of problems to different machines to check the computable and also plan to simulate one of the newly designed machines for that machine 1 description is given as an input to machine 2 to simulate the same.

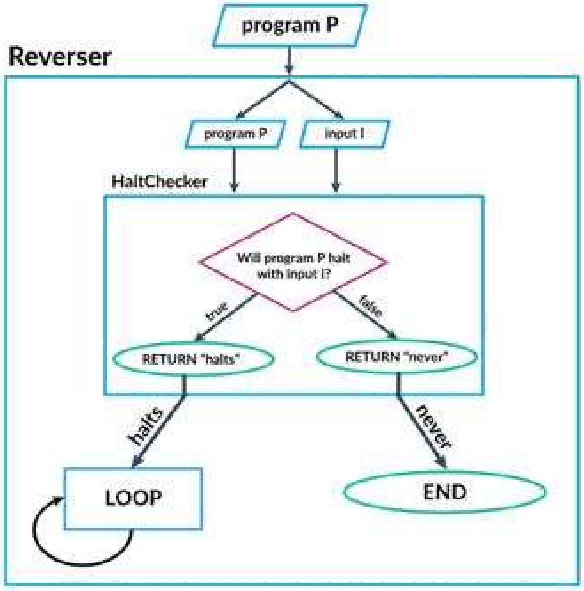


Figure. Reverser Program

The designed automata may solve the problem of

a) Halting problem

b) Decidable problem

c) Semi decidable program

i) Select the correct problem from the above list whether the program is halt or loop from the figure titled as Reverser Problem.

ii) In this given figure, if the execution doesn't enter into the halting state, then identify the problem type for this execution.

Answer

i) a) Halting problem (1 Mark)

ii) b) Decidable problem (2 Marks)

55. Question

Identify the statement which is true about recursively enumerable (RE) language.

a) It must be accepted by a finite automaton

b) It must be generated by a context-free grammar

c) It can be recognized by a Turing machine that may or may not halt

d) It is guaranteed to have a polynomial-time solution

Answer

Answer: c) It can be recognized by a Turing machine that may or may not halt

56. Question

If a language is recursively enumerable but not recursive, what does it imply?

a) It cannot be accepted by any machine

b) It can be accepted by a Turing machine, but the machine may not halt on some inputs

c) It has a polynomial-time decision procedure

d) It is equivalent to a context-free language

Answer

Answer: b) It can be accepted by a Turing machine, but the machine may not halt on some inputs

57. Question

The following theorem is used to prove that the language Ld is not recursively enumerable language (i.e) There is no TM that accepts Ld. Complete the steps with missing statement to prove that it is not recursively enumerable language.

Proof;

There are two possibilities.

1. w_i Î L_d

Reason: ____________A?_____________

2. w_i Ï L_d
Reason: ____________B?_____________

Answer

1. w_i Î L_d

A: If wi is in Ld, then Mi accepts wi but by definition of Ld , wi is not in Ld, because Ld contains only those wj such that Mj does not accepts wj . (2 Marks)

2. w_i Ï L_d

B: If w_i is not in L_d, then M_i does not accept w_i. By definition of L_d, w_i is in L_d. (2 Marks)

v Since w_i can neither be in L_d nor fail to be in L_d , here conclude that there is contradiction of one assumption that M exists.

L_d is not recursively enumerable. (2 Marks)

58. Question

Identify the properties which is true for recursively enumerable languages.
a) They are closed under union but not under intersection
b) They are closed under complement
c) They cannot be recognized by a Turing machine
d) They are equivalent to regular languages

Answer

Answer: a) They are closed under union but not under intersection

59. Question

Two different teams designed two different Turing machines (machine 1 & machine 2) with infinite input tape. The team leader assigned the same kind of problems to different machines to check the computable and also plan to simulate one of the newly designed machines for that machine 1 description is given as an input to machine 2 to simulate the same.
P and Q machine is designed if P is encoded and its description given to Q machine as an input. Identify the type of the Q machine.

Answer

Universal Turing machine (2 Marks)

60. Question

Identify the properties which are true for recursive languages.
a) They are not closed under complement
b) They are closed under union and intersection
c) They can only be accepted by non-deterministic Turing machines
d) They are a strict subset of regular languages

Answer

Answer: b) They are closed under union and intersection