



Nov-Dec  
2011

[4063] – 352

T.E. (Information Technology) (Semester – I) Examination, 2011  
THEORY OF COMPUTATION  
(2008 Pattern) (New)

Time : 3 Hours

Max. Marks : 100

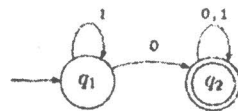
- Instructions:**
- 1) Answer Question 1 or 2, 3 or 4 and 5 or 6 from Section – I and Question 7 or 8, 9 or 10 and 11 or 12 from Section – II.
  - 2) Answers to the **two** Sections should be written in **separate** answer books.
  - 3) Neat diagrams must be drawn **wherever** necessary.
  - 4) Figures to the **right** indicate **full** marks.
  - 5) Assume suitable data if **necessary**.

SECTION – I

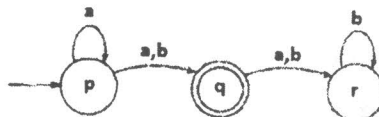
1. a) Define and explain : 8
  - i) Language
  - ii) Cartesian Product
  - iii) Regular Expression
  - iv) Kleene Closure.
- b) Design a Finite State Machine for divisibility by 5 tester of a given decimal number. 8

OR

2. a) Construct NFA from the following regular expressions : 8
  - i)  $0^*1^*2^*$
  - ii)  $(00 + 1)^*(10)^*$ .
- b) Obtain regular expression for the following FA. 8



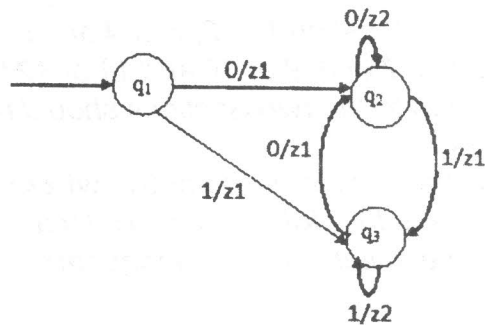
3. a) Convert the following NFA to its equivalent DFA. 8



P.T.O.

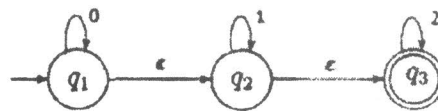


- b) Design a Moore Machine for checking divisibility by 3 of a given decimal number (residue of 3). 4
- c) Consider the following Mealy machine, construct a Moore machine equivalent to it. 4



OR

4. a) Convert the following NFA- $\epsilon$  to its equivalent DFA. 8



- b) Construct the NFA for the language of all strings that begin and end with same symbol over the alphabet  $\Sigma = \{0, 1\}$ . 4
- c) Design a DFA which accepts the odd number 1's and any number of 0's over  $\Sigma = \{0, 1\}$ . 4
5. a) Show that the following grammar is ambiguous 6

$$S \rightarrow aSbS$$

$$S \rightarrow bSaS$$

$$S \rightarrow \epsilon$$

- b) Convert the following grammar to Chomsky Normal Form (CNF) 6

$$G = (\{S\}, \{a, b\}, P, S)$$

$$P = \{S \rightarrow aSa \mid bSb \mid a \mid b \mid aa \mid bb\}$$

- c) Obtain a grammar to generate the language 6

$$L = \{a^{n+2}b^n \mid n \geq 0 \text{ and } m > n\}$$

OR



6. a) Obtain the unambiguous grammar for the following grammar 6

$$E \rightarrow E + E \mid E - E$$

$$E \rightarrow E * E \mid E / E$$

$$E \rightarrow (E) \mid I$$

$$I \rightarrow a \mid b \mid c$$

- b) Consider the following grammar 4

$$S \rightarrow aAS \mid a$$

$$A \rightarrow SbA \mid SS \mid ba$$

Derive the string aabbbaa using

i) Leftmost derivation

ii) Rightmost derivation.

- c) Convert the following grammar to GNF 8

$$G = (\{A_1, A_2, A_3\}, \{a, b\}, P, A_1)$$

$$P = \{A_1 \rightarrow A_2A_3$$

$$A_2 \rightarrow A_3A_1 \mid b$$

$$A_3 \rightarrow A_1A_2 \mid a\}$$

## SECTION – II

7. a) Convert the following right linear grammar to left linear grammar 4

$$S \rightarrow 0A$$

$$A \rightarrow 1A$$

$$A \rightarrow \epsilon$$

- b) Obtain a grammar to generate a string consisting of any number of a's and b's with at least one a. 4

- c) State and prove Pumping lemma theorem for Context-Free Languages. 8

OR

8. a) Show that CFLs are closed under Union, Concatenation and Kleene closure. 8

- b) By using Pumping Lemma, prove that following language 8

$$L = \{ww \mid w \in \{a, b\}^*\} \text{ is not a context-free language.}$$



9. a) Obtain a PDA to accept the language 8  
 $L = \{a^n b^n \mid n \geq 1\}$  by a final state.
- b) Obtain PDA for the following grammar 8  
 $S \rightarrow aABC$   
 $A \rightarrow aB \mid a$   
 $B \rightarrow bA \mid b$   
 $C \rightarrow a.$

OR

10. a) Construct PDA which accepts language consisting of even length palindrome of strings of a's and b's. 8
- b) Define post machines and explain its elements. 4
- c) Define acceptance by PDA 4  
i) By final state  
ii) By empty stack.
11. a) Construct a Turing Machine to accept the following language 8  
 $L = \{x \in \{a, b\}^* \mid x \text{ contains the substring } aba\}$
- b) Write short notes on : 10  
i) Limitation of Turing Machine  
ii) Halting Problem of Turing Machine.

OR

12. a) Design a Turing Machine to add two unary numbers. 8
- b) Write short notes on : 10  
i) Universal Turing Machine  
ii) Multi-tape Turing Machine.