Code: 15A05404 **R15**

B.Tech III Year I Semester (R15) Regular Examinations November/December 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 alphabet, string and language.
(b) Formally define an automaton.
(c) State Arden's lemma.
(d) Give the operator precedence in regular expressions.
(e) Define an ambiguous grammar.
(f) When do we say that a grammar is in Chomsky's normal form?
(g) Describe the transition function in push down automaton.
(h) Formally define a PDA.
(i) Define the transition of a Turing machine.
(j) Explain the types of universal Turing machine.

PART – B

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

UNIT – I

2 (a) Construct a finite automaton which accepts all strings, over an alphabet {0, 1}, where each block of five consecutive symbols contain at least two zeroes.

(b) Construct an NFA for the regular expression (0+1)* (00+11)(10+001)*.

OR

3 (a) Construct a Moore machine that is equivalent to the Mealy machine given below.

Present state	Next state			
	a = 0		a = 1	
	State	Output	State	Output
→ q0	q3	0	q11	1
q10	q0	1	q3	0
q11	q0	1	q3	0
q20	q21	1	q20	0
q21	q21	1	q20	0
q3	q10	0	q0	1

(b) Discuss Chomsky's hierarchy of formal languages.

UNIT – II

4 (a) Prove that the language $L = \{w/w \subseteq \{0,1\}$ and length of w is a prime number$\}$.

(b) Under which operations, regular languages are closed.

OR

5 (a) List and explain the algebraic properties of regular expressions.

(b) Design right linear regular grammar which derives strings that contain a substring of 110. Convert the same into its equivalent left linear regular grammar.

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UNIT – III

6 (a) Convert the following grammar into Greibach normal form.

$A \rightarrow BC$

$B \rightarrow CA \mid b$

$C \rightarrow AB \mid a$.

(b) Verify whether the following grammar is ambiguous or not.

$S \rightarrow SaSaS\ b$.

OR

7 (a) Simplify the following context free grammar. (Here, Λ stands for epsilon).

$S \rightarrow TU \mid V$

$T \rightarrow aTb \mid \Lambda$

$U \rightarrow cU \mid \Lambda$

$V \rightarrow aVc \mid W$

$W \rightarrow bW \mid \Lambda$

(b) Explain the closure properties of context free languages.

UNIT – IV

8 (a) Construct a PDA which recognizes all strings that contain equal number of 0_s and 1_s.

(b) A PDA is more powerful than a finite automaton. Justify this statement.

OR

9 (a) Construct a CFG equivalent to the following PDA.

PDA = {(p, q), (0, 1), δ, p, q, (Z, X)}, where p is initial state, q is final state.

δ is defined as δ(p,0,z)=(p,XZ), δ(p,0,X)=(p,XX), δ(p,1,X)=(q,ϵ), δ(p,1,X)=(p,ϵ), δ(p,ϵ,z)=(p,ϵ).

(b) Explain the functioning of two stack PDA.

UNIT – V

10 (a) Construct a Turing machine that carries out multiplication of two unary numbers.

(b) Describe linear bounded automaton.

OR

11 (a) Construct a Turing machine that recognizes the language $a^n b^n c^n$.

(b) Define PCP. Verify whether the following lists have a PCP solution.

$\binom{abab}{ababaaa}, \binom{aaabbb}{bb}, \binom{aab}{baab}, \binom{ba}{baa}, \binom{ab}{ba}, \binom{aa}{a}$.

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