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# IS42

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## M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

## MAKE UP EXAMINATIONS - JULY 2010

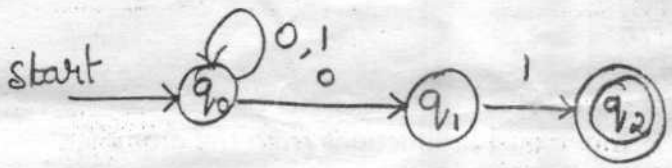
| | | | | | |
|---|---|---|---|---|---|
| Course & Branch | : | **B.E.(Information Science & Engineering)** | Semester | : | **IV** |
| Subject | : | **Finite Automata and Formal Languages** | Max. Marks | : | **100** |
| Subject Code | : | **IS42** | Duration | : | **3 hrs.** |

**Instructions to the Candidates:** Answer one full question from each unit

### UNIT-I

1. a) Define DA, NFA & ε-NFA. Construct a DFA that recognizes the set of all strings on $\Sigma=\{a,b\}$ ending with abb. (10)

   b) Convert the following NFA to DFA using subset construction method. Write transition table of DFA. (10)




2. a) Obtain a DFA to accept the following language. (8)
   L={w, such that |w|mod3 ≥ |w|mod2
   Where wε{a,b}*}

   b) Obtain regular expressions for the following languages. (4)
   i) $L = \{a^n b^m | m+n \text{ is even}\}$
   ii) $L = \{w : n_a(w) \bmod 3 = 0 \text{ where } w\varepsilon\{a,b\}^*\}$

   c) Prove that, if L=L(A) for some DFA A, then there is a regular expression R such that L=L(R). (8)

### UNIT – II

3. a) Prove that if L & M are the regular languages, then L∩M is also regular. (8)

   b) Using table filling method, minimize the following DFA. Write the transition table of resulting DFA. (12)

| | | 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 |

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4. a) State and prove pumping Lemma for regular languages. (10)
   b) S.T. $L=\{a^nb^n|n\geq 0\}$ is not regular. (6)
   c) Define homomorphism and inverse homomorphism. (4)

**UNIT –III**

5. a) Write the CFG for the following languages. (8)
      i) $L=\{w|n_a(w)=n_b(w)+1\}$
      ii) $L=\{a^nb^m \mid n\geq 0, m>n\}$
   b) Consider the grammar - (8)
   $S \rightarrow aB/bA$
   $A \rightarrow aS/bAA/a$
   $B \rightarrow bS/aBB/b$
   Find 2 leftmost derivation in the string aabbab and write parse trees.
   c) Define CFG and CNF. Give an example in each. (4)

6. a) Consider the grammar - (12)
   $E \rightarrow T|E+T$
   $T \rightarrow T*F/F$
   $F \rightarrow (E)|I$
   $I \rightarrow Ia|Ib|I\phi|I1|a|b$
      i) Remove unit-productions from the grammar
      ii) Write the CNF of the resulting grammar
   b) Eliminate ε-productions from the given grammar (4)
   $S \rightarrow ABC/BaB$
   $A \rightarrow aA/BaC/aaa$
   $B \rightarrow bBb|a|D$
   $C \rightarrow CA|AC$
   $D \rightarrow \varepsilon$
   c) S.T. $L = \{a^nb^nc^n|n\geq 0\}$ is not content free (4)

**UNIT – IV**

7. a) Derive PDA and construct a PDA that accepts the language (12)
   $L=\{WCW^R : W\varepsilon\{a,b\}^*, W^R$ is reverse of W} by a final state. Write the ID in string aabCbaa.
   b) Convert the PDA $P_N = (\{q\}, \{i,e\},\{z\}, S_N,q,z\}$ to a CFG, if $S_N$ is given by (8)
      i) $S_N(q,i,z) = (q,zz)$
      ii) $S_N(q,e,z)=(q,\varepsilon)$

8. a) With a neat diagram, explain the working of a pushdown automata. (6)
   b) Is the PDA to accept the language $L(M)=\{W|W\varepsilon\{a+b\}^*$ ad $n_a(w)=n_b(w)\}$ (10)
   deterministic?
   c) For the following grammar construct a PDA. (4)
   $S \rightarrow aABB|aAA$
   $A \rightarrow aBB|a$
   $B \rightarrow bBB|A$
   $C \rightarrow a$

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**UNIT - V**

9. a) What are Turing Machine and Multitape Turing Machine? Explain the general structure multi tape Turing Machine. (8)

   b) Design a Turing Machine to accept the language $L=\{0^n1^n, n\geq 1\}$. Also give the graphical representation and ID for the input 0011. (12)

10 a) Obtain a TM to compute the – which is called monus or proper subtraction and is defined by m-n=max (m-n,o). Write the transition diagram. (14)

   b) Discuss about Halting problem of TM. (6)

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