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**Model Question Paper**
**Fourth Semester B. Tech Degree Examination**
**(2013 scheme)**
**13.406 Formal Languages & Automata Theory**

Time: 3 Hrs Max. Marks: 100

**Part-A**

*Answer all questions.*

1. Define 2DFA, with example. How does it differ from DFA?
2. Is the language $\{0^{2n} \mid n>=1\}$ regular? Justify.
3. Suppose $\delta$ is the transition function of a DFA. Prove that for any input strings $x$ and $y$, $\delta(q, xy) = \delta(\delta(q, x), y)$.
4. Let G be the grammar $S \rightarrow aS \mid aSbS \mid \epsilon$. Prove that $L(G) = \{x \mid$ each prefix of $x$ has at least as many $a$'s as $b$'s$\}$.
5. Define Turing machine. What are its uses?

(5 x 4 = 20 marks)

**Part-B**

*Answer one full question from each module.*

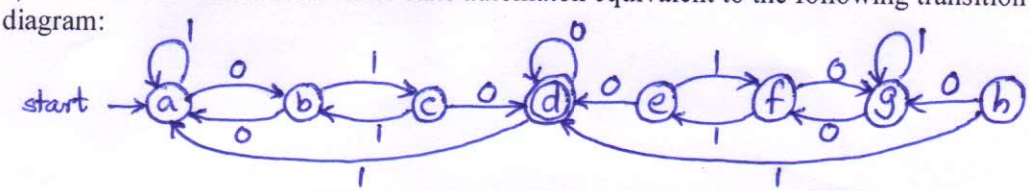
Module I

6. a) Construct the DFA equivalent to the following NFA. $M=(\{q_0, q_1\}, \{0, 1\}, \delta, q_0, \{q_1\})$ and $\delta(q_0, 0) = \{q_0, q_1\}$, $\delta(q_0, 1) = \{q_1\}$, $\delta(q_1, 0) = \phi$, $\delta(q_1, 1) = \{q_0, q_1\}$.
   b) Define Moore machine. Design a Moore machine to output residue mod 4(remainder of the input number when divided by 4) for binary input string treated as binary integer.

7. a) With the help of an example, explain how a Mealy machine is transformed to equivalent Moore machine.
   b) Construct NFA without $\epsilon$ – transitions from the following NFA. $M=(\{q_0, q_1, q_2\}, \{0, 1, 2\}, \delta, q_0, \{q_2\})$ and $\delta(q_0, 0) = \{q_0\}$, $\delta(q_0, \epsilon) = \{q_1\}$, $\delta(q_1, 1) = \{q_1\}$, $\delta(q_1, \epsilon) = \{q_2\}$, $\delta(q_2, 2) = \{q_2\}$.

Module II

8. a) Write regular expressions for each of the following languages over the alphabet {0, 1}.
      i) The set of all strings with at most one pair of consecutive 0's and at most one pair of consecutive 1's.
      ii) The set of all strings not containing 101 as a substring.
   b) Find the minimum state finite state automaton equivalent to the following transition diagram:




9. a) Construct finite automata(NFA) equivalent to the regular expression:
      $01[((10)^* + 11)^* + 0]^*1$
   b) Construct regular expressions corresponding to the following state diagram: