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06CS56

Fifth Semester B.E. Degree Examination, December 2012
Formal Languages and Automata Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define automata and discuss why study automata. **(06 Marks)**

b. Write the DFA's for the following languages over $\Sigma = \{a, b\}$

i) {set of all string having two consecutive a's}

ii) $L = \{w : |w| \bmod 3 = 0\}$

iii) $L = \{awa : w \in (a + b)^*\}$. **(08 Marks)**

c. Define NFA convert the following NFA to its equivalent DFA. **(06 Marks)**

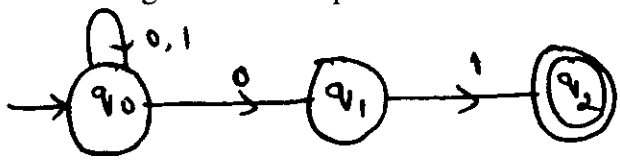

Fig.Q.1(c)

2 a. Write regular expression for the following languages:

i) {strings of a's and b's having two consecutive a's}

ii) {strings of a's and b's whose 3rd symbol from right end is a}

iii) $L = \{w : |w| \bmod 3 = 0\}$. **(06 Marks)**

b. Obtain a regular expression for the DFA shown below using Kleen's theorem. **(10 Marks)**

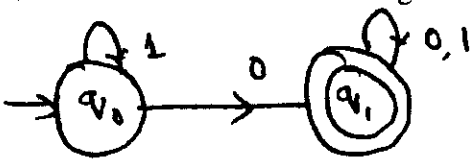

Fig.Q.2(b)

c. Obtain an $\in$- NFA for the regular expression $a^* + b^* + c^*$. **(04 Marks)**

3 a. State and prove pumping lemma for regular languages. **(08 Marks)**

b. Show that the language $L = \{w | n_a(w) = n_b(w)\}$ is not regular. **(04 Marks)**

c. Minimize the following DFA using table filling method. **(08 Marks)**

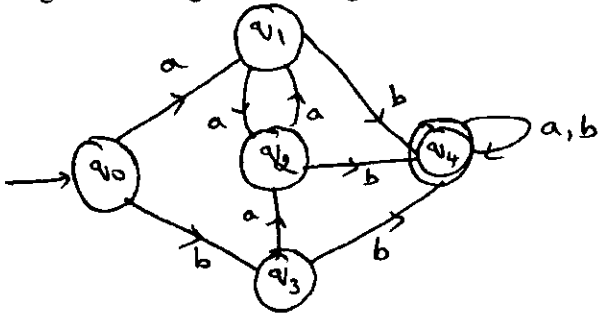

Fig.Q.3(c)

4 a. Write CFG for the following languages:
i) L = {set of all non-palindromes over {a, b}}
ii) For the regular expression (011 + 1)* (01). **(06 Marks)**

b. Consider the following grammar G,
$S \rightarrow aAS \mid a$
$A \rightarrow SbA \mid SS \mid ba$
Obtain : i) LMD; ii) RMD; iii) Parse tree for LMD; iv) Parse tree for RMD for the string aabbaa. **(08 Marks)**

c. Show that the following grammar is ambiguous.
$S \rightarrow iCtS \mid iCtSeS \mid a$
$C \rightarrow b.$ **(06 Marks)**

PART – B

5 a. Define PDA. Design PDA for the language L = $\{wCw^R, w \in (a + b)^*\}$. Show that ID's for the string abcba and also write the transition diagram. **(12 Marks)**

b. Obtain a PDA for the following CFG:
$S \rightarrow SS$
$S \rightarrow aSb$
$S \rightarrow bSa$
$S \rightarrow t.$ **(08 Marks)**

6 a. Remove useless symbols from the following grammar:
$S \rightarrow aA \mid \beta$
$A \rightarrow aA \mid a$
$B \rightarrow bB$
$D \rightarrow ab \mid Ea$
$E \rightarrow ac \mid d.$ **(08 Marks)**

b. Define CNF. Convert the following CFG to CNF:
$E \rightarrow E + E$
$E \rightarrow E * E$
$E \rightarrow (E)$
$E \rightarrow id$ **(08 Marks)**

c. Prove that context tree languages are closed under union operation. **(04 Marks)**

7 a. Define turing machine and multitape turing machine. Show that the languages accepted by these machines are same. **(08 Marks)**

b. Design a turing machine to accept the language L = $\{a^n b^n c^n / n \geq 1\}$. Give the graphical representation for the TM obtained. **(12 Marks)**

8 Write short notes on:
a. Regular expression in unix.
b. Applications of CFGs.
c. Post correspondence problem.
d. Recursively enumerable languages. **(20 Marks)**

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