CS402-THORY OF AUTOMATA

CURRENT PAPER

SOLVED SUBJECTIVE FROM FINAL TERMS PAPERS

SOLVED BY JUNAID MALIK AND TEAM



AL-Junaid Institude

Contact no: 03041659294

VU LMS HELP vulmshelp.com

LMS Handling

Subject Enrollment

1) Online classes available
HTML, CSS, Javascript
Phyton..etc
2) Solved Graded Activities
- *Assignment's*
- *Quizze's*
- *GDB's*

3) Sloved Quiz File's
4) Short Note's
5) Past paper's &
Current paper's

Final project CS619

1) SRS
(Software Requirement's Specification)
2) DD
(Design Document)
3) Test phase + viva
4) Viva preparation
5) Final Deliverable

Website Link
vulmshelp.com

Gmail
junaidfazal08@gmail.com

AL-JUNAID INSTITUTE GRPOUP

Q No 1. How Moore and Mealy machine works in Computer Memory what is their importance in Computing ?

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.

Q No 2. What is sequential circuit ?

Sequential Circuit:

A sequential circuit contains a memory component.

The memory component provides a state input. A flip-flop is often used as a memory component.

The state variable indicates the states of the sequential machine, i.e. the status or stage or progress of the whole event.

The state of a sequential circuit is indicated by the output of a flip-flop. A single flip-flop can be used to indicate two states (q=0 and q=1). When there are more than two states, additional flip-flops are used. Given n flip-flops, a total of 2^n states can be represented.

In other words, a sequential machine can be put into a number of different states depending on the particular inputs given.

The output is a function of both the Present Inputs and the Present States.

In addition to the outputs, the circuit must also generate an update to the memory components so that the state of the machine can also be changed with respect to the new inputs. The update is called the Next State Function and is also a function of the Present Inputs and the Present States.

Both the output functions and the Next State Functions are combinational circuits.
$Z=f(X,S^t)$
$S=g(X,S^t)$

The superscript t indicates the present time period while the superscript (t+1) indicates the next time period.

The characteristic of a sequential circuit is completely defined by a state transition diagram that enumerates all possible transitions for every possible input combination.

Q No 3. What is the concept of Pumping Lemma I and II and what is the difference between pumping Lemma 1 and pumping Lemma 2 ?

In fact PLI & PLII are same (A way to recognize Non Regular language). The only difference is that the conditions in pumping lemma II are more stricter than Pumping Lemma I some language that are difficult to proof Non Regular by Pumping Lemma I are proved Non Regular by pumping Lemma II easily.

Further mare in pumping lemma I we have to generate all words to of a language but in Pumping Lemma II we have to generate a single word to prove a language non regular.

Explanation:

Some languages like PALINDROME that are proved to be regular by first version

due to some of their symmetrical words when we pump these words they remain to be

the parts of the language like

bbabb

By pumping lemma 1

Let y = a

Now repeating y three times results in

bbaaabb

That is also a valid word of PALINDROME so by pumping lemma I PALINDROME can not be proved non regular, so there was the need of pumping lemma version version 2.

Now consider for the word

bbabb

if we take N=2

Then by pumping y (let we take it b) two times results in

bbbbabb

That word is not in PALINDROME.

But if we take N=3 and y = a

Then by pumping y two times results in

bbaaabb

That word is in PALINDROME. So be careful in taking total no of states of the FA

and also the repeating factor (y) to prove an infinite language non regular you

need to prove only one word that is not part of the language.

Q No 4. What is the significance of Pumping Lemma II ?

The significance of 2nd version of 'pumping lemma' is that there are some infinite non regular languages like PALINDROME we can built FA that can accept there certain words but if we increase the length of their words that FA don't accept these words so by pumping lemma version I it is very difficult to prove them non regular but with the second version we can prove that a language is Non regular even it's some words may be accepted by some FA's.
See page 195 of the book for further example.

Q No 5.Moore and Mealy machine?

1. 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.

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

Q No 6. What is the difference between semiword and word please also give an example regarding this?

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.

What is the difference between derivation tree and total tree ?

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

Q No 7.What does mean the LANGUAGE IS CLOSED?

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.

Q No 8.What are the Productions?

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.

Q No 9.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?

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.

Q No 10.What is the Difference between Nullable and Null production? How to make eliminate Nullable and for Null Productions from the CFG ?

The production of the form

nonterminal ® L

is said to be ***null production***.

Example:

Consider the following CFG

S ® aA|bB|L, A ® aa|L, B ® aS

Here S ® L and A ® L are null productions.

A production is called ***nullable production*** there is a derivation that starts at Non Terminal and leads to L *i.e.*

S ----------> *aA* | *bB* | *aa*

A----------> *C* | *bb*

C----------> L

Here A nullable Non Terminal due to Nullable production A---------> C as C leads to null.

Example:

Consider the following CFG

S ® XY, X ® Zb, Y ® bW

Z ® AB, W ® Z, A ® aA|bA|L

B ®Ba|Bb|L.

Here A ® L and B ® L are null productions, while Z ® AB, W ® Z are nullable productions.

Method:

Delete all the Null productions and add new productions *e.g.*

Consider the following productions of a certain CFG X ® aNbNa, N ® L, delete the production N ® L and using the production

X ® aNbNa, add the following new productions

X ® aNba, X ® abNa and X ® aba

Thus the new CFG will contain the following productions X ® Nba|abNa|aba|aNbNa

Note: It is to be noted that X ® aNbNa will still be included in the new CFG.

Method:

Consider the following CFG

S ® XY, X ® Zb, Y ® bW

Z ® AB, W ® Z, A ® aA|bA|L

B ®Ba|Bb|L.

Here A ® L and B ® L are null productions, while Z ® AB, W ® Z are nullable productions. The new CFG after, applying the method, will be

S ® XY

X ® Zb|b

Y ® bW|b

Z ® AB|A|B

W ® Z

A ® aA|a|bA|b

B ®Ba|a|Bb|b

Note: While adding new productions all Nullable productions should be handled with care. All Nullable productions will be used to add new productions, but only the Null production will be deleted

Q No 11. Is it possible to make CFG for infix and postfix expression's using derivation tree ?

Derivation tree is only used to derive words of language that is described by a CFG. Yes, we can create CFG for languages infix expressions, postfix expressions.

Q No 12 what is the uses of push down automata in computing ?

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.

AL-JUNAID INSTITUTE GRPOUP

Q No 13: What is difference between PUSH DOWN STACK and PUSH DOWN STORE ?

No difference at all. Both terms are used to describe memory structure attached with FAs to store some characters in it.

Q No 14 How we can distinguish between "CFG" and "CNF" in the questions ?

Chomsky Normal Form (CNF)

If a CFG has only productions of the form

nonterminal ---------◊ string of two nonterminals

or

Nonterminal ----------◊ one terminal

Then the CFG is said to be in Chomsky Normal Form (CNF).

Thus if the given CFG is in the form specified above it will be called in CNF.

Q No 14.What is meant by the terms stack consistence and input tape consistence ?

Term **Stack consistent** means we can pop any character from the top of the stack only. PDA should not be able to pop any character other than that is present on the top of the stack.

Term **Tape consistent** means we can read only the first letter on the tape not any other letter of the tape after the first one.

Q No 14 What is the concept of unit production ?

The productions of the form

one Nonterminal --------◊ one Nonterminal

Are called unit productions.

For example

S --------◊ A (Unit Produciton)

A--------◊ a | b

Here there is no need of Unit Production S→ A. we can directly write

S ----à a | b

Q No 16: Why Context Free Grammars are called "Context Free?

Context Free Grammars are called context free because the words of the languages of Context Free Grammars have words like "aaabbb"(PALINDROME). In these words the value of letters (a , b) is the same on whatever position they appear. On the other hand in context sensitive grammars their value depend on the position they appear in the word a simple example may be as follows

Suppose we have a decimal number **141** in our language **.** When compiler reads it, it would be in the form of string. The compiler would calculate its decimal equivalent so that we can perform mathematical functions on it. In calculating its decimal value , weight of first **"1"** is different than the second "1" it means it is **context sensitive** (depends on in which position the "1" has appeared).

i.e.

$$1*10^2 + 4*10^1 + 1*10^0 = 14$$

(value of one is 100) (value of one is just one)

That is not the case with the words of Context Free Languages. (The value of "**a"** is always same in whatever position **"a"** appears).

Q No 17. What is Unit Production?

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

Q No 18.What is Left most Derivation in CFG?

It is a method of generation of strings from a CFG starting from left most letter of the string.

Q No 19.Give a example of converting a CFG to CNF?

Consider the CFG given below
S→ ABC
A→ aa | b
B→ c
C→d

Its CNF will be

S→ DC
D → AB
A→ EE | b
E→a
B→c
C→d

Q No 20 .In the lecture 41 's example, we have converted PDA to conversion form and a word 'aaaabb' is derived from this conversion form PDA. What are the derivation steps.

The PDA converted to conversion form has some specific features that are important to understand first. These features are

The states named START, READ, HERE and ACCEPT are called joints of the machine.

With the help of the conversion form we have been able to achieve that POP state has only one path out of it and the path taking (multiple paths) decisions take place only on the READ state.

The word 'aaaabb' is generated as follows from the PDA

START-POP4-PUSH $

This step pops $ and then pushes it to ensure that stack contains $ at the beginning.

READ1-POP6-PUSH $-PUSH a

As first time after reading "a" there is $ at the top of stack so we will follow path segment READ1-POP6-PUSH $-PUSH a

READ1-POP5-PUSH a-PUSH a

Now a is on the top of the stack so we will follow READ1-POP5-PUSH a-PUSH a

READ1-POP5-PUSH a-PUSH a

Again following same segment for a

READ1-POP5-PUSH a-PUSH a

Again following same segment for a

READ1-POP1- HERE-POP2

As we read b on input tape.

READ2-POP1-HERE-POP2

As we read b on input tape.

READ2-POP3-ACCEPT.

As we read Δ from the input tape

Q No 21.How to differentiate between "wanted" and "unwanted branch" ?

When we derive a word in Top down parsing beginning with the starting Non Terminal the branches of the tree that do not lead to our required word are left aside these branches are called unwanted branches.

For example for CFG

S----->AA

A----->a | b

If we want to generate the word "aa" we will leave the branch generated by the production A------>b.

Q No 4.What is the difference between intersection and union of a language?

Intersection of two languages will consist of all those words which are in both languages while union of two languages will consist of all those words which are present in at least one language.

Symbol for intersection is ∩ and for union is U.

Q No 22. What is the difference between Context free languages and regular languages?

Regular languages can be represented by FA's because we do not need any memory to recognize (accept or reject them on FA) them but there is another class of languages that can not be represented by FA's because these languages require that we have some memory (with the help of memory we can store letters of the string we are checking so that we can compare them with next coming letters in the string).

For example language anbn requires that we must store a's and then compare their count with next coming b's so that we can check whether a's are equal to b's or not.

Due to this reason we use Context Free Grammars to represent them because we can5t write RE's for them.

So Context Free Languages represent a broader category this category also include regular languages as subcategory. It means that context free languages include regular languages as well as some other languages.

Question No 23:

What is the difference between semi word and word?

A word is complete combinations of terminals only e.g. abba or ab or a or null string.

Semi word: A semi word 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)

Question No 24:

What is the difference between derivation tree and total tree?

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 No 25:

What is pumping lemma? And what is history?

A theorem to check validity (Regularity) of an infinite language should not be used with finite languages. Whenever an infinite is regular then there must be a loop (circuit) because without a loop means infinite no. of states that is not possible practically. (Machine can have finite states only)

Question No 26

What is the difference between pumping Lemma 1 and pumping Lemma 2?

Infact PLI & PLII are same (A way to recognize Non Regular language). The only difference is in PLII we take care about the substring x & y that length (x) + length (y) less than or equal no. of state of machine. This is because through PLI palindrome (that is Non Regular) is proved to be regular and through PLII this problem is fixed.

Question No 27

How to know what is RE?

It is a matter of practice that you come to know what does an RE represent. You may start with simpler REs and later you will be able to recognize different REs gradually.

Question No 28

Why we use null string in FA?

If null string is part of our language then we have to handle it in FA, it's not compulsion.

Question No 29

What is tree structure?

A tree is a connected undirected graph with no simple circuits. Since a tree cannot have a simple circuit, a tree cannot contain multiple edges or loops. Therefore any tree must be a simple graph.

Question No 30

What is derivation?

The process of generating string by a grammar using production rule.it describe how to show the specific word of language by CFG

Question No 31

How we determined CFG?

Terminal: Small Letter

Not-Terminal: Capital Letter

Production: Left side Terminal change into Right side Terminal or Non-Terminal

Question No 32:

Decision Procedure and decision procedure:

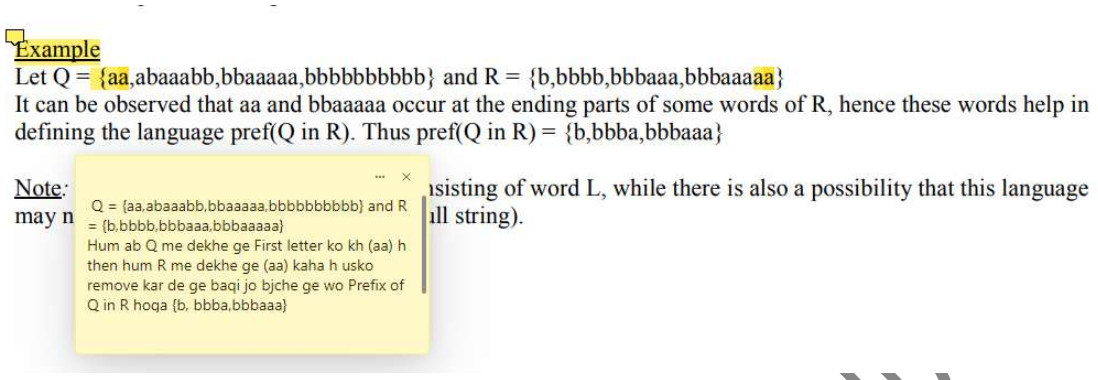
Decision procedure
If an effectively solvable problem has answer in yes or no, then this solution is called decision procedure.
Decidable problem
A problem that has decision procedure is called decidable problem *e.g.* the following problems

For More visit: vumshelp

AL-JUNAID INSTITUTE GRPOUP

Question No 33:

Pref(Q in R)?



Question No 35:

Different Between Live production and Dead production:

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

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

Question No 36:

For More Visit: vulmshelp

Example

Consider the following CFG

$S \rightarrow ABAB$

$A \rightarrow a|\Lambda$

$B \rightarrow b|\Lambda$

Here $S \rightarrow ABAB$ is nullable production and $A \rightarrow \Lambda$, $B \rightarrow \Lambda$ are null productions. Removing the null productions

$A \rightarrow \Lambda$ and $B \rightarrow \Lambda$, and introducing the new productions as

$S \rightarrow BAB|AAB|ABB|ABA|AA|AB|BA|BB|A|B$

Now $S \rightarrow A|B$ are unit productions to be eliminated as shown below

© Copyright Virtual University of Pakistan

$S \rightarrow A$ gives $S \rightarrow a$ (using $A \rightarrow a$)

$S \rightarrow B$ gives $S \rightarrow b$ (using $B \rightarrow b$)

Thus the new resultant CFG takes the form

$S \rightarrow BAB|AAB|ABB|ABA|AA|AB|BA|BB|a|b$, $A \rightarrow a$, $B \rightarrow b$.

Introduce the nonterminal C where $C \rightarrow AB$, so that

$S \rightarrow BAB|AAB|ABB|ABA|AA|AB|BA|BB|a|b$

$S \rightarrow BC|AC|CB|CA|AA|C|BA|BB|a|b$

$A \rightarrow a$

$B \rightarrow b$

$C \rightarrow AB$

is the CFG in CNF.

For More

Question No 37:

Kleene's theorem:

Every Language define By FA and also Define By TG and RE is called KLEEN's Theorem.

1.If any language accept FA the it can also Accept TG

2. If any Language Accept TG then it can also accept RE

3. If any Language Accept RE then It can also accept FA.

Question No 38:

Example

$\Sigma = \{a,b\}$

productions:

$S \rightarrow aS$

$S \rightarrow bS$

$S \rightarrow a$

$S \rightarrow b$

$S \rightarrow \Lambda$

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

For More Visit: vulmshelp.c

Question No 39: (mera 5 NUBER ka aya tha)

write the concept of unit production in CFG?

Unit production

The productions of the form nonterminal → one nonterminal, is called the ***unit production***.
Following is an example showing how ***to eliminate the unit productions from a given CFG.***

Example
Consider the following CFG

$S \rightarrow A|bb$
$A \rightarrow B|b$
$B \rightarrow S|a$

Separate the unit productions from the nonunit productions as shown below

© Copyright Virtual University of Pakistan

unit prods.	nonunit prods.
$S \rightarrow A$	$S \rightarrow bb$
$A \rightarrow B$	$A \rightarrow b$
$B \rightarrow S$	$B \rightarrow a$

$S \rightarrow A$ gives $S \rightarrow b$ (using $A \rightarrow b$)
$S \rightarrow A \rightarrow B$ gives $S \rightarrow a$ (using $B \rightarrow a$)
$A \rightarrow B$ gives $A \rightarrow a$ (using $B \rightarrow a$)
$A \rightarrow B \rightarrow S$ gives $A \rightarrow bb$ (using $S \rightarrow bb$)
$B \rightarrow S$ gives $B \rightarrow bb$ (using $S \rightarrow bb$)
$B \rightarrow S \rightarrow A$ gives $B \rightarrow b$ (using $A \rightarrow b$)

Thus the new CFG will be

$S \rightarrow a|b|bb$, $A \rightarrow a|b|bb$, $B \rightarrow a|b|bb$.

Which generates the finite language {a,b,bb}.

For Me