Code: 13A05404 **R13**

B.Tech III Year I Semester (R13) Supplementary Examinations June 2017

FORMAL LANGUAGES & AUTOMATA THEORY

(Information Technology)

Time: 3 hours Max. Marks: 70

PART - A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define DFA. Construct a DFA recognizing the language generated by (a+b)*b.

(b) Convert the following Moore machine into Mealy machine.

State	Input		output
	a	b	
A	A	B	0
B	B	B	1

(c) Define a regular expression. Write regular expression generating the language of all strings over the alphabet {a, b} and end with ab.

(d) Write any four algebraic laws (identities) for regular expressions.

(e) Show the leftmost derivation and the corresponding parse tree for the string a+a*a using the following CFG.

$E \rightarrow E + E/E * /a.$

(f) Define the Chomsky normal form for a CFG. Write CFG equivalent to the following CFG and is in CNF.

$A \rightarrow Aa/Ba/a \qquad B \rightarrow Bb/Ba/b$

(g) Draw transition diagram for the following PDA.

$\delta(A, a, Z_0) = (A, a, Z_0) \qquad \delta(A, b, a) = (B, a)$

$\delta(B, a, b) = (B, a) \qquad \delta(B, b, b) = (A, a)$

(h) Construct a PDA which can recognize the language generated by the following CFG.

$S \rightarrow A/B \qquad A \rightarrow Aa/a \qquad B \rightarrow Bb/b$

(i) What is Post's correspondence problem? Give an example.

(j) Define a Turing machine. Draw the transition graph for a TM recognizing.

$L = \{a^i b^j / i, j > 0\}$

PART - B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 (a) Prove that 1+3+5+………..+r = n^2, for all n>0, where r is an odd integer and n is the number of terms in the sum.

(b) Describe the Chomsky hierarchy of languages.

OR

3 Construct DFA equivalent to the following NFA.

State	Input	
	0	1
Q_0	$\{Q_0, Q_1\}$	Q_0
Q_1	Q_2	Q_1
Q_2	Q_3	Q_3
Q_3	ϕ	Q_2
Q_0 is the initial state Q_3 is the final state		

Show the moves of the DFA and NFA for the string 1000.

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UNIT - II

4 (a) State and prove Arden's theorem. Using Arden's theorem, find the regular expression generating the language recognized by the following FA.

State	Input	
	0	1
A	{A, B}	ϕ
B	C	{A, B}
C	B	ϕ
A is the initial state and C is the final state.		

(b) Write any five decision problems and the steps to solve them for regular languages.

OR

5 (a) State and prove pumping lemma for regular languages. Prove that the language of palindromes over {a, b} is not regular using pumping lemma.

(b) Write steps to check the equality of two FAs. Use the procedure and check the equivalence.

	a	b
Q_0	Q_1	Q_0
Q_1	Q_1	Q_2
Q_2	Q_2	Q_2
Q_0 is initial state and Q_2 is final state.		

	a	b
A	B	C
B	D	E
C	F	G
D	D	E
E	E	E
F	D	E
G	F	G
A is initial state and E is final state.		

UNIT - III

6 (a) Let G be the grammar $S \rightarrow 0B/1A,\ A \rightarrow 0/0S/1AA,\ B \rightarrow 1/1S/0BB$. For the string 00110101, find: (i) The leftmost derivation. (ii) The rightmost derivation. (iii) The derivation tree.

(b) Let G be $S \rightarrow AB, A \rightarrow a,\ B \rightarrow C/b,\ C \rightarrow D,\ D \rightarrow E$ and $E \rightarrow a$. Eliminate unit productions and get an equivalent grammar.

OR

7 (a) Write the procedure to convert a given CFG into equivalent grammar in CNF. Apply the procedure and convert the grammar with following production into CNF.

$S \rightarrow \neg S/[S+)S]/p/q$

(b) Define Greibach normal form for a CFG. Reduce the following CFG into GNF.

$S \rightarrow ABb/a \qquad A \rightarrow aaA \qquad B \rightarrow bAb$

UNIT - IV

8 Define a PDA and language of a PDA. Construct a PDA for the following language. $L = \{a^i b^j c^k / i,j,k > 0 \text{ and } j = i + k\}$. Show the moves of the PDA for the string aabbbbcc using instantaneous description.

OR

9 Find a CFG which generates the language $L = \{a^n b^m c^n / m,n > 0\}$. Construct a PDA M from the grammar designed by you. Show the derivation and the moves of the PDA for the string aabcc.

UNIT - V

10 (a) Construct a Turing machine which can accept the strings of the following language. $L = \{x \in \{a, b\} * / x \text{ is a palindrome}\}$. Show the moves of the TM for the string aba.

(b) Describe about the multitape TMs with suitable illustrations.

OR

11 Write short notes on the following:

(a) Universal Turing machine.

(b) Linear bounded automat.

(c) The halting problem of TM.

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