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06CS56

Fifth Semester B.E. Degree Examination, June/July 2011
Formal Languages and Automata Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions selecting atleast TWO questions from each part.***

PART – A

1 a. Define symbols, alphabets, strings and languages, with examples. **(04 Marks)**

b. Construct a DFA to accept strings over {a, b}, such that every block of length five contains at least two a's. Use extended transition of function to trace a string W = aabba. **(08 Marks)**

c. Prove that if $D = (\theta_D, \Sigma, \delta_D, \{q_0\}, F_D)$ is the DFA constructed from NFA $N = (\theta_N, \Sigma, \delta_N, \{q_N\}, F_N)$ by subset construction then L(D) = L(N). **(08 Marks)**

2 a. Define ϵ - NFA. What are the steps involved in converting ϵ - NFA to DFA. Convert following ϵ - NFA to DFA. **(08 Marks)**

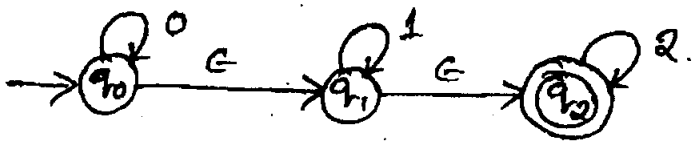

Fig. Q2(a)

b. Write regular expression for
i) $L = \{a^n b^m \mid n \geq 4 \text{ and } m \leq 3\}$
ii) $L = \{a^{2n} b^{2m} \mid n \geq o, m \geq 0\}$. **(06 Marks)**

c. Convert the following DFA to regular expression using Kleene's theorem. **(06 Marks)**

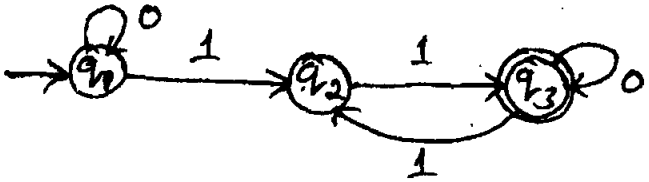

Fig. 2(b)(DFA)

3 a. Construct NFA for the regular expression (a* + b* + c*). **(04 Marks)**

b. State and prove pumping lemma for regular languages. Show that $L = \{o^n \mid n \text{ is prime}\}$ is not regular. **(10 Marks)**

c. Minimize the following DFA using table filling algorithm. **(06 Marks)**

δ	0	1
→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	E

Table Q3 (C)

4 a. Define CFG. Write a CFG for
i) L = {Strings ofer a's and b's, with equal number of a's and b's }
ii) L = $\{a^n b^n c^i \mid n \geq 0, i \geq 1\} \cup \{a^n b^n c^m d^m \mid n, m \geq o\}$. **(06 Marks)**

b. Design a grammar for valid expressions over operator – and /. The arguments of expressions are valid identifier over symbols a, b, 0 and 1. Derive LMD and RMD for string W = (a11 – b0) / (b00 – a01). Write parse tree for LMD. **(10 Marks)**

c. Show that the following grammar is ambiguous
$S \rightarrow SS \mid (S) \mid \in$ over W = (( ) ( ) ( )). **(04 Marks)**

PART – B

5 a. Write block diagram, of PDA with its tuples. What are the two ways of accepting languages in PDA? **(04 Marks)**

b. Design a PDA for $L = \{a^i b^J c^k \mid J = i + k, i, k \geq o\}$ write transition diagram and ID for string W = abbbcc. **(12 Marks)**

c. Convert following CFG to PDA.
$S \rightarrow AS \mid \in$
$A \rightarrow OA1 \mid A1 \mid 01.$ **(04 Marks)**

6 a. Remove useless symbols from following grammar
$S \rightarrow aA \mid B$
$A \rightarrow aB \mid B$
$B \rightarrow aB \mid b \mid bC$
$D \rightarrow Ea$
$E \rightarrow a/aE \mid bc.$ **(06 Marks)**

b. Define CNF and GNF. Convert the following grammar to CNF
$S \rightarrow A\ S\ B \mid \in$
$B \rightarrow S\ b\ S \mid A \mid bb$
$A \rightarrow aAs \mid a.$ **(08 Marks)**

c. Prove that if L is a CFL and R is a regular language then $L \cap R$ is a CFL. **(06 Marks)**

7 a. Define Turing Machine and Instantaneous Descriptions (ID) for Turing machine. **(04 Marks)**

b. Design a Turing machine to add 2 numbers consider input = $0^m 1\ 0^n$ and output = 0^{m+n}. Write transition diagram and ID for string W = 00/0000. **(12 Marks)**

c. Write a note on multitape and non – deterministic turing machines. **(04 Marks)**

8 a. Explain the relationship between the recursive, RE and non-RE languages. **(06 Marks)**

b. If both a language L and its compliment are RE, then prove that L is recursive. **(06 Marks)**

c. Write a short note on :
i) Post correspondence problem
ii) Undecidability of ambiguity for CFG's. **(08 Marks)**

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