BTS–IV–04.17–0618 Reg. No. | | | | | | | | |

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B.Tech. Degree IV Semester Examination April 2017

CS 15-1404 AUTOMATA LANGUAGES AND COMPUTATIONS

(2015 Scheme)

Time: 3 Hours Maximum Marks: 60

PART A

(Answer *ALL* questions)

$(10 \times 2 = 20)$

I. (a) Define NFA and DFA. Give an example of each and list an application of DFA.

(b) Explain Finite automata with output. Give an example each.

(c) How do we express the language of any finite automata? Use the method to represent the following languages.

(i) Binary strings starting with two 0's and ending with two 1's.

(ii) Strings made of a, b, c containing $'aa'$ or $'bb'$ or $'cc'$ as a substring.

(d) What is meant by regular grammars? Write a regular grammar for an automata which accepts 'one or more 0's, followed by one or more 1's followed by one or more 2's'.

(e) Explain Chomsky normal form and Greibach normal form. Convert the following grammar to CNF. $S \rightarrow AbC, A \rightarrow aB, B \rightarrow cd, C \rightarrow a$.

(f) Define a Push Down Automata (PDA). Design a PDA to accept the language $L(G) = \{a^n b^n \mid n >= 1\}$.

(g) Explain the working of a Turing machine. Design a turing machine to verify whether an input string is a binary string.

(h) Explain Chomsky classification of languages.

(i) What are Context Sensitive Languages and Linear Bounded Automata?

(j) State Ardens Theorem. What is its application?

PART B

$(4 \times 10 = 40)$

II. (a) Convert the following NFA to equivalent DFA. (5)

	Next State	
Present State	$a = 0$	$a = 1$
$\rightarrow A$	B	A, C
B	B	C
C	A, D	B
D	D	B

Final state = D

(b) Construct NFA for the following regular expression. (5)

(i) $(1+0)^* + 10(1^*0)^*$.

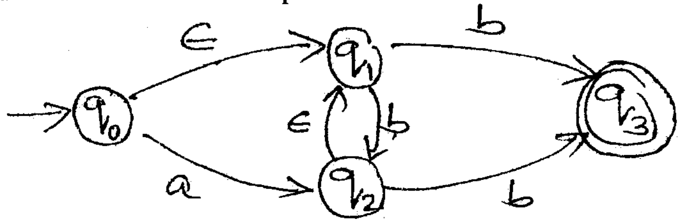
(ii) $00((10)^* + (111)^*)$.

OR

(P.T.O.)

III. (a) Prove that for every NFA there exits an equivalent DFA. (5)

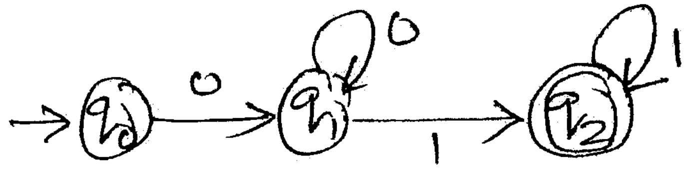
(b) What do you mean by $\in$ – closure (q)? Eliminate epsilon from the following NFA and draw the NFA without epsilon. (5)



IV. (a) Develop finite automata for the following regular expressions. (5)

(i) $10+(0+11)^*01$ (ii) $(a^*ab+ba)^*a$

(b) Using Ardens theorem, find the regular expression corresponding to the following automata. (5)



OR

V. (a) State the Pumping Lemma for regular languages. Show that the set of perfect squares is not a regular language. (5)

(b) Construct regular grammar for the following regular expressions. (5)

(i) $aa^*bb^*cc^*$

(ii) $(0+1)^*000(0+1)^*$

VI. (a) Convert the following grammar to Greibach Normal Form. (5)

$S \to AA \mid a$

$A \to SS \mid b$

(b) Simplify the following CFG: (5)

$S \to aAB \mid bX$

$A \to Ba \mid bSX \mid a$

$B \to aAB \mid b \mid \in$

$X \to aC$

OR

VII. (a) Design a PDA to accept the language $L = \{a^n b^n c^m d^m \mid m,n >= 1\}$ by empty stack. (5)

(b) Construct an equivalent PDA for the following context free grammars. (5)

$S \to aB \mid bA$

$A \to aAB \mid bBB \mid a$

$B \to aS \mid bA \mid b$

VIII. (a) Design a turing machine to accept the language $L = \{a^n b^n c^m \mid n,m >= 1\}$. (5)

(b) Explain multi-tape and mutli-track turing machines. (5)

OR

IX. (a) Design a turing machines to accept the language (5)

$L(M) = \{ww^R \mid \text{where} \mid w \mid > 0\}$

(b) Explain any two of the following: (5)

(i) Halting problem of turing machines.

(ii) Storage in finite control.

(iii) Universal Turing Machines.

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