Question 1. What Is The Difference Between The Strings And The Words Of A Language?

Answer :

A string is any combination of the letters of an alphabet where as the words of a language are the strings that are always made according to certain rules used to define that language.For example if we take

Alphabet Σ = { a , b } Here a , b are the letters of this alphabet.

As you can see we can make a lot of strings from these letters a and b.

For example a,b,aa,ab,ba,bb,aaa,aab,aba,baa,…… and so on.

But when we define a language over this alphabet having no a's and only odd number ofb's. Then the words of this language would have only those strings that have only odd number of b's and no a's.some example words of our defined language are b , bbb , bbbbb , bbbbbbb , ……..and so on.

So we can say that all the words are strings but all the strings may not be the words of a language. Hence strings are any combination of letters of an alphabet and the words of a language are strings made according to some rule.

Question 2. What Is The Difference Between An Alphabet And An Element Of A Set. Whether Alphabet Is An Element Of A Set Or It Is A Set Itself?

Answer :

An Alphabet is a set in itself. The elements of an Alphabet are called letters.

For example

Binary Alphabet Σ = {0,1}

Here 0,1 are the letters of binary alphabet.

Binary Alphabet is very important because it the Alphabet used by the computer.

Set of Natural Numbers

N={1,2,3,4,5,……..}

Here 1,2,3…… are the elements of set of Natural Numbers.

Question 3. What Is Null String (Λ) ?

Answer :

The string with zero occurrences of symbols (letters) from ?.

It is denoted by (Small Greek letter Lambda) λ or (Capital Greek letter Lambda or epsilon) Λ, is called an empty string or null string.

The capital lambda will mostly be used to denote the empty string, in further discussion.

Question 4. What Is The Concept Of Valid And Invalid Alphabets ?

Answer :

While defining an alphabet of letters consisting of more than one symbols, no letter should be started with any other the letter of the same alphabet i.e. one letter should not be the prefix of another. However, a letter may be ended in the letter of same alphabet i.e. one letter may be the suffix of another.

Σ= { a , b } (Valid Alphabet)

Σ= { a , b , cd } (Valid Alphabet)

Σ= { a , b , ac } (Invalid Alphabet)

Question 6. What Is Non-determinism And Determinism And What Is The Difference Between Them ?

Answer :

Determinism means that our computational model (machine) knows what to do for every possible inputs. Non determinism our machine may or may not know what it has to do on all possible inputs.

As you can conclude from above definition that Non-Deterministic machine can not be implemented (used) on computer unless it is converted in Deterministic machine.

Question 7. What Is Meant By Equivalent Fa's ?

Answer :

FA's that accept the same set of languages are called Equivalent FA's.

Question 8. Valid/in-valid Alphabets?

Answer :

Any alphabet is valid if any of its letter does not appear in the start of any other letter otherwise it is invalid.

Question 9. Differentiate Kleene Star Closure And Plus?

Answer :

Given Σ, then the Kleene Star Closure of the alphabet Σ, denoted by Σ*, is the collection of all strings defined over Σ, including Λ (epsilon).

Plus Operation is same as Kleene Star Closure except that it does not generate Λ (null string), automatically.

Given Σ, then the Kleene Star Closure of the alphabet Σ, denoted by Σ*, is the collection of all strings defined over Σ, including Λ.

Plus Operation is same as Kleene Star Closure except that it does not generate Λ (null string), automatically.

You can use other symbol for alphabet but we are mostly use sigma symbol.

Question 10. Define Regular Expression?

Answer :

Regular Expression is the generalized form of any regular language through which you can construct any string related to that language.

Take an example from your handouts

L1 = {Λ, a, aa, aaa, …} and L2 = {a, aa, aaa, aaaa, …} can simply be expressed by a* and a+, respectively.

so a* and a+ are the generalized form of Languages L1, L2.

And a* and a+ are called the regular expressions (RE) for L1 and L2 respectively.

Question 11. What Is The Concept Of Fa Also Known As Fsm (Finite State Machine) ?

Answer :

FA (Finite Automaton) is a finite state machine that recognizes a regular language. In computer science, a finite-state machine (FSM) or finite-state automaton (FSA) is an abstract machine that has only a finite, constant amount of memory. The internal states of the machine carry no further structure. This kind of model is very widely used in the study of computation and languages.

Question 12. What Is The Concept Of The Union Of Fa's ?

Answer :

When we take Union of two FA's it means that resultant FA's should accept all the words that were accepted by the two FA's individually. It is like taking union of two sets, the resultant set contain members of both sets.

For example

Let A ={1,3,5,7,9}

and

B = {0,2,4,6,8,10}

then, A U B = { 0,1,2,3,4,5,6,7,8,9,10 }

you can see that A U B contain elements of both sets similar is the case with FA's.

Question 13. What Is Difference Between Fa's And Nfa's. Are They Opposite To Each Other ?

Answer :

FA stands for finite automata while NFA stands for non-deterministic finite automata, In FA there must be a transition for each letter of the alphabet from each state. So in FA number of transitions must be equal to (number of states * number of letter in alphabet).

While in NFA there may be more than one transition for a letter from a state. And finally every FA is an NFA while every NFA may be an FA or not.

Question 14. Differentiate Between (a,b) And (a+b)?

Answer :

(a, b) = Represents a and b.

(a + b) = Represents either a or b.

Question 15. How To Create A Re Of A Particular Language?

Answer :

Regular expression is used to express the infinite or finite language, these RE are made in such a way that these can generate the strings of that unique language also for the cross check that the defined RE is of a specified language that RE should accept all the string of that language and all language strings should be accepted by that RE.

Question 16. If A Language Can Be Expressed In The Form Of Fa Than Why It Is Needed To Use Nfa ?

Answer :

NFA stands for non-deterministic FA and this sort of structure has relaxation compared with FA. So it is rather more easy to represent a language using NFA.

We have methods to convert NFA into FA's so sometimes it is easier to build NFA of a given language and than convert its NFA into FA using these methods rather than directly building an FA for a language which may be very difficult.

Question 17. How Moore And Mealy Machine Works In Computer Memory What Is Their Importance In Computing ?

Answer :

Mealy & Moore Machines work in computing as incrementing machine & 1's complement machine etc. These operations as basic computer operations so these machines are very important.

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Question 18. Moore And Mealy Machine?

Answer :

In order to run a string on a Mealy or Moore machine, you can take directions from transition table. Running string on Mealy or Moore machine is similar to running string on a FA. For example, if want to run abba on the machine, take start from initial state. Check what is the transition for a, what state it goes. After that check what is the path of b from that state and so on. In this way you will be able to run whole of the string. Note that there is no final state in Mealy or Moore machine. So there is no case of acceptance or rejection of string. You just have to determine what the output is. I hope that will clear your mind for further clarification please listens to your lecture carefully.

The string is taken for the testing purposes. You can take any sort of string and determine its output using machine.

Question 19. What Is The Difference Between Semiword And Word Please Also Give An Example Regarding This?

Answer :

Word: A word is complete combinations of terminals only e.g. abba or ab or a or null string.
Semiword: A semiword is a string of terminals (may be none) concatenated with exactly one nonterminal on the right i.e. a semi word, in general, is of the following form (terminal) (terminal) ——- (terminal)(nonterminal)
For example

aaaaaaB , aabbaaaA , A.

Question 20. What Is The Difference Between Derivation Tree And Total Tree ?

Answer :

A Derivation tree is the one that shows how to derive any specific word of the language described by CFG but Total Language Tree shows all words of the Language described by CFG on it.

Question 21. What Does Mean The Language Is Closed?

Answer :

When we say that a Language is closed it is always with respect to certain operation.

A simple example may be that the set of integers is closed under addition. It means when we take two numbers from set of integers say 3, 7 the result of their addition would also be in the set of integers.

Similarly if the result of an operation on the words of a language results in the word of the same language we say that the language is closed under that operation.

Question 22. What Are The Productions?

Answer :

Productions are the grammatical rules and regulations. These rules express the behavior of CFG. Using production in CFG terminals are converted into non-terminals and when all the terminals are converted using productions, a word is acquired.

Question 23. What Is The Difference Between Concatenation And Intersection Of Two Fa's Also What Is The Difference Among Union Of Two Fa's And Addition Of Them?

Answer :

In intersection of two FA's only those strings are accepted which are independently accepted by both FA's, while in concatenation of two FA's only those strings will be accepted in which

first part of string is accepted by first FA and remaining part of string is accepted by the second FA.

While taking union of two FA's one can represent it using + sign. So (FA1 U FA2) and (FA + FA2) both are same. There is no difference between them.

Question 24. What Is The Uses Of Push Down Automata In Computing ?

Answer :

PDA is just an enhancement in FAs. i.e Memory is attached with machine that recognizes some language. FA is basic structure for most advanced electronic machines such as computer etc.

Question 25. What Is Unit Production?

Answer :

The production in which one non-terminal leads to only one non-terminal.

Question 26. What are the applications of automata theory?

In compiler construction.

In switching theory and design of digital circuits.

To verify the correctness of a program.

Design and analysis of complex software and hardware systems.

To design finite state machines such as Moore and mealy machines.

Question 27. Define proof by contrapositive.

It is other form of if then statement. The contra positive of the statement "if H

then C" is "if not C then not H".

28.What is Є-closure of a state q0?

Є-closure(q0) denotes a set of all vertices p such that there is a path from q0 to p labeled Є.

29.Define Induction principle.

• Basis step:

P(1) is true.

• Assume p(k) is true.

• P(K+1) is shown to be true.

30.What is a regular expression?

A regular expression is a string that describes the whole set of strings according to certain syntax rules. These expressions are used by many text editors and utilities to

search bodies of text for certain patterns etc. Definition is: Let Σ be an alphabet. The regular expression over Σ and the sets they denote are:

i. Φ is a r.e and denotes empty set. ii. Є is a r.e and denotes the set {Є}

iii. For each 'a' in Σ , a+ is a r.e and denotes the set {a}.

iv. If 'r' and 's' are r.e denoting the languages R and S respectively then (r+s),

(rs) and (r*) are r.e that denote the sets RUS, RS and R* respectively.

31. Differentiate L* and L+

?

L* denotes Kleene closure and is given by L* = ЄU Li

i=0

example : 0* ={Є ,0,00,000,……}

Language includes empty words also.

?

L+ denotes Positive closure and is given by L+= Li

i=1 example:0+={0,00,000,……..}

32.What is Arden's Theorem?

Arden's theorem helps in checking the equivalence of two regular expressions. Let P and Q be the two regular expressions over the input alphabet Σ. The regular

expression R is given as : R=Q+RP

Which has a unique solution as R=QP*.

33.Write a r.e to denote a language L which accepts all the strings which begin or end with either 00 or 11.

The r.e consists of two parts: L1=(00+11) (any no of 0's and 1's)

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

L2=(any no of 0's and 1's)(00+11)

=(0+1)*(00+11) Hence r.e R=L1+L2

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

34.Construct a r.e for the language which accepts all strings with atleast two c's over the set Σ={c,b}

(b+c)* c (b+c)* c (b+c)*

35.Construct a r.e for the language over the set Σ={a,b} in which total number of a's are divisible by 3

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

36.what is: (i) $(0+1)^*$ (ii)$(01)^*$ (iii)(0+1) (iv)(0+1)+

(0+1)*= { Є , 0 , 1 , 01 , 10 ,001 ,101 ,101001,……}

Any combinations of 0's and 1's.

(01)*={Є , 01 ,0101 ,010101 ,……..}

All combinations with the pattern 01. (0+1)= 0 or 1,No other possibilities.

(0+1)+= {0,1,01,10,1000,0101,…….}

37.Reg exp denoting a language over Σ ={1} having

(i)even length of string (ii)odd length of a string

(i) Even length of string R=(11)*

(ii) Odd length of the string R=1(11)*

38.Reg exp for:

(i)All strings over {0,1} with the substring '0101'

(ii)All strings beginning with '11 ' and ending with 'ab'

(iii)Set of all strings over {a,b}with 3 consecutive b's.

(iv)Set of all strings that end with '1'and has no substring '00'

(i)(0+1)* 0101(0+1)* (ii)11(1+a+b)* ab

(iii)(a+b)* bbb (a+b)* (iv)(1+01)* (10+11)* 1

39. What are the applications of Regular expressions and Finite automata

Lexical analyzers and Text editors are two applications.

Lexical analyzers:The tokens of the programming language can be expressed

using regular expressions. The lexical analyzer scans the input program and separates the tokens.For eg identifier can be expressed as a regular expression as:

(letter)(letter+digit)*

If anything in the source language matches with this reg exp then it is recognized as an identifier.The letter is{A,B,C,……..Z,a,b,c….z} and digit is

{0,1,…9}.Thus reg exp identifies token in a language.

Text editors: These are programs used for processing the text. For example

UNIX text editors uses the reg exp for substituting the strings such as: S/bbb*/b/

Gives the substitute a single blank for the first string of two or more blanks in a given line. In UNIX text editors any reg exp is converted to an NFA with Є –transitions, this NFA can be then simulated directly.

40.Reg exp for the language that accepts all strings in which 'a' appears tripled over the set Σ ={a}

reg exp=(aaa)*

41.What are the applications of pumping lemma?

Pumping lemma is used to check if a language is regular or not. (i) Assume that the language(L) is regular.

(ii) Select a constant 'n'.

(iii) Select a string(z) in L, such that |z|>n.

(iv) Split the word z into u,v and w such that |uv|<=n and |v|>=1.

(v) You achieve a contradiction to pumping lemma that there exists an ‘i’

Such that uviw is not in L.Then L is not a regular language.

42. What is the closure property of regular sets?

The regular sets are closed under union, concatenation and Kleene closure. r1Ur2= r1 +r2

r1.r2= r1r2 (r)*=r*

The class of regular sets are closed under complementation, substitution, homomorphism and inverse homomorphism.

44.Reg exp for the language such that every string will have atleast one ‘a’ followed by atleast one ‘b’.

$R=a^+b^+$

45.Write the exp for the language starting with and has no consecutive b’s

reg exp=(a+ab)*