6E3203

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B.Tech. (Sem.VI) (Main) Examination, May/June-2011
Computer Engineering
6CS3 Theory of Computation

[Time : 3 Hours]

[Total Marks : 80]
[Min. Passing Marks : 24]

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary.) Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

UNIT - I

1. (a) Define the finite automata. Differentiate between the following terms and their purpose
   (i) Finite Acceptors and Transducers
   (ii) Final states, Trap state, Non- final state
   (iii) Deterministic and non – deterministic finite acceptors.(8)

   (b) Minimize the following finite automata. Also write procedure for minimization. (8)

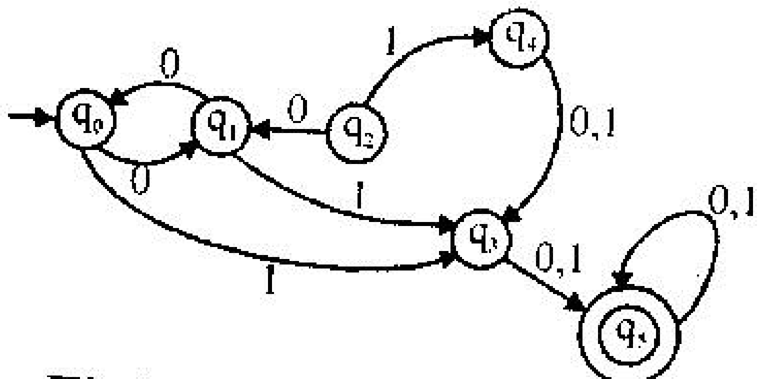

Fig. : Finite Automata to be reduced

OR

1. (a) Define the finite automata. Explain difference between deterministic and non-deterministic finite automata. Find deterministic (DFA) for the following non-deterministic finite automation (NDFA)

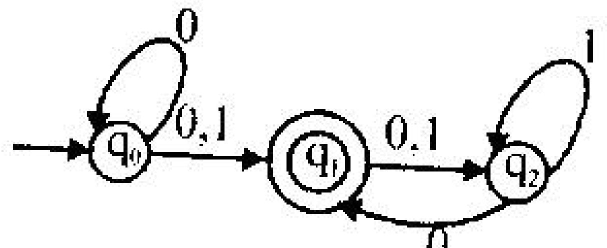

Fig. : NDFA to be converted into DFA (8)

(b) Explain the purpose of Mealy machine and Moore machine. Write application area of Mealy and Moore machine. Can we determine the type of machine by checking output? If yes, Justify you answer. Convert the following Mealy machine into Moore machine for following (figure) transition diagram. (8)

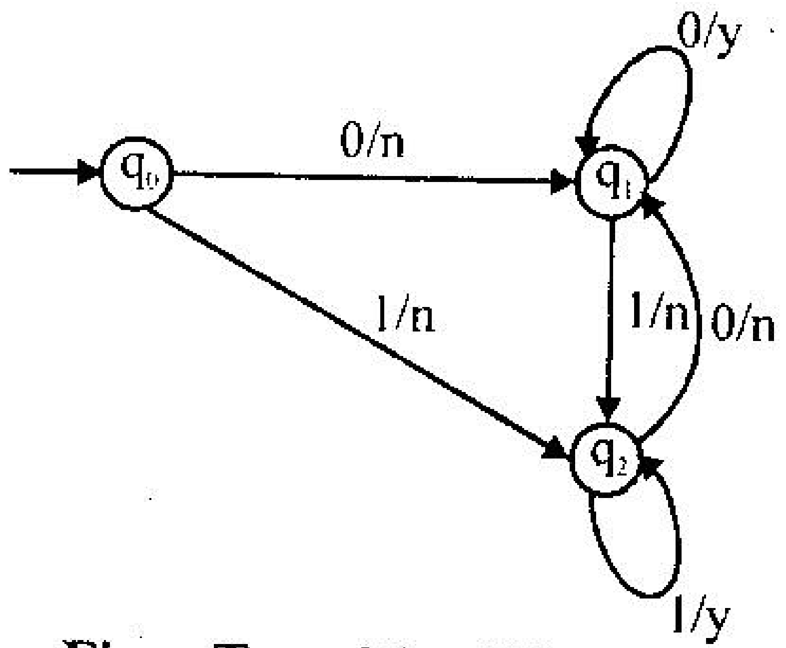

Fig. : Transition Diagram

UNIT - II

2. (a) Define regular expressions and languages associated with regular expressions. Write the regular expression and finite automata (transition diagram) for following language over alphabets $\sum = \{a, b\}$

(i) The set of strings that start with "ab" and end with "bb".

(ii) The set of strings that starts with 'a' and ends with 'b' and contain at least one sequence of "a a a" in that string. (8)

(b) State and explain pumping Lemma. Prove that following expression is not regular using pumping Lemma;
$L = \{a^n b^n : n \geq 1\}$ (8)

OR

2. (a) Write the closure properties of regular languages. Explain pigeon hole principle. Prove that language $L = \{a^n b^n : n \geq 0\}$ is not regular using method of contradiction. (8)

(b) Show that the following language $L = \{a^n$: n is a perfect square$\}$ is not regular. (8)

UNIT - III

3. (a) Define the context – free grammar and find the context free grammar for the following languages :

(i) $L = \{a^n b^m : n \leq m+3\}$

(ii) $L = \{a^n b^m : n \neq 2m\}$ (8)

(b) Design a push down automata for language $L=\{a^n b^n : n \geq 1\}$. Also check the acceptability of string "a a aa bb a b". (8)

OR

3. (a) Define context – free grammar and translate the following grammar into Greibach Normal Form;

$S \rightarrow ab\ AB$ $\quad$ $A \rightarrow bAB/\lambda$

$B \rightarrow BAa/A/\lambda$ $\quad$ $D \rightarrow aB$ (8)

(b) Construct a PDA that accepts the language generated by the grammar with predictions.

$S \rightarrow aSbb/a$ (8)

UNIT - IV

4. (a) Define the turing machine. Also write the capabilities of turing machine and advantages over the other. Construct a turing machine that could recognize the following language; $L=\{a^n b^n c^n : n \geq 1\}$ (8)

(b) Design a turing machine that computes 2's complement of given string over the $\Sigma=\{0,1\}$. Show the output of your machine for string "0 0 0 0 0". (8)

OR

4. (a) Write short note on the following
   (i) Universal turing machine
   (ii) Multitape and Multi –dimensional turing machine
   (iii) Halting problem. (8)

(b) Design a Turing Machine to compute the following function for 'X' represented in unary. $\Sigma=\{1\}$, $F[x]=\left\lfloor \frac{x}{2} \right\rfloor$. Explain the output for x = 5. (8)

UNIT - V

5. (a) Explain the model of Linear Bounded Automata. (8)

(b) Find the linear bounded automata for language $L=\{a^n : n \text{ is a prime number}\}$ (8)

OR

5. Write short notes on any three (3) of the following:
   (i) Recursive and Recursively Enumerable languages.
   (ii) Context free grammar and context sensitive grammar
   (iii) Linear bounded automata.
   (iv) Chomsky Hierarchy of Languages. (8)