53 (IT 503) THCP

2014

THEORY OF COMPUTATION

Paper : IT 503

Full Marks : 100

Pass Marks : 30

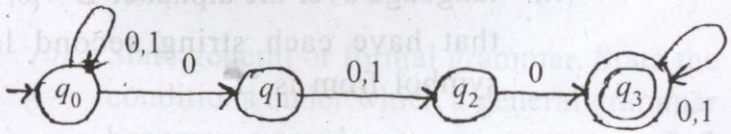
Time : Three hours

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

*Answer **any five** questions out of **seven**.*

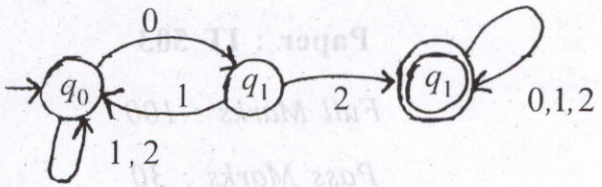
1. *(a)* Define detail Chomsky classification of grammar and also define Chomsky hierarchy. 3+3

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



(c) What do you understand by DFA (Deterministic Finite Automata) and is it different from NFA. 3+3

2. (a) Consider the following DFA.



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

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

(b) Draw the DFA for the following languages

(i) language over the alphabet $\Sigma = \{0,1\}$, that have the set of all strings that either beings or ends with '01'. 6

(ii) language over the alphabet $\Sigma = \{0, 1\}$, that have each string second last symbol from is '1'. 6

3. *(a)* Define right-linear and left-linear grammar. 2+2

(b) Consider the following grammar

$$S \rightarrow bA \mid aB$$

$$A \rightarrow bAA \mid aS \mid a$$

$$B \rightarrow aBB \mid bSb$$

find left-most derivation and right-most derivation and parse tree for the string 'baaabbabba'. 3+3+4

(c) Show that $id + id * id$ can be generated by two distinct left-most derivation in the grammar

$$E \rightarrow E+E \mid E*E \mid (E) \mid id$$ 6

4. *(a)* Define deterministic push down automata DPDA. How DPDA is different from PDA ? Is it true that DPDA and PDA are equivalent in the sense of language acceptance is concerned ? 4+4+2

(b) State general or formal grammar. State the conditions under which a general grammar becomes a regular grammar. 2+2

(c) Construct the PDA for the language 6

$$L=\left\{WcW^R \mid W \in \{0,1\}\right\}$$

5. (a) Obtain greibach normal form equivalent to the following context free grammar

$$S \rightarrow 0 \mid AA$$

$$A \rightarrow 1 \mid SS$$ 6

(b) Consider the following transition functions of a PDA that accepts strings through empty stack mechanism. Find out the CFG for the PDA below 8

$A=(\{q_0,q_1,\},\{a,b\},\{z_0,z_1\},\delta,q_0,Z_0,\phi)$,

δ is given by

$$\delta(q_0,b,z_0)=\{(q_0,zz_0)\}$$

$$\delta(q_0,\in,z_0)=\{(q_0,\in)\}$$

$$\delta(q_0,b,z)=\{(q_0,zz)\}$$

$$\delta(q_0,a,z)=\{(q_1,z)\}$$

$$\delta(q_1,b,z)=\{(q_1,\in)\}$$

$$\delta(q_1,a,z)=\{(q_0,z_0)\}$$

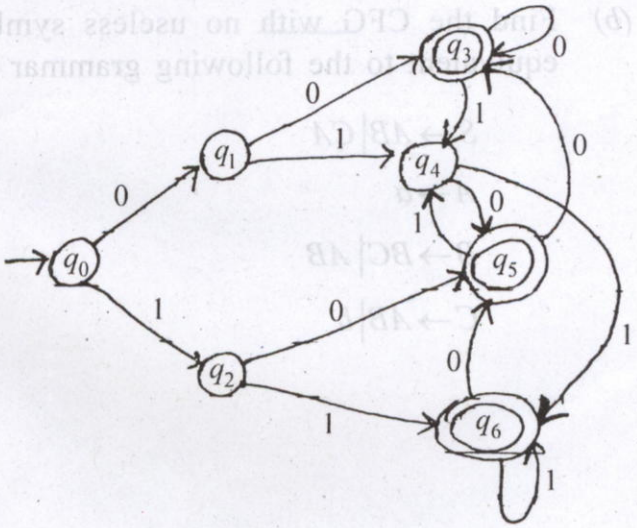
(c) Write regular expression for the following language over the alphabet

$\Sigma = \{0,1\}$, L: { the set of all strings with even number of zero's and even number of one's }

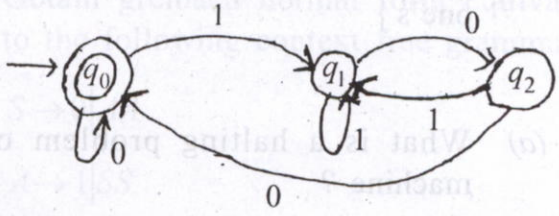
6

6. (a) What is a halting problem of Turing machine ? 4

(b) Construct the minimum state DFA equivalent to the transition diagram given below : 8



(c) Construct the regular expression corresponding to the state diagram given in the following figure : 8



7. (a) What is recursively enumerable language ? 4

(b) Find the CFG with no useless symbols equivalent to the following grammar 8

$$S \rightarrow AB \mid CA$$

$$A \rightarrow a$$

$$B \rightarrow BC \mid AB$$

$$C \rightarrow AB \mid b$$

(c) Convert the following grammar into CNF form 8

$$S \rightarrow aB \mid bA$$

$$A \rightarrow bAA \mid aS \mid a$$

$$B \rightarrow aBB \mid bS \mid b$$
