R21

Code No.: U21PCN05CS

MATURI VENKATA SUBBA RAO (MVSR) ENGINEERING COLLEGE

(Autonomous)

B.E. V Semester (Main& Supple.) (Branch: CSE & CSE(IOT-CS-BCT)) Examination, February 2025

AUTOMATA LANGUAGES AND COMPUTATION

Time : 3 hours

Max. Marks : 70

Note : i) FIRST Question is compulsory and answer any **FOUR** questions from the remaining six questions. Each question carries 14 Marks.

ii) Answers to each question must be written at one place only and in the same order as they occur in the question paper.

iii) Missing data, if any, may suitably be assumed.

Q.No.		Marks	CO	BT Levels
1. a)	Define DFA. What are the notations for DFA?	(2)	CO1	L1
b)	List the properties of regular sets.	(2)	CO2	L1
c)	Show the graphical notation used to represent Pushdown Automata (PDA).	(2)	CO3	L2
d)	Outline the primary objectives of Turing Machine.	(2)	CO4	L2
e)	Define Universal Turing Machine.	(2)	CO5	L1
f)	Define the term Chomsky Normal Form.	(2)	CO3	L1
g)	What is Recursively Enumerable Language?	(2)	CO4	L2
2. a)	Consider the following ε-NFA.	(7)	CO1	L3

	ε	a	b	c
→p	∅	{p}	{q}	{r}
q	{p}	{q}	{r}	∅
*r	{q}	{r}	∅	{p}

a) Compute the ε -closure of each state.

b) Convert the automaton to an NFA.

b)	State the theorem for Converting Regular Expressions to Automata. Explain with example.	(7)	CO1	L2
3. a)	State Myhill-Nerode Theorem. Explain minimization of Finite Automata with an example.	(7)	CO2	
b)	The following grammar generates the language of regular expression 0* 1 (0 + 1)* :	(7)	CO2	L3

$S \rightarrow A \mid B$

$A \rightarrow 0\ A \mid \varepsilon$

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

Give leftmost and rightmost derivations of the following strings:

a) 00101

b) 1001

c) 00011

R21

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4	(a)	Explain Pumping Lemma Lemma for Context free Languages with an example.	(7)	CO3	L2
	(b)	Construct an equivalent PDA for the following CFG. S→ aAB | bBA A→ bS | a B→ aS | b	(7)	CO3	L3
5	(a)	Design Turing Machine for the following Language. L = { ww^R | w is any string of 0's and 1's }	(7)	CO4	L6
	(b)	Explain programming techniques for Turing Machine construction.	(7)	CO4	L2
6	(a)	Define the Universal Language L_u, and show that L_u is Recursively Enumerable.	(7)	CO5	L4
	(b)	State and explain Post's Correspondence problem with an example.	(7)	CO5	L4
7	(a)	Consider the below finite automata and check whether the following strings are accepted or not.	(5)	CO1	L2

States (Q)	Input Alphabtes	
	0	1
→q0	q1	q3
q1	q0	q2
(q2)	q3	q1
q3	q2	q0

(i) 1110 (ii) 0001 (iii) 1010 (iv) 0101

	(b)	Convert the following CFG to PDA and verify for the string (a + b): I → a | b | Ia | Ib | I0 | I1 E → I | E + E | E * E | (E)	(5)	CO3	L3
	(c)	What is CSL? Discuss with an example.	(4)	CO5	L3

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R21

Code No.: U21PCN05CS

MATURI VENKATA SUBBA RAO (MVSR) ENGINEERING COLLEGE

(Autonomous)

B.E. V Semester (Main) (Branch: CSE) Examination, January 2024

AUTOMATA LANGUAGES AND COMPUTATION

Time : 3 hours

Max. Marks : 70

Note : i) FIRST Question is compulsory and answer any FOUR questions from the remaining six questions. Each question carries 14 Marks.
ii) Answers to each question must be written at one place only and in the same order as they occur in the question paper.
iii) Missing data, if any, may suitably be assumed.

Q.No.			Marks
1.	a)	Construct an NFA that accepts the set of all strings over {0,1} whose second symbol from the right end is 1.	(2)
	b)	Define the Context Free Grammar for the language $L=\{0^n1^n \mid n>=1\}$.	(2)
	c)	Give the Formal Definition of a PDA.	(2)
	d)	What do you mean by restricted Turing Machine.	(2)
	e)	Give any three examples of recursively enumerable languages.	(2)
	f)	List out the Closure properties of CFL's	(2)
	g)	Distinguish between PCP and MPCP problems.	(2)
2	(a)	Outline the procedure of converting NFA to DFA with a suitable example.	(7)
	(b)	Construct NFA with ε which accepts a language consisting of the strings of any number of 0's followed by any number of 1's followed by any number of 2's and also convert into NFA without ε transitions.	(7)
3	(a)	Prove that the following language L is not regular using pumping lemma L = { ww^R | w belongs to {a,b}* }	(7)
	(b)	Explain the procedure for constructing minimum state DFA with an example.	(7)
4	(a)	Show that for every CFG there exists a PDA such that L(G)=N(P).	(7)
	(b)	Construct a PDA that accepts $L=\{0^n1^n \mid n>=0\}$	(7)
5	(a)	Design a Turing Machine to accept $L=\{WcW^R \mid W \text{ is in } (a+b)^*\}$	(7)
	(b)	Design a Turing Machine to recognize the Language $L=\{1^n2^n3^n \mid n>=1\}$	(7)
6	(a)	What is undecidability? Check whether the following instance of PCP has a solution. X = (1, 10111, 10) Y = (111, 10, 0)	(7)
	(b)	Explain the design of Universal Turing Machine with its Halting Problem.	(7)
7	(a)	What is ambiguous grammar? Check whether the following grammar is ambiguous or not? S→ aS |aSbS |ϵ	(5)
	(b)	Define Chomsky Normal Form (CNF). Convert the following grammar to CNF. S→0S0|1S1|ϵ	(5)
	(c)	Discuss the examples of undecidable problems	(4)

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Code No: E- 5773/N/AICTE

FACULTY OF ENGINEERING

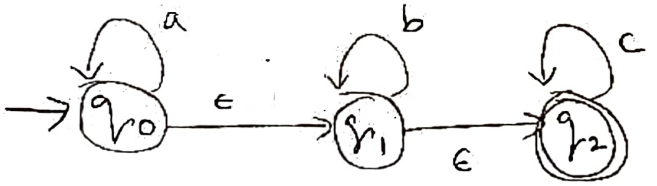
B.E (CSE) V- Semester (AICTE) (Main) (New) Examinations, February/ March 2023

Subject: Automata Language and Computation

Time: 3 Hours **Max. Marks: 70**

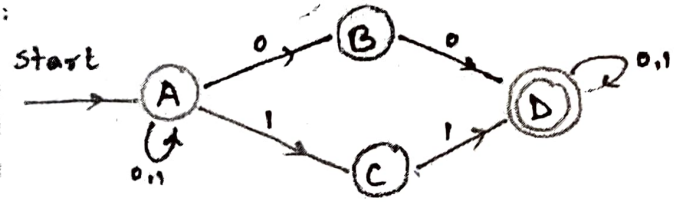
Note: (i) First question is compulsory and answer any four questions from the remaining six questions. Each questions carries 14 Marks.
(ii) Answer to each question must be written at one place only and in the same order as they occur in the question paper.
(iii) Missing data, if any, may be suitably assumed.

1. a) Define Regular expressions and construct a regular expression for the Set of all strings over Σ={a,b} containing strings of length exactly two.
   b) Draw an ϵ-NFA for the regular expression 01(0+11)* 01
   c) Construct a context-free grammar for even number of a's over Σ={a,b}
   d) Describe Universal Turing Machine (UTM).
   e) Find the Epsilon closures of all the states in the below Automaton



   f) Write the closure and decision properties of CFLs
   g) Define ID of Turing machine.

2. a) Differentiate between NFA and DFA.
   b)



   i) Construct an equivalent DFA for the above NFA.
   ii) Give applications of Finite automata.

3. a) Construct a Pushdown Automata (PDA) to accept palindromes over Σ= {a,b}.
   b) Construct the leftmost derivation, rightmost derivation and parse trees for the following string **"ibtibtaea"** by using the given context free grammar
   G (V={S,C}, T={i,b,a,t,e}, P, S)
   S→ iCtS | iCtSeS | a C→b

..2..

4. a) Convert the following Context free grammar into Chomsky Normal form after simplifying the grammar.

G(V={S,A,B,C,D}, T={a,b},P,S} is

S→aAa |aBC A→aS | bD |Ɛ B→aBa | C | b C→abb | DD D→ aDa

b) State and Use pumping lemma to prove that the language L= {a^p | p is a prime number} is not a CFL.

5. a) Design a Turing machine over ∑= {a,b} to accept the language L={$a^n b^n$| n>0 }. Check whether the string **aabb** is accepted by the Turing machine.

b) Describe the various types and programming techniques of Turing machine.

6. a) Find the solution to the instance of Post Correspondence Problem given in the table.

I	x_i	y_i
1	0	000
2	01000	01
3	01	1

b) Write a short notes on i) Undecidability ii) Chomsky Hierarchy.

7. a) Minimize the following Deterministic Finite Automaton (DFA) and then draw the Minimized DFA transition diagram. Check whether the string 011 is Accepted by the Minimized DFA.

State/Input	0	1
→q1	q2	q3
q2	q3	q5
* q3	q4	q3
q4	q3	q5
*q5	q2	q5

Initial state={q1} final states={q3,q5}

b) Prove that the following Context free grammar is ambiguous or not.

For the string "**3*2+5**"

E→I

E → E + E

E → E * E

E → (E)

I → ε | 0 | 1 |2|3|4|5|6|7|8|9

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Code No. D-2134/AICTE

FACULTY OF ENGINEERING

B.E. (CSE) V - Semester (AICTE) (Main) Examination, March / April 2022

Subject: Automata Languages and Computation

Time: 3 hours **Max. Marks: 70**

(Missing data, if any, may be suitably assumed)

PART – A

Note: Answer all questions **(10 x 2 = 20 Marks)**

1. Mention closure properties of Regular Languages.
2. Construct a DFA for L = {w/ |w| mod 5 = 0}.
3. State pumping lemma for CFLs.
4. Construct a CFG for $0^*1(0 + 1)^*$.
5. Give an application for CYK algorithm.
6. What are ambiguous grammars? Give an example.
7. What is ID of a Turing machine? Give an example.
8. Construct a TM for adder function.
9. Define PCP with an example.
10. Define CHURCH's hypothesis.

PART – B

Note: Answer any five questions. **(5 x 10 = 50 Marks)**

11 (a) State and prove pumping lemma for Regular Languages.
(b) Construct an NFA without $\in$ transitions for the given $\in$ - NFA $\{0^n1^n 2^n \mid n \geq 0\}$.

12 (a) Construct a CFG for balanced parenthesis and generate the strings
(i) (( )) (ii) (( ) (( )))
(b) Given E → + EE | * EE | - EE | x | y, generate LMD, RMD and parse tree for the string " + *-xyxy "

13 (a) Convert the given grammar to CNF : S → aS | AB | €, A → €, B → €, D → b.

(b) Construct a PDA for L = {wCw^r, where w belongs to {0, 1}* }

14 (a) Design a TM to computer 2n, n ≥ 1.
(b) Design a TM which recognize equal number of a's and b's.

15 (a) What is UTM?
(b) Give short notes on Chomsky Hierarchy.

16 (a) Differentiate between FA, PDA and TMs.
(b) Explain the process of converting CNF into GNF with an example.

17 (a) P and NP problems.
(b) Define Regular Expressions give a regular expression for stings containing not more than 3 a's given Σ = {a, b}.

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Code No: 14642

FACULTY OF ENGINEERING

BE V-Semester (CSE) (CBCS) (Backlog) Examination, July 2021

Subject: Automata Languages and Computation

Time: 2 Hours

Max .Marks: 70

Note: Missing data, if any, may be suitably assumed

PART – A

(5x2=10 Marks)

Answer any five questions.

1 Mention closure properties of Regular Languages.
2 Construct a DFA for L={w | | w | mod 5=0}
3 State pumping lemma for CFLs.
4 Construct a CFG for 0*1(0+1)*
5 Give an application for CYK algorithm.
6 What are ambiguous grammars? Give an example.
7 What is ID of a Turing machine? Give an example.
8 Construct a TM for adder function.
9 Define PCP with an example.
10 Define CHURCH's hypothesis.

PART – B

(4x15=60 Marks)

Answer any four questions.

11 (a) State and prove pumping lemma for Regular Languages.
(b) Construct an NFA without ϵ transitions for the given €–NFA {0*1*2* | $n \geq 0$}

12 (a) Construct a CFG for balanced parenthesis and generate the strings
(i) (( )) (ii) (( ) (( )))
(b) Given E→+EE | *EE | -EE | x | y, generate LMD, RMD and parse tree for the string "+*-xyxy"

13 (a) Convert the given grammar to CNF: S→aS | AB | €, A→€, B→€,D→b
(b) Construct a PDA for L={wCw', where w belongs to {0,1}*}

14 (a) Design a TM to compute 2n, n>=1
(b) Design a TM which recognizes equal number of a's and b's

15 (a) Explain Universal Turing Machine.
(b) Give short notes on Chomsky Hierarchy

16 (a) Differentiate between FA, PDA and TMs.
(b) Explain the process of converting CNF into GNF with an example.

17 (a) Write notes on P and NP Problems.
(b) Define Regular Expressions, Give a regular expression for strings containing not more than 3 a's given Σ={a,b}

Code No: 15126/AICTE

FACULTY OF ENGINEERING

BE V-Semester (CSE) (AICTE) (Main) Examination, July 2021

Subject: Automata Languages & Computation

Time: 2 Hours **Max .Marks: 70**

Note: Missing data, if any, may be suitably assumed

PART – A

Note: Answer any five questions. **(5x2=10 Marks)**

1 Give a R.E for L={w| Na(w)mod 3=0, where w belongs to (a,b)*}
2 Mention closure properties of CFLs
3 State pumping lemma for Regular Languages
4 What are ambiguous grammars? Give an example
5 What is the ID of a PDA? Explain with an example
6 Define PCP with an example
7 What are the reasons for a TM for not accepting the input
8 Halting problem of TM
9 Compare Right Linear and Left Linear grammars.
10 What is UTM

PART – B

Note: Answer any four questions. **(4x15=60 Marks)**

11a) Construct an ϵ -NFA for the expression: $ab\,((a+b)^*ab\,(a^*+b^*))^*$

b) What is minimization of an FA? Explain with an example

12 a) Construct a CFG for palindrome. Generate (i) 0110110 (ii) 010010

b) Given S→S + S| S * S| (S)|2|3|4 generate LMD, RMD, and parse tree for the string " 2+((3*4)*2) "

13 a) Explain the process of converting CNF into GNF with an example

b) Convert the given grammar to CNF : S →aS | AB | €, A → €, B → €, D → b

14 a) Design a TM to recognize L = {1n2n3n| n >= 1}

b) Design a TM to multiply 2 numbers m and n separated by a 1

15 a) Give short notes on Chomsky Hierarchy

b) P and NP problems.

16 a) Define Recursively Enumerable Languages and their properties

b) Construct DFA for the R.E : 10 + (0 + 11) 0*1

17 a) Explain the process and application of CYK algorithm

b) Design a PDA recognizing the set L of balanced parenthesis

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Code No. 2641/CBCS/BL

FACULTY OF ENGINEERING

B.E. (CSE) V – Semester(CBCS) (Backlog) Examination, October 2020

Subject: Automata Languages and Computation

Time: 2 Hours **Max. Marks :70**

PART –A

Note : Answer any Five Questions (5x2 = 10 Marks)

1 Construct DFA that accepts all strings of a's and b's where each string starts with 'a' and ends with 'ab' over alphabet {a,b}.
2 State pumping lemma for regular languages.
3 Define PDA and the languages accepted by a PDA.
4 Give grammar for the language L(G) = $0^n1^n | n \geq 1$.
5 What are the Normal forms of CFGs?
6 What is undecidability?
7 Define inherent ambiguity.
8 What are the reasons for a TM not accepting its input?
9 What are the types of Turing machines?
10 What do you mean by Recursively enumerable languages?

PART-B

Note : Answer any Four Questions (4 x 15 = 60 Marks)

11. a) Construct a DFA

		0	1
→	qo	{qo,q1}	{q0}
	q_1	Φ	{q2}
	qo	Φ	{q3}
*	qo	{q3}	{q3}

b) Construct an NFA equivalent to the regular expression 10 + (0+11) 0∗1 with epsilon-transitions.

12. (a) Design a PDA recognizing the set L of all non-palindromes over {a, b}.
(b) Convert the grammar S → aSb/ab into Chomsky Normal Form. [5]

13. (a) Give the new set of productions after removing the unit productions from the following CFG.
S → AA, A → B / BB, B→ abB / b/ bb.
(b) Show that the set of palindromes over {0, 1} is not regular using pumping lemma.

14. a) Convert the following grammar to CNF.

S → aAa | aBC
A → aS | bD | ε
B → aBa | C | b
C → abb | DD
D → aDa

b) State pumping Lemma for CFL's. What are its applications?

15. Design a TM to accept $a^nb^nc^n / n \geq 1$.

16. a) Construct a TM to accept the language of palindromes over the alphabet {a, b}.
b) Explain Halting problem of a TM.

17. Give short notes on the following:
a) CHOMSKY hierarchy
b) Recursive and Recursive enumerable languages.

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Code No.2641/CBCS

FACULTY OF ENGINEERING

B.E. V – Semester (CSE)(CBCS)(Main & Backlog) Examination, December 2019

Subject: Automata Languages and Computation

Time: 3 Hours **Max. Marks: 70**

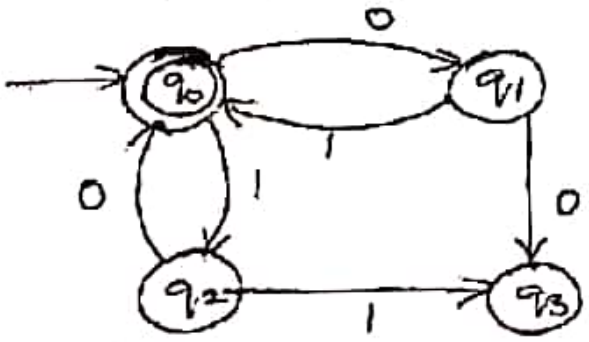
Note: Answer all questions from Part A. Answer any five questions from Part B.

PART – A (2x10=20 Marks)

1. Define Non-deterministic Finite automata. [2]
2. Give examples for regular expressions. [2]
3. State pumping lemma for regular languages. [2]
4. What is a derivation tree? [2]
5. State the general form of transition function for NPDA. [2]
6. What are the reasons for a TM not accepting its input? [2]
7. What is LL(k) grammar? [2]
8. What is a universal language L_u? [2]
9. State Rice theorem. [2]
10. Define PCP and MPCP. [2]

PART – B (5x10=50 Marks)

11. a) Obtain a regular expression for the finite automata. [7]



b) Define ε-closure of a state and explain with a suitable example. [3]

12. a) Convert the following grammar to CNF. [7]

$S \rightarrow aAa \mid aBC$

$A \rightarrow aS \mid bD \mid \varepsilon$

$B \rightarrow aBa \mid C \mid b$

$C \rightarrow abb \mid DD$

$D \rightarrow aDa$

b) State pumping Lemma for CFL's. What are its applications? [3]

13. How can a PDA be converted to a grammar? Explain the methodology with the help of given example. $S \rightarrow 0BB, B \rightarrow 0S, B \rightarrow 1S, B \rightarrow 0$ [10]

Contd...2

14. a) Show that the CFG with following production is Unambiguous. [5]

S → S(S)|ε

b) Is the following grammar ambiguous? Justify [5]

S→AB, A→aA|ε, B→ab|bB|ε.

15. Minimize the following DFA [10]

		0	1
→	A	B	E
	B	C	F
•	C	D	H
	D	E	H
	E	F	I
•	F	G	B
	G	H	B
	H	I	C
•	I	A	E

16. Show the PCP with two lists X = (b, bab3, ba) and Y = (b3, ba, a) has a solution. Give the solution sequence. [10

17. a) Explain various types of Turing Machines. [5

b) Construct a TM to accept the language in which all strings ends with 'abb' over the alphabet {a, b}. [5

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Code No. 2650/ CBCS

FACULTY OF ENGINEERING

B.E. (IT) V-Semester (CBCS) (Main & Backlog) Examination, December 2019

Subject : Automata Theory

Time : 3 hours **Max. Marks :**

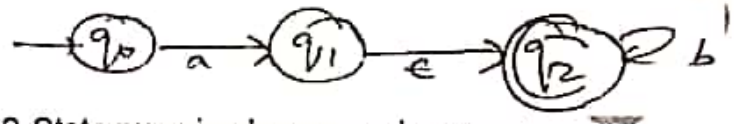
Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B

PART – A (20 Marks)

1 Construct DFA to accept the string ending with 'ab' for $\Sigma = \{a, b\}$.
2 Define NFA, ε - nfa.
3 Write the R.E. to accept string of 'a' and 'b's having 3 consecutive a's.
4 What is an Ambiguous G?
5 What are useless symbol and unit production?
6 What is CFG?
7 What is DPDA?
8 What is multi-tape TM?
9 Define counter machines.
10 Explain MPCP.

PART – B (50 Marks)

11 Convert the t-NFA to NFA.



12 State pumping lemma and prove
$L = \{0^i 1^i \mid i \geq 1\}$ is regular or not.

13 Consider the following G
$S \rightarrow AB \mid BC$
$A \rightarrow BA \mid a$
$B \rightarrow CC \mid b$
$C \rightarrow AB \mid a$

Test whether the string "baaba" is in the language by cyk algorithm.

14 Obtain PDA to accept the language
$L(M) = \{W \subset W^r \mid W \in (a+b)^*\}$ by final state.

15 Explain the programming techniques for TM.

16 Construct a PDA 'M' equivalent to the following CFG
$S \rightarrow OBB$
$B \rightarrow 0S \mid 1S \mid 0$

Test whether 010^4 is in the language.

17 Define PCP and show whether the list is having solution.

	A	B
1	10	101
2	011	11
3	101	011

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CODE NO: 11117/BL

FACULTY OF ENGINEERING

B.E 3/4 (CSE) I-semester (Backlog) EXAMINATION, May / June 2019

Subject: Automata Languages and Computation

Time: 3 Hours Max. Marks : 75

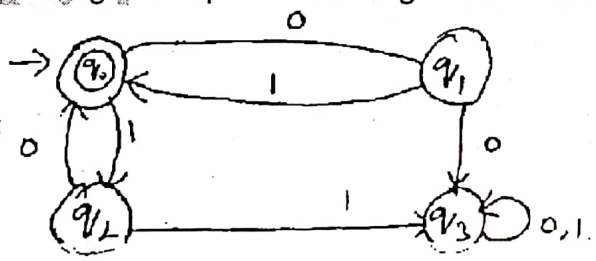
Note: Answer All Questions From Part-A, & Any Five Questions From Part-B.

Part-A (25 Marks)

1. Construct a DFA that accepts all strings of o's and 1's where each string starts with 'O' and ends with '01' over alphabet {0,1} 3
2. Draw NFA for regular expression o* + 1* 3
3. State the algebraic laws of regular expressions. 2
4. Stare pumping lemma for regular expressions. 2
5. What are $\in$- production and unit – production? 2
6. Give a formal definition of PDA and explain the terms in it. 3
7. *What is universal language?* 2
8. *What is undecidability?* 3
9. *Explain SAT Problem.* 3
10. *Define inherent ambiguity* 2

Part-B (50 Marks)

11. a) Draw a DFA that accepts strings containing even o of o's and ' dd no of 1's. 4
    b) Convert the given FA to regular expression using Arden's theorem. 6



12. Minimize the given DFA.

State	∑	
	O	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

...2

13 Discuss to relate the following
   a. CFG's and PDA's 5
   b. TM's and recursive Enumerable languages. 5

14 Convert the following grammer to GNF. 10
   S $\rightarrow$AA/0
   A $\rightarrow$SS/1

15 a) Design a TM that accepts $a^n b^n / n \geq 1$ 5
   b) Construct PDA equivalent to the following grammer 5
   S $\rightarrow$ aB / bA
   A $\rightarrow$ a / aS / bAA
   B $\rightarrow$b / bS / aBB

16 a Show that PCP (Post correspondence Problem) with two lists x=(b, bab^3, ba) and y=(b^3,ba,a) has a solution give the solution sequence. 5
   b Explain Halthing problem of TM. 5

17 Give short notes on
   a Chomsky hierarchy. 5
   b Define the term 'automata' with example and differentiate NFA and DFA. 5

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M.Anupama

Code No. 11512/CBCS/S

FACULTY OF ENGINEERING

B.E. (CSE) V - Semester (CBCS) (~~Main~~ Supply) Examination, May / June 2019

Subject : Automata Language and Computation

Time : 3 Hours Max. Marks: 70

Note: Answer all questions from Part-A & any five questions from Part-B.

PART – A (20 Marks)

1 Give a Regular expression for the set of all strings whose length is at least 2, given $\sum = \{0,1\}$.
2 Mention the closure properties of Regular languages.
3 What do you mean by inherently ambiguous languages?
4 What are the normal forms of CFG's?
5 State Myhill-Nerode Theorem.
6 What is ID of a TM?
7 State Church's hypothesis.
8 How is a TM used as a computer of non negative integer functions?
9 What do you mean by Undecidability?
10 Compare right linear and left linear grammars.

PART – B (50 Marks)

11 (a) Give ϵ-NFA to accept $\{0^n 1^n 2^n \mid n \geq 0\}$ and give the ϵ-closures of all states. [6]
(b) Differentiate between Moore and Mealy machines. [4]

12 (a) State pumping lemma for CFLs . [5]
(b) Give LMD, RMD and Parse tree for the string w = a * b + a* b given S →S + S | S * S | a | b [5]

13 How can a PDA be converted to a CFG? Explain the methodology with the help of an example. [10]

14 (a) Design a TM which recognizes palindromes. [6]
(b) Describe the programming techniques for the construction of the a TM. [4]

15 (a) Explain Chomsky Hierarchy of languages. [6]
(b) What are the reasons for TM not accepting input? [4]

16 (a) Explain UTM. [6]
(b) Prove the equivalence of DFA and NFA. [4]

17 Explain the following processes in detail. [10]
(a) How to find out if a grammar is LR(0) or not by taking an example.
(b) How to find out if a string belongs to a grammar or not using CYK algorithm.

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M. Anupama

Code No. 11512/CBCS

FACULTY OF ENGINEERING

B.E. (CSE) V - Semester (CBCS) (Main) Examination, November / December 2018

Subject : Automata Language and Computation

Time : 3 Hours **Max. Marks: 70**

Note: Answer all questions from Part-A & any five questions from Part-B.

PART – A (20 Marks)

1 Construct a DFA that accepts all strings of a's and b's where each string starts and ends with a different letter given ∑={a,b}
2 Define the term 'Automata' with an example.
3 State pumping lemma for Regular languages.
4 Mention closure properties of CFLs .
5 Give two applications of CFGs.
6 What are the reasons for a TM not accepting input?
7 What are Intractable problems?
8 Define PCP.
9 What are Recursively Enumerable Languages?
10 What do you mean by context sensitive Language?

PART – B (50 Marks)

11 (a) Construct an ϵ-NFA for $ab(a+b)^* ab(a^*+b^*)$. [5]
(b) Differentiate between Moore and Mealy machines giving examples. [5]

12 (a) Define a CFG and give a CFG for generating all integers. [5]
(b) Is the following grammar ambiguous? Justify
$S \rightarrow AB, A \rightarrow aA \mid \epsilon, B \rightarrow ab \mid bB \mid \epsilon$ [5]

13. Is the given grammar LR(0)? Why ?
E → E*B | E+B | B , B →0 | 1 [10]

14 (a) Design a TM which recognizes all stringsending in 101. [5]
(b) Design a TM to accept $a^n b^n a^n \mid n \geq 1$. [5]

15 (a) Explain Chomsky Hierarchy of languages. [5]
b) What are the reasons for TM not accepting input? [5]

16 (a) Give RLG and LLG for $(0+1)^*00(0+1)^*$. [5]
(b) Prove the equivalence of DFA and NFA. [5]

17 Give short notes on: [10]
(a) LBA
(b) UTM

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Code No. 134/S

FACULTY OF ENGINEERING

B.E. 3/4 (CSE) I– Semester(Supple.) Examination, June 2018

Subject: Automata Languages and Computation

Time : 3 Hours **Max. Marks: 75**

Note:Answer all questions from Part-A &answer any five questions from Part–B .

PART – A (25 Marks)

1. Construct a DFA that accepts all strings of a's and b's where each string starts with 'a' and ends with 'ab' over $\sum = \{a, b\}$ [3]
2. Define the term 'Automata' with an example [2]
3. State pumping lemma for Regular languages [2]
4. Compare Right Linear Grammar with left Linear Grammar [3]
5. Give 2 applications of CFG's [2]
6. Mention Universal Turing Machine. [2]
7. Define MyHill Nerode Theorem [2]
8. What are the reasons for a TM not accepting input. [3]
9. Define PCP and MPCP [3]
10. Mention closure properties and CFL's. [2]

PART – B (10x5 = 50 Marks)

11.a) Differentiate between NFA and DFA [4]

b) Construct a R.E. for all strings over $\sum = \{0,1\}$ starting and ending with different symbols. [3]

C) Construct an $\in$ –NFA for $(a+b)^* ab(a^* + b^*)$ [3]

12.a) Obtain a CFG for generating all integers. [5]

b) Is the following grammar ambiguous. jusify $S \to AB, A \to aA|\in, B \to ab|bB|\in$ [5]

13. Consider the grammar with the following productions $S \to iCtS|iCtSeS|a, C \to b$

a) Generate the string 'ibtibtaea' using left most derivation and construct a derivation tree for it. [5]

b) Derive an equivalent CNF for the above grammar. [5]

14 a) Design a PDA recognizing the set L of all palindromes over {a,b} [5]

b) Use pumping lemma to prove that the language L = $\{ww|w \in \{0,1\}^*\}$ is not a CFL [5]

contd...2...

15. a) Design a TM to recognize all bit strings ending in 101 [5]

b) Design a TM to accept $a^n b^n a^n | n \geq 1$ [5]

16. a) Explain undecidability with an example [5]

b) State and explain the properties of Recursively Enumerable Languages [5]

17. Give short notes on

a) LBA (Linear bounded Automata) [5]

b) Chomsky Hierarchy [5]

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Code No. 134

FACULTY OF ENGINEERING

B.E. 3/4 (CSE) I – Semester (Main & Backlog) Examination, December 2017

Subject: Automata Languages and Computation

Time: 3 Hours **Max.Marks: 75**

Note: Answer all questions from Part A and any five questions from Part B.

PART – A (25 Marks)

1 Distinguish between NFA and DFA. 3

2 What are regular expressions? 2

3 Compare right linear grammar and left line grammar. 3

4 What do you mean by ambiguous grammar? 2

5 State the general form of transition function for NPDA. 2

6 State pumping lemma for CFG. 3

7 What is restricted turing machine? 3

8 Mention ID format for TM. 2

9 What do you mean by post correspondence problem? 3

10 State church's hypothesis. 2

PART – B (5x10 = 50 Marks)

11 a) Construct a DFA 6

	0	1
$\rightarrow \gamma_o$	$q_o q_1$	q_o
q_1	ϕ	q_2
q_2	ϕ	q_3
$\alpha\ q_3$	q_3	q_3

b) Minimize the following DFA 4

	0	1
$\rightarrow$A	B	E
B	C	F
$*$C	D	H
D	E	H
E	F	I
$*$F	G	B
G	H	B
H	I	C
$*$I	A	C

12 a) Explain algebric laws for regular expressions. 5

b) Write short note on "equivalence and minimization of automata". 5

13 Convert the following PDA P = {{p, q}, {0,1}, {x, z_o}, δ , q, z_o} to context for grammar if δ is given by 10

δ (q, 1, z_o) = (q, xz_o)

δ (q, 1, x) = (q, xx)

δ (q, 0, x) = (p, x)

δ (q, ϵ, x) = (q, ϵ)

δ (p, 1, x) = (p, ϵ)

δ (q, 0, z_o) = (q, z_o)

14 Explain about the programming techniques of TM with example. 10

15 a) Explain post correspondence problem. 5

b) Explain about universal language. 5

16 a) Given grammar C with production 5

S→ aB | bA
A→ a | aS | bAA
B→ b | bS | aBB for a string 'aaabbabbba'.
Find the right most and left most derivation parse true.

b) Using pumping lemma prove L = {ww / wϵ {0,1}} is not CFL. 5

17 a) Explain the classes of P, NP and explain the terms NP – Bhard and NP – complete. 5

b) Give the regular grammar for the language L = O^n / n ≥1. 5

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FACULTY OF ENGINEERING

B.E. 3/4 (CSE) I – Semester (New) (Suppl.) Examination, May/June 2017

Subject: Automata Languages and Computation

Time: 3 Hours **Max.Marks: 75**

Note: Answer all questions from Part A. Answer any five questions from Part B.

PART – A (25 Marks)

1 Define deterministic finite automata. 2

2 Design a finite automaton that accepts all the strings starting with '0' and ending with '11' over the alphabet = {0, 1}. 3

3 Mention the decision properties of regular languages. 2

4 Define context free grammar. 3

5 Differentiate between FA and PDA. 2

6 Define Greibach Normal Form with an example. 3

7 Define TM. 3

8 Mention the Extensions to the Turing Machine. 3

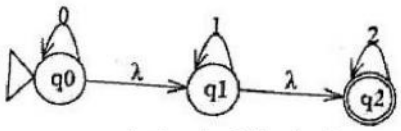
9 Define Post-Corresponding problem. 2

10 What is meant by Restricted Satisfiability Problem? 2

PART – B (5x10 = 50 Marks)

11 a) Construct DFA for the language L = {W | W does not contain the substring 110}. 5

b) Convert the following automata to regular expression. 5



12 a) Using Pumping lemma prove whether the following language is regular or not?

C = {w | w has an equal number of 0's and 1's}. 5

b) Given a CFG. 5

$E \rightarrow E + T / T$
$T \rightarrow T X F / F$
$F \rightarrow (E) / a$
Give parse Tree and derivation (both LMD and RMD) for a data. Verify whether grammar is ambiguous / not.

13 a) Construct PDA that recognize the language $\{0^n1^n \mid n \geq 0\}$. 5

b) Reduce the following grammar to CNF. 5

$S \rightarrow aB / ab$
$A \rightarrow aAB / a$
$B \rightarrow ABb / b$

14 a) What are the various programming techniques for Turing Machine. 5

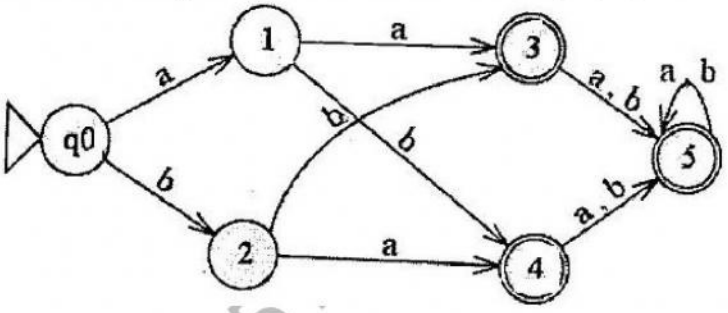
b) Construct a TM for multiplication of two numbers M X N. 5

15 a) Distinguish between Recursive and Recursively Enumerable language. Give an example for each. 5

b) Write short note on the universal Turing Machine. 5

16 Give the DFA accepting the set of strings over alphabet = {0, 1} such that in each string number of 0's is divisible by five and number of 1's is divisible by 3. Justify it with an example. 10

17 a) Minimize the following DFA and draw the minimized DFA. 6



b) Explain Chomsky classification of languages. 4

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Code No. 3152 / O/S

FACULTY OF ENGINEERING

B.E. 3/4 (CSE) I - Semester (Old) Examination, May / June 2017

Subject : Automata Languages and Computation

Time : 3 Hours **Max. Marks: 75**

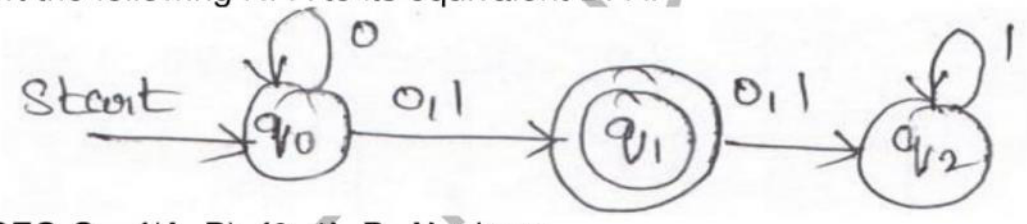
Note: Answer all questions from Part-A and answer any five questions from Part-B.

PART – A (25 Marks)

1 Define Finite Automata. (2)
2 Determine DFA accepting all strings over {0, 1} which begins with and ends with 01. (3)
3 Write down the applications of Pumping lemma of RL. (3)
4 Define Ambiguous grammar. (2)
5 Define 'δ' function of push down Automata. (3)
6 Define context free grammar. (2)
7 What do you mean by Undecidability? (2)
8 What is Restricted satisfiabiltiy problem? (3)
9 Mention the programming techniques for TM's. (2)
10 Define Turing machine. (3)

PART – B (50 Marks)

11 (a) Distinguish between DFA and NFA. (4)
(b) Convert the following NFA to its equivalent DFA. (6)



12 (a) Give CFG G = {(A, B), {0, 1}, P, A} where (5)
P consists of
$A \rightarrow oBA / 0$
$B \rightarrow A1B / AA / 10$
Give the RMD, LMD and parse tree for the string "001100".
(b) Obtain context free grammar to generate string consisting of any number of a's and b's with atleast one a. (5)

13 Obtain a PDA to accept the language $L = \{a^n b^n / n \geq, 1\}$ by a final state. (10)

14 (a) Describe briefly about problems that computers cannot solve. (5)
(b) Explain about Extensions to the Turing machines. (5)

15 Obtain a TM to accept a palindrome consisting of a's and b's of any length. (10)

16 (a) Define Chomsky hierarchy. (3)
(b) What are recursively enumerable languages? Give example. (3)
(c) Explain undecidability. (4)

17 (a) Write about Post correspondence problem. (5)
(b) Give an Instance of PCP, show that this instance has no solution. (5)

i	List A	List B
1	011	101
2	11	011
3	1101	110

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FACULTY OF ENGINEERING

B.E. 3/4 (CSE) I-Semester (New) (Main) Examination, Nov./Dec. 2016

Subject : Automata Languages and Computation

Time : 3 hours **Max. Marks : 75**

Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (25 Marks)

1	Define strings, alphabets, and languages.	3
2	Write any two applications of finite automata.	2
3	Write a regular expression which accepts set of all strings whose Σ=(0, 1).	2
4	Define pumping lemma for regular languages.	2
5	What do you mean by equivalence states?	3
6	Define Ambiguous grammar.	2
7	Write about Chomsky normal form.	3
8	Define 'δ' of turing machine with an example.	3
9	Write about classes P and NP.	3
10	Define undecidability.	2

PART – B (50 Marks)

11 a) Construct DFA for {W | W is any string except 11 and 111} where Σ={0, 1}. 5

b) Construct DFA equivalent to the NFA's ({p, q, r, s}, {0, 1}, δ, p, {s}). Where δ is defined as follows : 5

δ	0	1
p	{p, q}	p
q	r	r
r	s	-
s	s	s

12 Minimize the given below DFA. Draw the minimized resultant FA. 10

Q\Σ	a	b
→A	B	E
B	C	D
*C	H	I
*D	I	H
E	F	G
*F	H	I
*G	H	I
H	H	H
I	I	I

..2

13 a) Use Pumping lemma theorem to prove whether the following languages is CFG or not. L= $\{0^n1^n0^n1^n \mid n \geq 0\}$. 5

b) Construct PDA that recognize the language L = $\{WW^R / W \in \{0, 1\}^*\}$. 5

14 Design a TM for the language. 10

B = $\{WW / W \in \{0, 1\}^*\}$.

15 a) What is the difference between PCP and MPCP? 5

b) Given the following list A and B of words. Is it having a solution? If so, give the sequence 5

	List A	List B
i	W_i	X_i
1	1	111
2	10111	10
3	10	0

16 a) Convert CFG which is given below into CNF form. 5

S---> bA/aB
A---> bAA/as/a
B---> aBB/bs/b

b) Write the FA for the regular expression a.(a+b)*b.b 5

17 a) What is Halting problem and its significance in automata languages? 5

b) Explain the Chomsky's hierarchy of language. 5

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Code No. 3152 / O

FACULTY OF ENGINEERING

B.E. 3/4 (CSE) I-Semester (Old) Examination, November / December 2016

Subject : Automata Languages and Computation

Time : 3 hours **Max. Marks : 75**

Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (25 Marks)

1 Define deterministic finite automata. 2

2 Determine an NFA accepting all strings over {0, 1} which end in 1, but do not contain the substring 00. 3

3 Write any three decision properties of regular languages. 3

4 Draw parse tree of an example string of a grammar. 2

5 Define push down automata. 2

6 Define left recursion. 2

7 Eliminate unit productions from the grammar

$S \to A0|B, \quad B \to A|11, \quad A \to 0|12|B.$ 3

8 Write about GNF. 3

9 Distinguish between classes P and NP. 3

10 Define PCP. 2

PART – B (50 Marks)

11 a) Write about informal picture of finite automata. 5

b) Obtain a DFA to accept strings of a's and b's having even number of a's and b's. 5

12 a) State and prove pumping lemma for regular languages. 5

b) Show that $L= \{a^n b^n | n \geq 0\}$ is not regular. 5

13 Obtain a PDA to accept the language $L(M) = \{WCW^R | W \in (a+b)^*\}$ where W^R is reverse of W by a final state. 10

14 a) Write in detail about programming techniques for T/M. 5

b) Explain briefly about ID's of TM. 5

15 Prove that for every nondeterministic TM (NTM) there exists a determine TM (DTM) such that L(NTM) = L(DTM). 10

16 a) Write about CNF and GNF. 4

b) Convert the following grammar into GNF. 6

$S \to AA \mid 0$

$A \to SS \mid 1$

17 a) Explain a restricted satisfiability problem. 5

b) Explain the terms NP-complete and NP-hard. 5

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Code No. 5153

FACULTY OF ENGINEERING

B.E. 3/4 (CSE) I - Semester (Main) Examination, December 2015

Subject : Automata Languages and Computation

Time : 3 hours **Max. Marks : 75**

Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (25 Marks)

1	Define the term 'Automata' with an example.		3
2	What are regular expressions?		2
3	Compare right-linear grammar with left-linear grammar.		3
4	What do you mean by inherently ambiguous language?		2
5	State the general form of transition function for NPDA.		2
6	State the pumping lemma for CFG.		3
7	What are the reasons for a TM not accepting its input?		3
8	What are the types of Turing machines?		2
9	What do you mean by Post's correspondence problem?		3
10	What do you mean by Recursively enumerable languages?		2

PART – B (50 Marks)

11	a)	Determine the DFA that accepts the language L(ab(a+ab*(a+aa)).	5
	b)	Construct a finite-state machine that delays an input string two bits, given 00 as the first two bits of output.	5
12	a)	Given grammar G with productions S→aB|bA,A→a|aS|bAA,B→b|bs|aBB. For the string aaabbabbba, find a rightmost derivation, leftmost derivation and parse tree.	5
	b)	Obtain a CFG for generating all integers.	5
13	a)	Construct a PDA equivalent to the CFG. S→0BB, B→0S, B→1S, B→0	5
	b)	Using pumping lemma prove that the language L = {ww|w∈{0,1}∗ is not a CFL	5
14	a)	Design a TM that recognizes the set of all bit strings that contain an even number of 1s.	5
	b)	Construct a Turing machine which computer the function f(n) = n mod.	5
15	a)	Find a regular expression for the language of the set of all strings of 0's and 1's whose number of 0's is divisible by 5 and whose number of 1's is even.	5
	b)	Compute ∈-NFA for the following, regular expression : 1(1+10)* + 10(0+01)*.	5
16	a)	Show that the CFG with following production is Unambiguous. S→ S(S)|∈	5
	b)	Is the following grammar ambiguous. Justify S→AB, A→aA|∈, B→ab|bB|∈.	5
17	a)	Explain undecidability with an example.	5
	b)	Explain the classes of P, NP and explain the terms NP-completed and NP-hard.	5

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Code No. 9112 / S

FACULTY OF ENGINEERING

B.E. 3/4 (CSE) I - Semester (Supplementary) Examination, June / July 2015

Subject : Automata Languages and Computation

Time : 3 hours **Max. Marks : 75**

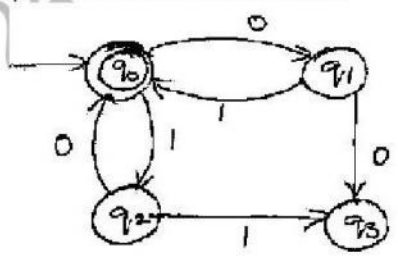
Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (25 Marks)

1	Give grammar for the language $L(G) = 0^n \mid n \geq 1$.	3
2	Mention closure properties of regular languages.	3
3	What is a derivation tree? Explain.	3
4	State Church's hypothesis.	2
5	Give the formal definition of PDA.	2
6	What is universal language?	2
7	Explain SAT problem.	3
8	Give 2 applications of CFG's.	2
9	What is undecidability?	3
10	Define inherent ambiguity.	2

PART – B (50 Marks)

11 a) Obtain a regular expression for the finite automata. 6



b) Define ϵ-closure of a state and explain with a suitable example. 4

12 a) Convert the following grammar to CNF. 6

S → aAa | aBC

A → aS | bD | ϵ

B → aBa | C | b

C → abb | DD

D → aDa

b) State pumping Lemma for CFL's. What are its applications? 4

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Code No. 9112 / S

- 2 -

13 How can a PDA be converted to a grammar? Explain the methodology with the help of an example. 10

14 a) Construct a TM to accept the language of palindroms over the alphabet {a, b}. 6

b) Explain Halting problem of a TM. 4

15 a) Find whether the given instance of PCP has a solution or not. 5

	List A	List B
1	10	101
2	011	11
3	101	011

b) State and explain the properties of recursively enumerable languages. 5

16 Consider the CFG : $S \rightarrow A_1A_2 \mid A_2A_3$; $A_1 \rightarrow A_2A_1 \mid 0$; $A_2 \rightarrow A_3A_3 \mid 1$; $A_3 \rightarrow A_1A_2 \mid 0$ 10

Test if "10010" is a member or not using CYK algorithm.

17 Give short notes on :

a) CHOMSKY hierarchy 5

b) LBA 5

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Code No. 6109 / S

FACULTY OF ENGINEERING

B.E. 3/4 (CSE) I-Semester (Suppl.) Examination, July 2014

Subject : Automata Languages and Computation

Time : 3 Hours **Max. Marks: 75**

Note: Answer all questions of Part - A and answer any five questions from Part-B.

PART – A (25 Marks)

1 Define δ in a TM. (2)
2 State pumping lemma for CFL's. (2)
3 Define Church's hypothesis. (2)
4 Define the term LBA and explain. (2)
5 Prove that (O+1)* 100 regular or not. (3)
6 State the closure properties of Regular Languages. (2)
7 Define PCP and MPCP. (2)
8 Construct a right linear grammar for (0+1)*00(0+1)*. (3)
9 Convert to CNF. (3)
$S \rightarrow aB \mid bA$
$A \rightarrow a \mid aS \mid bAA$
$B \rightarrow b \mid bS \mid aBB$
10 What are intractable problem ? Explain. (3)

PART – B (50 Marks)

11 (a) Construct a DFA equivalent to the regular expression 10+(0+11)0*1. (6)
(b) Differentiate between NFA and DFA. (4)

12 (a) Given CFG G = ({S, A}, {a, b}, P, S) where
P consists of $S \rightarrow aAS \mid a$
$A \rightarrow SbA \mid SS \mid ba$
Give the LMD, RMD and parse tree for "aabbaa" (5)
(b) What are ambiguous grammars ? Give examples. Is the above grammar ambiguous. (5)

13 Design a PDA to accept equal no of a's and b's over the alphabet $(a+b)^+$. (10)

14 (a) Write short notes on Universal TM . (5)
(b) Design a TM for L $\{WW^R \mid W \in (0+1)^*$, R stands for Reverse$\}$. (5)

15 Reduce to GNF
$S \rightarrow AA \mid O$
$A \rightarrow SS \mid 1$ (10)

16 (a) Define Chomsky hierarchy. (3)
(b) What are recursively enumerable languages? Give example. (3)
(c) Explain undecidability. (4)

17 (a) Explain a restricted satisfiability problem. (5)
(b) Explain the classes of P, NP and explain the terms NP - complete and NP-nard. (5)

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FACULTY OF ENGINEERING

B.E. 3/4 (CSE) I – Semester (Main) Examination, November 2013

Subject : Automata Languages and Computation

Time : 3 hours **Max. Marks : 75**

Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (25 Marks)

1. Obtain a DFA to accept strings of 0's, is and 2's beginning with a '0' followed by odd no. of 1's and ending with a '2'. 3

2. Obtain a regular expression to accept strings of a's and b's whose length is either even or multiples of 3 or both. 2

3. If $\sum = \{0,1\}$, $\Gamma = \{1,2,3\}$, $h(0) = 3122$, $h(1) = 132$ 2
   What is (0+1)* (00)*?

4. Consider the following grammar 3
   S → aCa
   C → aCa|b
   What is the language generated by this grammar?

5. Define Chomsky Normal Form (CNF). 2

6. Prove that reversal of a CFL is also an CFL. 3

7. What do you understand by the term LBA? 3

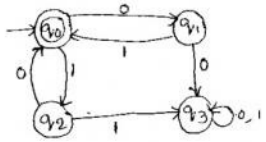
8. Define turning machine. How a TM accepts a language? 3

9. Define MPCP. 2

10. What is universal language? 2

PART – B (50 Marks)

11.a) Construct a DFA to accept decimal strings divisible by 3. 5
   b) Convert the FA to regular expression. 5



12.a) Prove that (00*1)*1 = 1+0(0+10)*11. 5
   b) State and prove pumping lemma for CFL. 5

13. Obtain a TM to accept a palindrome consisting of a's and b's of any length. 10

14.a) Convert the following grammar into GNF. 5

A → BC B → CA/b C → AB/a

b) Obtain a CFG for the following PDA. 5

$\delta(q_0, a, z) = (q_0, AZ)$, $\delta(q_0, a, A) = (q_0, A)$

$\delta(q_0, b, A) = (q_1, \in)$, $\delta(q_1, \in, z) = (q_2, \in)$

15.a) Prove that PCP is undecidable. 5
   b) State PCP and find whether given instances of PCP has solution or not. 5

	List A	List B
1	10	101
2	011	11
3	101	011

16.a) Obtain a TM to multiply two unary no's separated by the delimiter '1'. 6
   b) Consider the CFG $S \rightarrow A_1A_2|A_2A_3$, $A1 \rightarrow A_2A_1|0$ 4
   $A_2 \rightarrow A_3A_3|1$, $A_3 \rightarrow A_1A_2|0$

   Test 10010 is a member or not using CYK algorithm

17. Minimize the following DFA : 10

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

*****