USN

16CS/IS52

Fifth Semester B.E. Makeup Examination, January 2020

FORMAL LANGUAGES AND AUTOMATA THEORY

Time: 3 Hours | Max. Marks: 100

Instructions: 1. Answer ANY FIVE full questions from Each UNIT
2. Assume any missing data

UNIT - I

L CO PO M

1 a. What is Automata? With Neat schematic representation explain the working of Automata?

(01) (01) (01) (08)

b. Construct DFA for the following Languages

- i. Set of all strings over $\Sigma=\{0,1\}$ starting with substring 01
- ii. Set of all strings over $\Sigma=\{0,1\}$ ending with substring 011
- iii. $L=\{\ |w| \bmod 3 <> 0,$ where $w \in \Sigma^*$ for $\sum=\{a, b\}\ \}$
- iv. $L=\{\ |w| \bmod 3 \geq |w| \bmod 2,$ where $w \in \Sigma^*$ for $\sum=\{a, b\}\ \}$

(03) (01) (03) (12)

OR

2 a. Define Ɛ-NFA and Construct the Ɛ-NFA with four states for the following Language and Compute $\delta^*(q0, aabba)$

$$L=\{a^n \mid n>=0\} \cup \{b^n a \mid n>=1\}$$

(03) (01) (02) (08)

b. Apply Subset Construction Scheme by lazy evaluation and Convert the following Ɛ-NFA into an equivalent DFA

δ	Ɛ	a	b	c
→p	Φ	{p}	{q}	{r}
q	{p}	{q}	{r}	Φ
*r	{q}	{r}	Φ	{p}

(03) (01) (12) (12)

UNIT – II

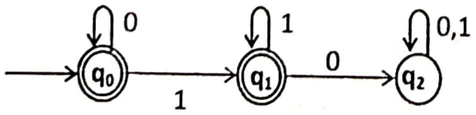
L CO PO M

3 a. Define Regular expression and build the Regular expression for the following languages

- i. To accept a language consisting of strings of a's and b's of odd length.
- ii. To accept a language consisting of strings of 0's and 1's that do not end with 01.
- iii. $L=\{vuv \mid u, v \in \Sigma^*$ for $\sum=\{a, b\}$ and $|v|=2\}$
- iv. $L=\{\ |w| \bmod 3 = |w| \bmod 2,$ where $w \in \Sigma^*$ for $\sum=\{a, b\}\ \}$

(03) (02) (03) (10)

b. Apply State elimination method to identify the Regular Expression for the following finite Automata



(03) (02) (02) (10)

OR

4 a. State and prove the Pumping Lemma for Regular Languages. Apply Pumping Lemma and discover that the following language is Non-Regular

$$L=\{0^n \mid n \text{ is perfect Square}\}$$

(03) (03) (12) (10)

Note: L (Level), CO (Course Outcome), PO (Programme Outcome), M (Marks)

b. Apply Table Filling Algorithm and Determine the Minimum State Deterministic Fin Automata(DFA) for the following DFA shown in the Fig 4

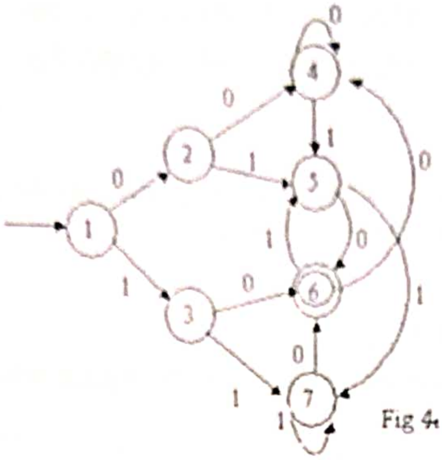


Fig 4

(05) (03) (03) (

L CO PO

UNIT – III

5 a. Obtain a context free grammar to generate a language consisting of equal number of a's and b's.

(2) (3) (1) (

b. Consider the context free grammar with productions.

E→I E→E+E

E→E*E E→(E)

I→a I→b

I →Ia I→Ib

I→I0 I→I1

Write leftmost derivation and parse tree for the string (a101+b1)*(a1+b).

(4) (3) (1) (

c. Eliminate Useless symbols in the grammar.

S → aA | bB

A → aA | a

B → bB

D → ab | Ea

E → aC | d

(2) (3) (1) (

OR

6 a. Show that the following grammar is ambiguous.

S→ aB|bA

A→ aS|bAA|a

B→ bS|aBB|b

(2) (3) (1) (

b. Eliminate Useless symbols in the grammar.

S → aA| a |Bb | cC

A → aB

(2) (3) (1) (

c. Eliminate all ϵ-productions from the grammar.

S→ ABCa|bD

A→ BC|b

B→ b| ϵ

C→c | ϵ

D→ d

Note: L (Level), CO (Course Outcome), PO (Programme Outcome), M (Marks)

(2) (3) (1) (

UNIT – IV

L CO PO M

7 a. Define Push Down Automata- PDA and Construct PDA for the following language by final state. Draw Transition Diagram and write the sequence of Instantaneous Description – ID's to trace the input string for n = 2.

$$L = \{a^n b^{2n} \mid a, b \in \Sigma, n \geq 0\}$$

(03) (04) (03) (10)

b. Define language acceptance of PDA and Construct PDA by empty stack for the following Grammar and write the sequence of Instantaneous Description – ID's to trace the input string – W = aaaaaa

$$S \rightarrow aAS \mid bAB \mid aB$$
$$A \rightarrow bBB \mid aS \mid a$$
$$B \rightarrow bA \mid a$$

(03) (04) (03) (10)

OR

8 a. Define Turing machine and With neat schematic diagram explain the working of Basic Turing machine.

(02) (04) (02) (10)

b. Construct Turing Machine to accept the following language and write the sequence of Instantaneous Description – ID's to trace the input string w = " aabb"

$$L = \{a^n b^n \mid a, b \in \Sigma, n \geq 0\}$$

(03) (04) (03) (10)

UNIT -V

L CO PO M

9 a. Explain the structure of LEX specification format with suitable example

(02) (05) (01) (10)

b. Develop a LEX program to count the number of identifiers, integer and floating point constants present in the input stream..

(03) (05) (03) (10)

OR

0 a. Explain the structure of YACC specification format with suitable example

(02) (05) (01) (10)

b. Develop a YACC program to recognize and evaluate the arithmetic expression involving additive operators (+, -) and multiplicative operators (*, /).

(03) (05) (03) (10)

Note: L (Level), CO (Course Outcome), PO (Programme Outcome), M (Marks)

USN

16CS/IS52/15IS52

Fifth Semester B.E. Semester End Examination, Dec./Jan. 2019-20

FORMAL LANGUAGES AND AUTOMATA THEORY

Time: 3 Hours

Max. Marks: 100

Instructions: 1. Answer any one full question from each UNIT.
2. Each full question of a UNIT carries 20 marks

UNIT - I

L CO PO M

1 a. Define the following with an example for each.
(i). Alphabet (ii). Strings (iii).Power of an alphabet (iv).Transition table
(v). Transition diagram
(1) (1) (1) (05)

b. Design a DFA to accept the language L={ w | w is of even length and begins with 01}.
(3) (1) (3) (07)

c. Design a NFA which accepts strings of 0'and 1's that have the symbol 1 in the second last position. Convert NFA to equivalent DFA.
(3) (1) (3) (08)

OR

2 a. Design a NFA to accept strings of 0's and 1's that have 1 in third last position. Define Epsilon closures with an example.
(3) (1) (3) (07)

b. Design a ε-NFA to accept the decimal number consisting of an optional+ or – sign, a string of digits, a decimal point and another string of digits, either this string of digits or string after decimal point can be empty but atleast one of the two strings is nonempty.
(6) (1) (3) (08)

c. Design a DFA to accept the language L={awa | w Є (a+b)*}
(3) (1) (3) (05)

UNIT – II

L CO PO M

3 a. Prove that, If L=L(A) for some DFA A, then there is a regular expression R such that L=L(R).
(3) (2) (1) (06)

b. Convert regular expression (0+1)*1(0+1) to a ε-NFA.
(3) (2) (1) (06)

c. Design a NFA which accepts all strings containing 110. Convert it to a regular expression.
(3) (2) (1) (08)

OR

4 a. Minimize the following DFA using table filling algorithm.

δ	0	1
→A	B	F
B	G	C
*C	A	C
D	C	G
E	H	F
F	C	G
G	G	E
H	G	C

(6) (2) (1) (10)

b. Show that L={$a^n b^n$ | n≥0} is not regular.
(3) (2) (1) (05)

Note: L (Level),CO (Course Outcome), PO (Programme Outcome), M (Marks)

c. State and Prove Pumping Lemma for regular languages.

(3) (2) (1) (05)

UNIT - III

L CO PO M

5 a. Define Context Free Grammar and Construct Context Free Grammar for the following Languages

i. Set of strings of a's and b's starting with substring 'ab'

ii. $L= \{ a^n b^m c^k \mid n=m+ k, \text{ for } k, m>=0\}$

(03) (02) (02) (06)

b. The following grammar generates the language of RE - 0*1(0+1)*

$S \rightarrow A \mid B$

$A \rightarrow 0A \mid \varepsilon$

$B \rightarrow 0B \mid 1B \mid \varepsilon$

Determine leftmost, rightmost derivations and Parse Tree for the following strings

a) 00101 b) 1001

(03) (02) (02) (10)

c. Prove that the family of Context free Languages is under UNION.

(05) (03) (12) (04)

OR

6 a. Define Ambiguous Grammar and Prove that the following grammar is ambiguous for string aab

$S \rightarrow aS \mid aSbS \mid \varepsilon$

(05) (02) (12) (06)

b. Simplify the following grammar by removing redundancies.

$S \rightarrow ASB \mid \varepsilon$

$A \rightarrow aAS \mid a$

$B \rightarrow SbS \mid A \mid bb$

(04) (03) (02) (10)

c. Organize the following grammar into an equivalent Grammar in Chomsky Normal Form – CNF

$S \rightarrow Aba \mid AB$

$A \rightarrow aab$

$B \rightarrow b$

(03) (03) (03) (04)

UNIT - IV

L CO PO M

7 a. Design a turing machine to accept the language $L=\{0^n 1^n \mid n>=1\}$.

(6) (4) (1) (10)

b. Show that the PDA to accept the language L(M) = {w | w ε (a+b)* having equal number of a's and b's } is nondeterministic.

(2) (4) (1) (08)

c. Define deterministic PDA.

(1) (4) (1) (02)

OR

8 a. Design a turing machine to accept the language consisting of all palindromes of 0's and 1's.

(6) (4) (1) (10)

b. Design a PDA to accept the language $L(M)= \{wCw^R \mid w \in (a+b)^* \text{ where } w^R \text{ is reverse of } w\}$ by a final state.

(6) (4) (1) (10)

UNIT -V

L CO PO M

9 a. Explain the structure of lex program with an example.

(2) (5) (3) (07)

b. Write a word counting lex program.

(3) (5) (3) (07)

c. Explain yacc parser with an example.

(2) (5) (1) (06)

Note: L (Level),CO (Course Outcome), PO (Programme Outcome), M (Marks)

OR

10 a. Explain shift reduce parsing.

(2) (5) (1) (07)

b. What is regular expression? Explain characters that form a regular expression.

(2) (5) (1) (08)

c. Write lex specification for decimal numbers.

(3) (5) (1) (05)

USN ☐☐☐☐☐☐☐☐☐☐ **15CS52/15IS52/16CS52/16IS52**

Fifth Semester B.E. Fast Track Semester End Examination, July/August 2019

FORMAL LANGUAGES AND AUTOMATA THEORY

Time: 3 Hours **Max. Marks: 100**

Instructions: *1. UNIT I & V are Compulsory.*
2. Answer any one full question from remaining each UNITS.

UNIT - I (Compulsory)

L CO PO M

1 a. Define the following with examples.
i) Alphabet ii) String iii) Language
(1) (1) (12) (05)

b. Design DFA for the following:
i) To accept the strings of a's and b's ending with 'ab'.
ii) L={ w such that |w|mod3=0, w € {a,b}* }
(3) (1) (3) (08)

c. Design an NFA to accept the strings of 0's and 1's that end with 10. Convert the same NFA to DFA.
(3) (1) (3) (07)

UNIT – II

L CO PO M

2 a. Define regular expression. Write regular expression for following:
i) L = { 0^n1^m | (m+n) is even }
ii) Strings of 0's and 1's whose 2nd symbol from the end is 0.
(3) (2) (2) (05)

b. Show that the language L={ a^nb^n | n >= 1 } is not regular.
(3) (3) (1) (05)

c. Minimize the following DFA using table-filling algorithm.

δ	0	1
-->A	B	F
B	G	C
*C	A	C
D	C	G
E	H	F
F	C	G
G	G	E
H	G	C

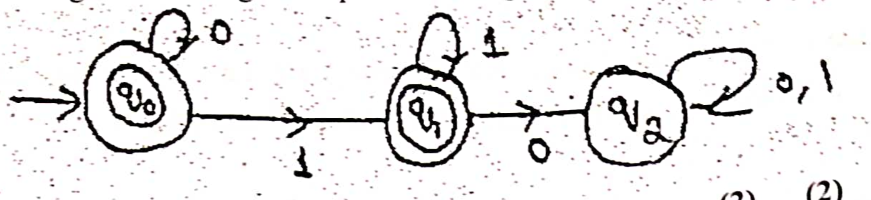
(3) (2) (3) (10)

OR

3 a. Write regular expression for the following:
i) L = { a^nb^m | n >= 4, m <= 3 }
ii) L = { $a^{2n}b^{2m+1}$ | m >= 0, n >= 0 }
(3) (2) (2) (05)

b. State and prove pumping lemma for regular languages.
(3) (3) (1) (07)

c. Translate the following DFA to a regular expression using state-elimination method.



(2) (2) (1) (08)

L CO PO M

UNIT - III

4 a. Define context-free-grammar(CFG). Construct the CFG for the following languages:

i) $L = \{ w \mid w \in (a+b)^*ab \}$ ii) $L = \{ a^nb^n \mid n >= 0 \}$

(3) (2) (2) (06)

b. Write LMD, RMD and parse tree for the string '+*-xyxy' using the grammar:

E -> +EE | *EE | -EE | x | y

(3) (2) (2) (08)

c. Illustrate the applications of CFG.

(2) (2) (12) (06)

OR

5 a. Define ambiguous grammar. Show that the following grammar is ambiguous for the string 'aab'.

S -> AB | aaB
A -> a | Aa
B -> b

(2) (3) (2) (05)

b. Define CNF. Convert the following grammar into CNF.

S --> 0A | 1B
A--> 0AA | 1S | 1
B --> 1BB | 0S | 0

(3) (3) (3) (10)

c. Illustrate the applications of CFG.

(2) (2) (12) (05)

L CO PO M

UNIT - IV

6 a. Explain the working of PDA with a diagram.

(2) (4) (12) (05)

b. Design a PDA for accepting the language $L = \{ ww^R \mid w \text{ is in } (0+1)^* \}$. Draw the transition diagram for PDA obtained. Show the instantaneous description of the PDA for the string '0110'.

(3) (4) (3) (10)

c. Define turing machine. Explain with a neat diagram, the working of a basic turing machine.

(2) (4) (12) (05)

OR

7 a. Define a deterministic PDA (DPDA). Design a DPDA along with transition diagram for the language $L = \{a^nb^{2n} \mid n >= 0\}$.

(3) (4) (3) (06)

b. Design a turing machine to accept the set of all palindromes over $\{a,b\}^*$. Also indicate the moves made by turing machine for the string 'aba'.

(3) (4) (3) (14)

L CO PO M

UNIT -V (Compulsory)

8 a. Explain the structure of lex with example.

(2) (5) (12) (06)

b. Explain parser-lexer communication.

(2) (5) (12) (06)

c. Define regular expression. Explain the various regular expressions in UNIX with example for each.

(2) (5) (12) (08)

Note: L (Level), CO (Course Outcome), PO (Programme Outcome), M (Marks)