

T.E. (Information Technology) (Semester – I) Examination, 2009
(2003 Course)

THEORY OF COMPUTATION

Time: 3 Hours

Max. Marks: 100

- Instructions :**
- 1) Answer any three questions from each Sections.
 - 2) Answers to the two Sections should be written in separate answer books.
 - 3) Neat diagrams must be drawn wherever necessary.
 - 4) Figures to the right indicate full marks.
 - 5) Assume suitable data, if necessary.

SECTION – I

1. a) Design a FA that accepts all words concating triple letter either 'aaa' or 'bbb'. 6
- b) Convert NFA $(\{q_0, q_1, q_2, q_3\}, \{a, b\}, \delta, q_0, \{q_3\})$ to its equivalent DFA. Clearly show the state table before minimization and after minimization. 12

OR

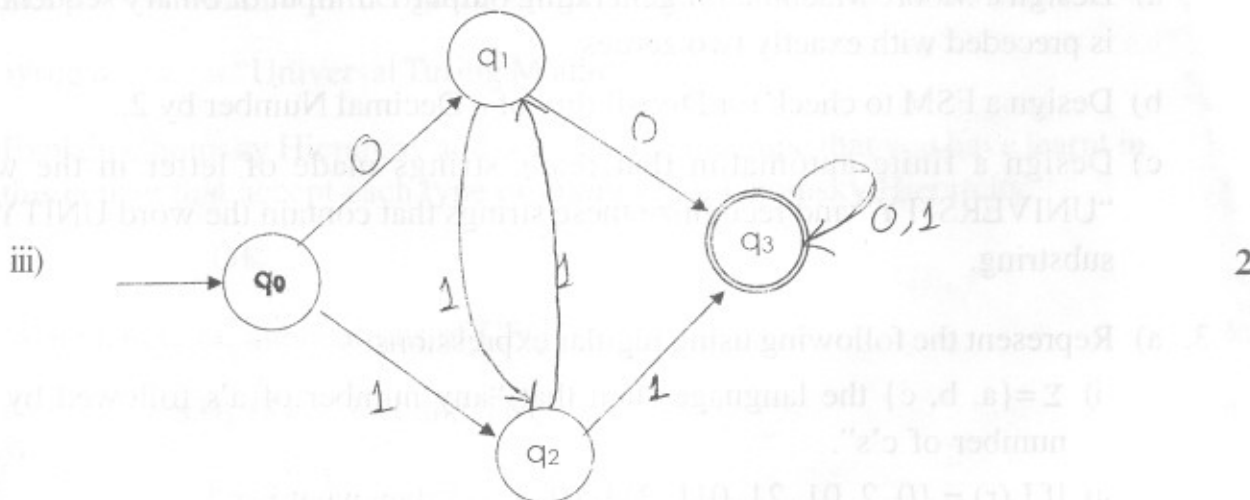
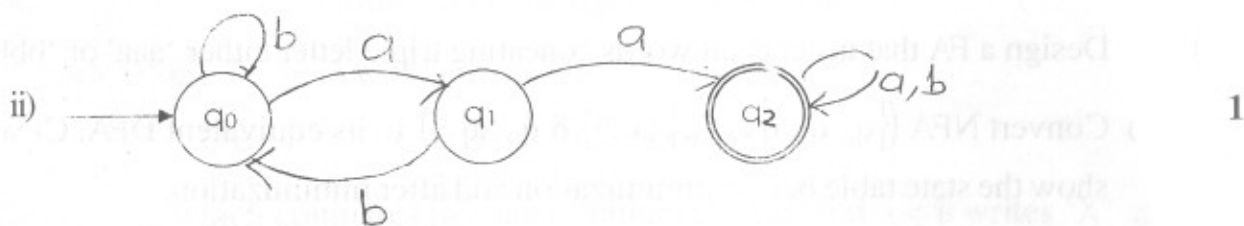
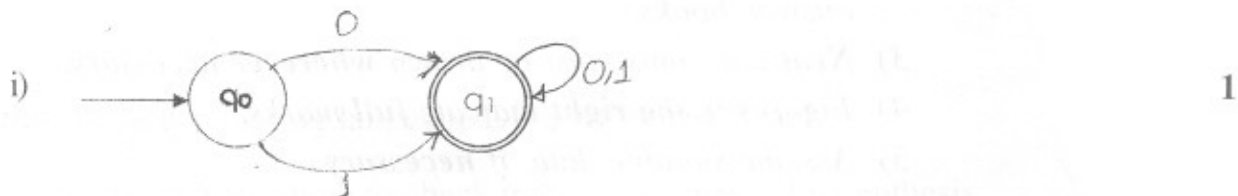
2. a) Design a Moore Machine for generating output 1 if input of binary sequence 1 is preceded with exactly two zeroes. 6
- b) Design a FSM to check for Divisibility of a Decimal Number by 2. 6
- c) Design a finite automaton that reads strings made of letter in the word "UNIVERSITY" and recognize these strings that contain the word UNITY as substring. 6
3. a) Represent the following using regular expressions.
 - i) $\Sigma = \{a, b, c\}$ the language such that "any number of a's followed by any number of c's".
 - ii) If $L(r) = \{0, 2, 01, 21, 011, 211, 0111, \dots\}$ then what is r ?
 - iii) If $L(r) = \{00, 010, 0110, 01110, \dots\}$ then what is r ?
 - iv) Language defined over $\Sigma = \{a, b\}$ has to have the strings beginning with 'a' and not to have two consecutive a's that is the regular expression for the same. 4



- b) Show that $(0^*1^*)^* = (0+1)^*$. 4
- c) Construct a NFA to accept the language represented by $a^*b^*c^*$. Construct this NFA to its equivalent DFA. 8

OR

4. a) Find the regular expression for the following DFA.



b) Construct a NFA with ϵ moves for the regular expression $(b(aa)^*.b+ab^*a)^*$ convert this NFA to its equivalent DFA.

12



5. a) Define the term "Phrase structured grammar". 2
- b) Write a CFG which defines the language containing strings of the form $0^n 1^n$ for $n \geq 1$. 4
- c) Find the CFL associated with the CFG. 4
- $S \rightarrow 0Q/1/P$
- $P \rightarrow 0/0S/1PP$
- $Q \rightarrow 1/1S/0QQ$
- d) Eliminate the ϵ productions from the grammar G consisting of
- $S \rightarrow PQP$
- $P \rightarrow OP/\epsilon$
- $Q \rightarrow IQ/\epsilon$ 6

OR

6. a) Write a CFG which generates the language L defined by the regular expression $(a + b)^* bbb(a + b)^*$ 4
- b) Convert the grammar given below to its equivalent CNF :
- $S \rightarrow PQP$
- $P \rightarrow OP/\epsilon$
- $Q \rightarrow IQ/\epsilon$ 6
- c) Eliminate the ϵ productions from the grammar G consisting of
- $S \rightarrow ABA$
- $P \rightarrow a A/\epsilon$
- $Q \rightarrow bB/\epsilon$ 6



SECTION – II

7. a) Design a PDA to recognize the language generated by the following grammar :
 $S \rightarrow S+S/S*S/4/2$.
 Show the acceptance of the input string $2 + 2*4$ by this PDA. 10
- b) Construct PDA accepting language consisting of even palindrome strings of a's and b's. 8

OR

8. a) Draw a PDA accepting language $L = \{WCW^T/W \in \{a, b\}^*\}$ 10
- b) Design a POST machine to check well formed ness of parenthesis. 8
9. a) Design TM to find 2's complement of a given binary number. 8
- b) Explain halting problem with an example. 8

OR

10. a) Design TM which compares two unary numbers a and b if $a < b$ writes 'X' at the end if $a = b$ writes ' at the end and 'Z' otherwise. 8
- b) Design TM which will recognize strings containing equal no of 0's and 1's. 8
11. a) Write a note on "Universal Turing Machine". 8
- b) Explain Chomsky Hierarchy and describe the machine that you have learnt in this course that accept each type of grammar of Chomsky Hierarchy. 8

OR

12. a) Write a note on applications of CFG. 8
- b) Compare FSM, PDM, PM and TM. 8