B.E. (Fifth Semester) EXAMINATION, June, 2004

(Computer Science & Engg. Branch)

THEORY OF COMPUTATION

(CS–505/5511)

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Make a FDA for any integer number divisible by 3. 10

   (b) Make a FSM to multiply a given binary integer by 3. 10

2. (a) Prove that Regular sets are closed under intersection. 8

   (b) Suppose D is the transfer function of deterministic finite state machine, prove any input string x and y : 6

$$\delta(q, xy) = \delta(\delta(q, x), y)$$



(c) Give the regular expression of the following machine. 6

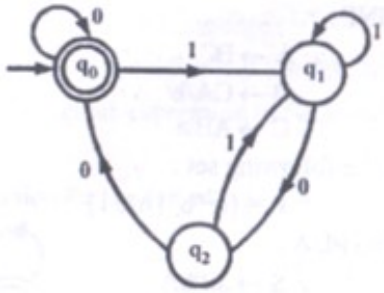


Fig. 1

3. (a) How to reduce the number of states of DFSM ? Make a reduce machine for the following example : 12

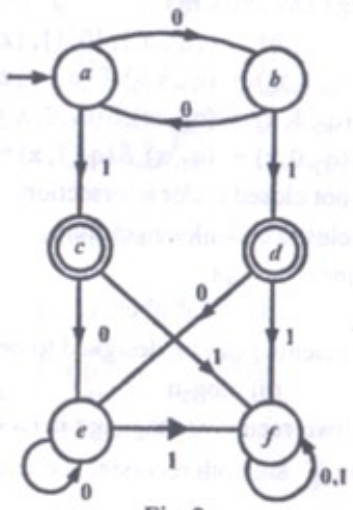


Fig. 2



(b) Given a grammar, make Non-deterministic finite automata and convert it to deterministic form : 8

$$S \rightarrow 0S \mid 1A \mid 1$$
$$A \rightarrow 0 \mid 0A \mid 1S$$

4. (a) What are steps to convert the context free grammar to Chomsky normal form ? Explain each step with suitable example. 10

   (b) Write a algorithm to convert a grammar to Greibach normal form (GNF). 10

5. (a) Let G be the grammar : 10

$$S \rightarrow aB \mid bA$$
$$A \rightarrow a \mid aS \mid bAA$$
$$B \rightarrow b \mid bS \mid aBB$$

for the string *aaabbabbba*, fing a :

(i) leftmost derivation (ii) rightmost derivation

(iii) Parse tree (iv) Is the grammar unambiguous ?

(b) Construct the PDA that accepts $\{\omega\, c\, \omega^R \mid \omega \in (0+1)^*\}$ by empty stack. Where $\omega^R$ represent the reverse of $\omega$. 10

6. Give a grammar for the language N (M) where :

$$M = (\{q_0, q_1\}, \{0, 1\}, \{z_0, x\}, \delta q_0, z_0, \phi)$$

and $\delta$ is given by : 20

$$\delta(q_0, 1, z_0) = \{(q_0, xz_0)\}$$
$$\delta(q_0, \varepsilon, z_0) = \{(q_0, \varepsilon)\}$$
$$\delta(q_0, 1, x) = \{(q_0, xx)\}$$
$$\delta(q_1, 1, x) = \{(q_1, \varepsilon)\}$$
$$\delta(q_0, 0, x) = \{(q_1, x)\}$$
$$\delta(q_1, 0, z_0) = \{(q_0, z_0)\}$$

7. Design turing machines to recognize the following language : 10,10

   (i) $\{0^n 1^n 0\, n \mid n \geq 1\}$

   (ii) $\{\omega\omega^R \mid \omega$ is in $(0+1)^*\}$

   where $\omega^R$ is the reverse of $\omega$.

8. Write short notes on any *two* of the following : 10 each

   (i) Decision algorithms

   (ii) Recursive and recursively enumerable languages

   (iii) Offline turing machine