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10CS56

Fifth Semester B.E. Degree Examination, June/July 2013

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 D.F.A. What are the difference between D.F.A and N.F.A? **(06 Marks)**

b. Construct a D.F.A. to accept strings over {a, b} such that every block of length five contains atleast two a's. **(08 Marks)**

c. Define N.F.A. and construct an N.F.A. that accepts the language 'aa*(a + b).' **(06 Marks)**

2 a. Define ε-NFA. Construct the ε-NFA that accepts 01(0 + 1)*. **(06 Marks)**

b. Let R be a regular expression. Then there exists a finite automaton A = (Q, Σ, δ, q_0, F). Prove the above theorem. **(06 Marks)**

c. Convert the following ε-NFA to DFA. **(08 Marks)**

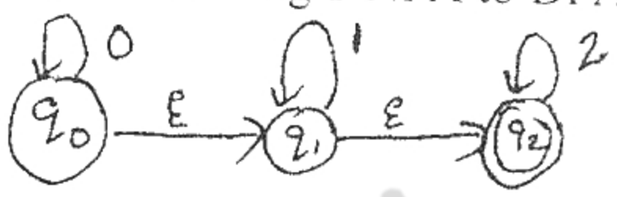

Fig.Q2(c)

3 a. State and prove pumping lemma for the regular language. **(07 Marks)**

b. Obtain the R.E. from the following FA using state elimination method. **(05 Marks)**

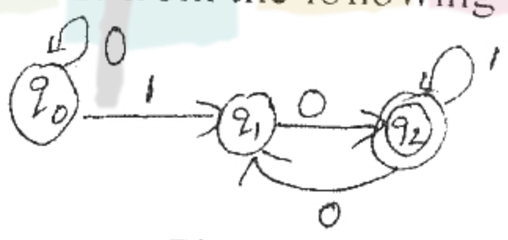

Fig.Q3(b)

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

State	→ A	B	*(C)	D	E	F	G	H
0	B	G	A	C	H	C	G	G
1	F	C	C	G	F	G	E	C

4 a. Consider the following grammar:

$E \rightarrow E + E/E - E$

$E \rightarrow E * E/E/E$

$E \rightarrow (E)$

$E \rightarrow a/b/c$

i) Obtain the left most derivation for the string (a + b * c)

ii) Obtain the right most derivation for the string (a + b) * c. **(08 Marks)**

b. Prove that the following grammar is ambiguous, using the string "ibtibtaea." **(08 Marks)**

$S \rightarrow iC_tS/iC_tSeS/a$

$C \rightarrow b$

c. Discuss the various applications of context free grammar. **(04 Marks)**

PART – B

5 a. Define PDA. Obtain a PDA to accept the following language:

$L = \{n_a(w) = n_b(w) \text{ where } n \geq 1\}$

Draw the transition diagram for PDA. Also, show the moves made by PDA for the string aabbab. **(12 Marks)**

b. Obtain the PDA for the following grammar:

$S \rightarrow aSa/aa$

$S \rightarrow bSb/bb$ **(08 Marks)**

6 a. What is an unit production? Begin with the grammer:

$S \rightarrow ABC/BaB$

$A \rightarrow aA/BaC/aaa$

$B \rightarrow bBb/a/D$

$C \rightarrow CA/AC$

$D \rightarrow \varepsilon$

i) Eliminate ε - productions.

ii) Eliminate unit productions in the resulting grammar.

iii) Eliminate any useless symbols in the resulting grammar. **(10 Marks)**

b. Obtain the following grammar in CNF:

$S \rightarrow OA/1B$

$A \rightarrow OAA/1S/1$

$B \rightarrow 1BB/OS/O$ **(10 Marks)**

7 a. Design a turing machine to accept the following language:

$L = \{0^n1^n / n \geq 1\}$

Also show the sequence of moves mde by the TM for the string "00001111". **(14 Marks)**

b. Write a note on multitape turing machine and non-deterministic turing machine. **(06 Marks)**

8 Write short notes on:

a. Post correspondence problem

b. Halting problem in TM

c. Universal turing machine

d. Applications of R.E. **(20 Marks)**

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