بسمِ اللہ الرَّحمٰن الرَّحیم

Cs 402

Final Term Preparation

Most Important Subjective

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SHORT QUESTION

Question No 1

How can you say that two FAs are equivalent?

Answer:-

It is to be noted that two FAs are said to be equivalent, if they accept the same language

Question No 2

What is a production?

Answer: -

Productions: The grammatical rules are often called productions.

Question No 3

If L1,L2 and L3 be any three finite languages over Sigma = {a,b}, then how will be

(L1 ∩ L2) ∪ (L2 ∩ L3) ≠ Ø

Answer: -

(L1 ∩ L2) ∪ (L2 ∩ L3) ≠ Ø is not always true. It depends on all the languages. If L1 has some common words with L2 or L2 has some common words with L3, then this will not be equal to empty. However if L1 does not have common words with L2 or L2 does not have common words with L3 then this statement will be wrong.

Question No 4

RE for Even-even

Answer: -

(aa+bb+(ab+ba)(aa+bb)(ab+ba))**

Question No 5

Differentiate between Regular and Non regular languages?

Answer: -

The language generated by any regular expression is called a regular language. The language that cannot be expressed by any regular expression is called a Nonregular language.

Question No 6

What are the halt states of PDAs?

Answer: -

ACCEPT and REJECT states are called the halt states.

1. *Reject state is like dead non final state.*
2. *Accept state is like final state.*

Question No 7

Identify the null productions and nullable productions from the following CFG:

S -> ABAB

A -> a | /

B-> b | /

Answer: -

Here S → ABAB is nullable production and A → Λ, B → Λ are null productions.

Question No 8

Define ambiguous grammer?

Answer:-

The CFG is said to be ambiguous if there exists at least one word of it's language that can be generated by the different production trees.

Question No 9

Define two rules ……(Row Language)

Answer:-

Following are the three rules of defining all possible productions of CFG of the row language

The trip starting from START state and ending in ACCEPT state with the NET style

Net(START, ACCEPT, $) gives the production of the form S → Net(START, ACCEPT, $)

Question No 10

(L1UL2C) intersection (L1CU L2) the language or accept any thing or not…

Answer:-

(L1 ∩ L2c) ∪ (L1c ∩ L2) is regular language that accepts the words which are in L1 but not in L2 or else in L2 but not in L1 .

Question No 11

What is Transition?

Answer:-

Transition showing how to move from one state to another.

Question No 12

Alternative form of this production

Σ = {a,b}

Productions:

S→aS| bS |a|b| Λ

Answer:-

This grammar also defines the language expressed by (a+b).*

Question No 13

What are formal languages?

Answer:-

Formal Languages are Syntactic languages.

Question No 14

Consider the following CFG

S aXb|bXa

XaX|bX|

What does it mean?

Answer:-

The above CFG generates the language of strings, defined over ={a,b}, beginning and ending in different letters.

Question No 15

What is Row Language?

Answer:-

Row language whose alphabet is Σ = {Row1, Row2, …, Row7} i.e. the alphabet consists of the letters which are the names of the rows in the summary table.

Question No 16

What does FA stands for?

Answer:-

Finite Automaton

Question No 17

What are live and dead productions.

Answer:-

Live production: A production of the form nonterminal → string of two nonterminals is called a live production.

Dead production: A production of the form nonterminal → terminal is called a dead production.

Question No 18

What do you mean by wanted and unwanted branches?

Answer:-

Wanted branches (the branches that lead to the required word) unwanted branches (the branches that don't lead to the required word)

Question No 19

Who invented Turing m/c

Answer:-

Alan Mathison Turing developed the machines called Turing machines.

Question No 20

What are formal languages?

Answer:-

Formal Languages are Syntactic languages.

Question No 21

Prove kleens theorem part two?

Answer:-

Kleene's Theorem Part II

If a language can be accepted by a TG then it can be expressed by an RE as well.

Question No 22

Can we accept the string going from final to initial state?

Answer:-

NO…

To examine whether a certain FA accepts any words, it is required to seek the paths from initial to final state.

Question No23

State uses of PDA in computing?

Answer:-

It provides theoretical basis for how computing machine can perform computation. It is uses for constructing compiler parser design.

Question No 24

What is meant by decidable problem?

Answer:-

Decidable problem

A problem that has decision procedure is called decidable problem e.g. the following problems

The two regular expressions define the same language.

The two FAs are equivalent.

Question No 25

Define strings. With example.

Answer:-

C of finite number of letters from the alphabet is called a string.

Question No 27

Write regular expression contain even words defined over sigma={a, b}

Answer:-

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

Question No 28

If two FA have no final state how the intersection of those FA will have final state?

Answer:-

If Both the FAs have no final state, so these FAs accept nothing. This implies that their union will not also accept any string. Hence FA corresponding to the language (L1∩ L2c) ∪(L1c∩ L2) accepts nothing. Thus both the languages are equivalent.

Question No 29

Give RE for EVEN – EVEN language.

Answer:-

Consider the EVEN) EVEN language, defined over Σ = {a, b}. As discussed earlier that EVEN)EVEN language can be expressed by the regular expression (aa+bb+(ab+ba)(aa+bb)(ab+ba))* b*

Question No 30

Use of push and pop states

Answer:-

A PUSH operator adds a new letter at the top of STACK,

POP is an operation that takes out a letter from the top of the STACK. The rest of the letters are moved one location up.

Question No 31

What is the concept of the Union of FA's ?

Answer:-

FA3 be an FA corresponding to r1+ r2, and then the initial state of FA3 must correspond to the initial state of FA1 and the initial state of FA2.

Question No 32

What does mean the LANGUAGE IS CLOSED?

Answer:-

Closed w.r.t. concatenation i.e.the language expressed by RE of type r.*

Question No 33

Stack consistence means that in the PDA?

Answer:-

When a row pops a character it should be there at the top of the STACK

Question No 34

Where Null string is use the most?

Answer:-

The choice of null string depends on the requirements of the language. In some case we need to have null string to be accepted by the FA.

Question No 35

Concept of unit production in CFG?

Answer:-

The productions of the form nonterminal → one nonterminal, is called the unit production. Unit production is removed in CFG

Question No 36

How can we define languages elaborate any five ways.

Answer:-

Defining Languages

The languages can be defined in different ways , such as Descriptive definition, Recursive definition, using regular Expressions (RE) and using Finite Automaton (FA) etc.

Long Question

Question No 1

Parsing Techniques

Answer:-

Recall the CFG for arithmetic expression

*S→S+S|S*S|number*

*It was observed that the word 3+4*5 created ambiguity by considering its value either 23 or 35. To remove this ambiguity, the CFG was modified to S→(S+S)|(S*S)|number*

*There arises a question that whether a new CFG can be defined without having parentheses with operator hierarchy (i.e. * before +)? The answer is yes. Following is the required PLUS'TIMES grammar S→E, E→T+E|T, T→F*T|F, F→€|I*

*Where I stands for any identifier i.e. number or of storage location name (variable). Following is the derivation of i+i*i*

S ⇒ E

⇒ T+E

⇒ F+E

⇒ i+E

⇒ i+T

*⇒ i+F*T*

*⇒ +i*T*

*⇒ i+i*F*

*⇒ i+i*i*

Question No 2

What are live and dead productions.

Answer:-

Live production: A production of the form nonterminal → string of two nonterminals is called a live production.

Dead production: A production of the form nonterminal → terminal is called a dead production.

Question No 3

Prefixes of a language in another language?

Answer:-

Prefixes of a language in another language

If two languages R and Q are given, then the language the prefixes of Q in R denoted by Pref(Q in R) is the set of strings of letters that, when concatenated to the front of some word in Q to produce some word in R i.e. Pref(Q in R) = the set of all strings p such that there exists words q in Q and w in R such that pq = w. Following are the examples in this regard

Example

Let Q = {aa,abaaabb,bbaaaaa,bbbbbbbbbb} and R = {b,bbbb,bbbaaa,bbbaaaaa}

It can be observed that aa and bbaaaaa occur at the ending parts of some words of R, hence these words help in defining the language pref(Q in R). Thus pref(Q in R) = {b,bbba,bbbaaa}

Question No 4

Write two difference and two similarities between DFA and NFA.

Answer:-

Difference

1-In FA Finite number of states, having one initial and some (maybe none) final states. While in NFA Finite many states with one initial and some final state. 2-In FA for each state and for each input letter there is a transition showing how to move from one state to another while in NFA there may be more than one transition for certain letters and there may not be any transition for certain letters. 3-In FA is valid while in NFA is not valid.

Common

Every Language that can be recognized by a DFA can also be recognized by a NFA. The reverse is True. Both DFA and NFA can only have one start state. But they can have multiple Final states finite set of input letters

Question No 5

Consider the language L which is EVEN-EVEN, defined over Σ = {a,b}. In how many classes does L may partition Σ*. Explain briefly.

Answer:-

*Consider the language L which is EVEN'EVEN, defined over Σ = {a,b}. It can be observed that L partitions Σ**

Into the following four classes

C1= set of all strings with even number of a's and odd number of b's.

C2= set of all strings with odd number of a's and odd number of b's.

C3= set of all strings with odd number of a's and even number of b's.

C4= set of all strings with even number of a's and even number of b's

Question No 6

Explain CFG and even-even language.

Answer:-

CFG

CFG is a collection of the followings

An alphabet Σ of letters called terminals from which the strings are formed, that will be the words of the language.

A set of symbols called non-terminals, one of which is S, stands for "start here".

A finite set of productions of the form

Non-terminal → finite string of terminals and /or non-terminals.

Following grammar generates EVEN-EVEN language.

Σ = {a,b}

Productions:

S → SS

S → XS

S → Λ

S → YSY

X → aa

X → bb

Y → ab

Y → ba

Question No 7

Differentiate b/w FA, TG and GTG?

Answer:-

FA

A Finite automaton (FA), is a collection of the followings

Finite number of states, having one initial and some (maybe none) final states.

Finite set of input letters (Σ) from which input strings are formed.

Finite set of transitions i.e. for each state and for each input letter there is a transition showing how to move from one state to another.

TG

A Transition graph (TG), is a collection of the followings

Finite number of states, at least one of which is start state and some (maybe none) final states.

Finite set of input letters (Σ) from which input strings are formed.

Finite set of transitions that show how to go from one state to another based on reading specified substrings of Input letters, possibly even the null string (Λ).

GTG

A generalized transition graph (GTG) is a collection of three things

Finite number of states, at least one of which is start state and some (maybe none) final states.

Finite set of input letters (Σ) from which input strings are formed.

Directed edges connecting some pair of states labeled with regular expression.

It may be noted that in GTG, the labels of transition edges are corresponding regular expressions

Question No 8

Five conditions of PDA conversion?

Answer:-

A PDA is in conversion form if it fulfills the following conditions:

There is only one ACCEPT state.

There are no REJECT states.

Every READ or HERE is followed immediately by a POP i.e. every edge leading out of any READ or HERE

State goes directly into a POP state.

No two POPs exist in a row on the same path without a READ or HERE between them whether or not there are any intervening PUSH states (i.e. the POP states must be separated by READs or HEREs).

All branching, deterministic or nondeterministic occurs at READ or HERE states, none at POP states and every edge has only one label.

Question No 10

Palindrome (both even and odd palindrome).

Answer

Example

The CFG for odd length of Palindrom is given as:

S → aSa | bSb | a | b

The CFG for even length of Palindrom is given as:

S → aSa | bSb | aa | bb | ^

Question No 11

Explain the decidability and examples.

Answer: -

Decidability

Effectively solvable problem

A problem is said to be effectively solvable if there exists an algorithm that provides the solution in finite number of steps e.g. finding solution for quadratic equation is effectively solvable problem, because the quadratic formula provides an algorithm that determines the solution in a finite number of arithmetic operations, (four multiplications, two subtractions, one square root and one division).

Question No 12

If L1,L2 and L3 be any three finite languages over Sigma = {a,b}, then how will be

(L1 ∩ L2) ∪ (L2 ∩ L3) ≠ Ø

Answer: -

(L1 ∩ L2) ∪ (L2 ∩ L3) ≠ Ø is not always true. It depends on all the languages. If L1 has some common words with L2 or L2 has some common words with L3, then this will not be equal to empty. However if L1 does not have common words with L2 or L2 does not have common words with L3 then this statement will be wrong.

Question No 13

Two different method for converting the NFA to FA 5marks

Answer: -

Method 1:

Since an NFA can be considered to be a TG as well, so a RE corresponding to the given NFA can be determined (using Kleene's theorem). Again using the methods discussed in the proof of Kleene's

Theorem, an FA can be built corresponding to that RE. Hence for a given NFA, an FA can be built equivalent to the NFA

Method 2:

Since in an NFA, there may be more than one transition for a certain letter and there may not be any transition for certain letter, so starting from the initial state corresponding to the initial state of given NFA, the transition diagram of the corresponding FA, can be built introducing an empty state for a letter having no transition at certain state and a state corresponding to the combination of states, for a letter having more than one transitions

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