53 (CS 502) THCM

2013

(December)

THEORY OF COMPUTATION

Paper : CS 502

Full Marks : 100

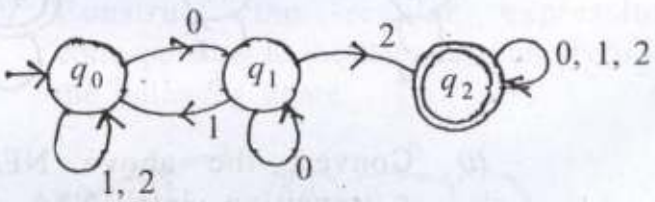
Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* Define the language of a DFA. 2

(b) Consider the following DFA.



(i) Write down the alphabet (Σ) and *any five* strings of the language of above DFA. 2+3=5

Contd.

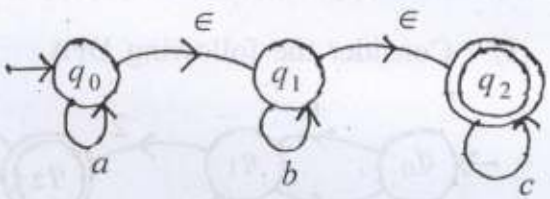
(ii) Explain the language of this DFA in simple sentence. 3

(c) Draw the DFA for the following languages. 5+5=10

(i) Language over the alphabet $\Sigma = \{0, 1\}$ that have the set of all strings that either begins or ends (or both) with '01'.

(ii) Language over the alphabet $\Sigma = \{0, 1\}$ that have the set of all strings where the second last symbol from the start is '0' and the second last symbol from the end is '1'.

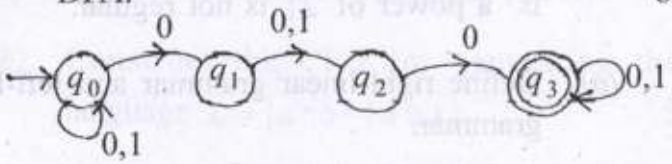
2. (a) Consider the following NFA with $\in$ (Epsilon) transition. 4+4=8



(i) Convert the above NFA with $\in$-transition into NFA without $\in$-transition

(ii) Convert the same into DFA.

(b) Convert the following NFA to its equivalent DFA. 8



(c) Define Moore machine and Melay machine. 2+2=4

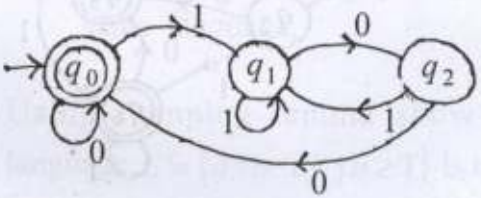
3. (a) Write down the regular expression for the following languages. 2+2=4

(i) Set of all strings from the alphabet $\Sigma = \{0,1\}$ such that the second last symbol from the end in each string is '1'.

(ii) Set of all strings from the alphabet $\Sigma = \{0,1\}$ such that each string, if starts with '0' then ends with '1' or, if starts with '1' then ends with '0'.

(b) Construct the NFA with ϵ-transition equivalent to (0 + 1)*(00 + 11). 5

(c) Construct the regular expression corresponding to the state diagram given in the following figure. 6



(d) Prove that the language $L = \{0^n \mid$ where n is a power of $2\}$ is not regular. 5

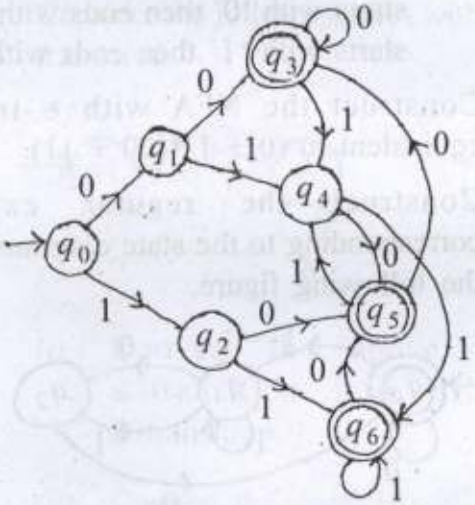
4. (a) Define right-linear grammar and left-linear grammar. 3

(b) Consider the following grammar. 9

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

Find out the left-most derivation, right-most derivation and parse tree for the string 'baaabbabba'.

(c) Construct the minimum state DFA equivalent to the transition diagram given below. 8



5. *(a)* Define Context-free Grammar (CFG). 2

(b) Construct the CFG for generating the language $L = \{a^n b^n \mid n \geq 1\}$. 5

(c) Find $L(G)$ where, 3

$G = (\{S, C\}, \{a, b\}, \{S \to aCa, C \to aCa \mid b\}, S)$

(d) Obtain Greiback Normal Form (GNF) equivalent to the following Context-free Grammar. 10

$S \to 0 \mid AA$

$A \to 1 \mid SS$

6. *(a)* Define DPDA. What are different ways in which a PDA accepts the language ? 2+3=5

(b) Consider a language $L = \{\omega C \omega R \mid \omega \in \{0, 1\}\}$.

(i) Construct a PDA for the above language.

(ii) Construct a Turing Machine for the same language. 7+8=15

7. *(a)* Using Pumping lemma show that the language $L = \{a^n b^n c^n \mid n \geq 1\}$ is not a CFL. 6

(b) Show that halting problem of turing machine is undecidable. 6

(c) When a language is said to be recursive or recursively enumerable ? 4

(d) When a problem is said to be decidable or undecidable ? 4
