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 G 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

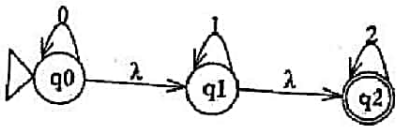
9 Define Post-Corresponding problem. 2

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 → E + T / T
T → T X F / F
F → (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 → aB / ab
A → aAB / a
B → ABb / b

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

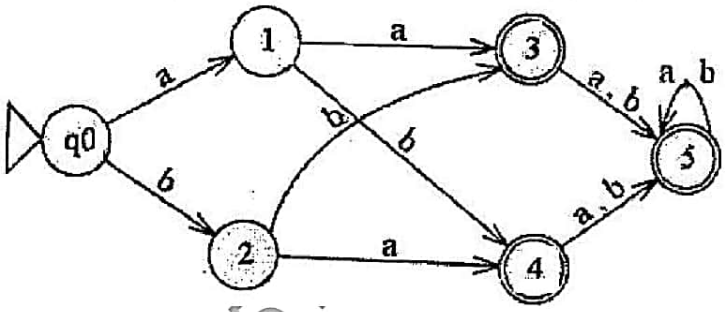
b) Construct a TM for multiplication of two numbers M X N. 5

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**

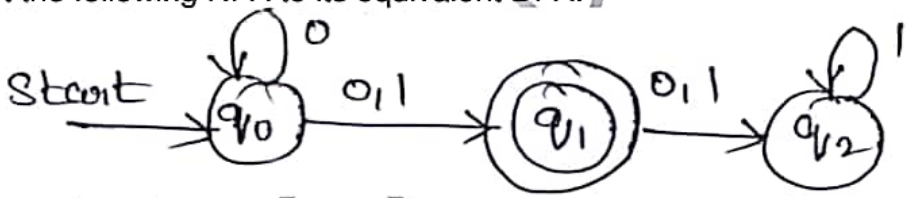
Note: Answer all questions from Part-A and answer any five questions from Part-B.

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

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 ϵ-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)|ϵ	5
	b)	Is the following grammar ambiguous. Justify S→AB, A→aA|ϵ, B→ab|bB|ϵ.	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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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**

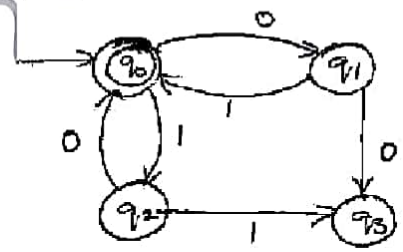
Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

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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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**

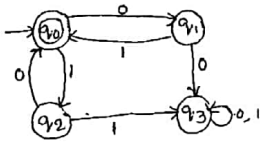
Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

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

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

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

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

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