53 (IT 503) THCP

2018

THEORY OF COMPUTATION

Paper : IT 503

Full Marks : 100

Time : Three hours

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

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

1. *(a)* Define the detail Chomsky classification of grammer and also define Chomsky hierarchy. 6

   (b) Draw the DFA for the following languages 5+5

   (i) Language over the alphabet $\sum = \{a, b\}$ that have the set of all strings, where the last symbol in input string appears earlier in the string ?

(ii) Language over the alphabet $\sum = \{a, b\}$ that have the set of all strings, where the number of b's divisible by 3.

(iii) What is ambiguity? Show that $S \rightarrow Sa \mid aS \mid a$ is an ambiguous grammer. 2+2

2. (a) Consider the following grammer: 8

$S \rightarrow bA \mid aB$

$A - bAA \mid aS \mid a$

$B \rightarrow aBB \mid bSb$

find the left most derivation and right most derivation and parse tree for the string baaabbabba.

(b) Construct the GFG for the PDA $p = (\{p, q\}, \{0, 1\} \{X, Z_0\}, \delta, q, Z_0)$, if δ is given by 8

$\delta(q, 1, Z_0) = \{(q, XZ_0)\}$

$\delta(q, 1, X) = \{(q, XX)\}$

$\delta(q, 0, X) = \{(p, X)\}$

$\delta(q, \varepsilon, X) = \{(q, \varepsilon)\}$

$\delta(p, 1, X) = \{(p, \varepsilon)\}$

$\delta(p, 0, Z_0) = \{(q, Z_0)\}$

(c) Define left linear and right linear grammer with examples. 4

3. (a) Remove ε-transitation from the following grammer 6

$S \rightarrow aSbS \mid bSaS \mid \varepsilon$

$S \rightarrow AB \mid aaB$

$A \rightarrow a \mid Aa$

$B \rightarrow b$

(b) Write down the regular expression for the following languages 4+4

(i) set of all strings from alphabet $\sum = \{0, 1\}$ such that first symbol must be equal to the last symbol.

(ii) set of all strings from alphabet $\sum = \{0, 1\}$ such that each string does not end in 01.

(c) Using pumping lemma for the regular set prove that the language

$L = \left\{ 0^n 1^m \mid n <= m \right\}$ is not regular 6

4. *(a)* Construct the PDA for the language

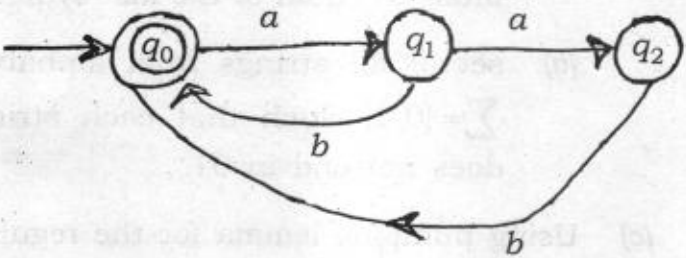
$$L = \left\{ WW^R \mid W \in \{0, 1\} \right\}$$ 8

(b) Determine the deterministic push down automata DPDA. Is it true that DPDA and PDA are equivalent in the sense of language acceptance is concern ? 4+2

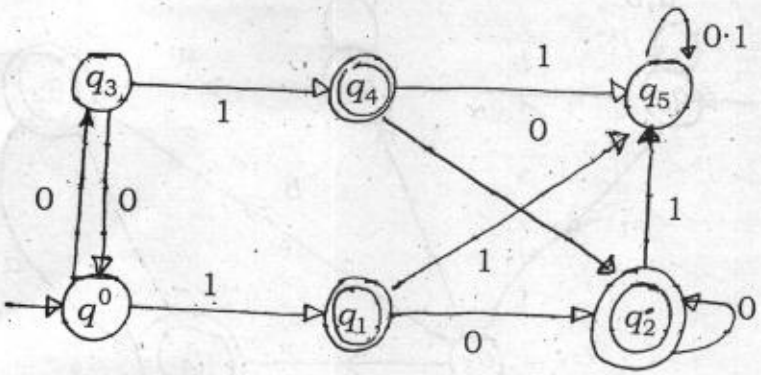
(c) Construct a DFA for the regular expression $aa* \mid bb*$. 6

5. *(a)* Define Regular expression and its importance in automata theory. 3+3

(b) Give the Regular expression accepted by following finite automata. 7



(c) Minimize the following DFA. 7



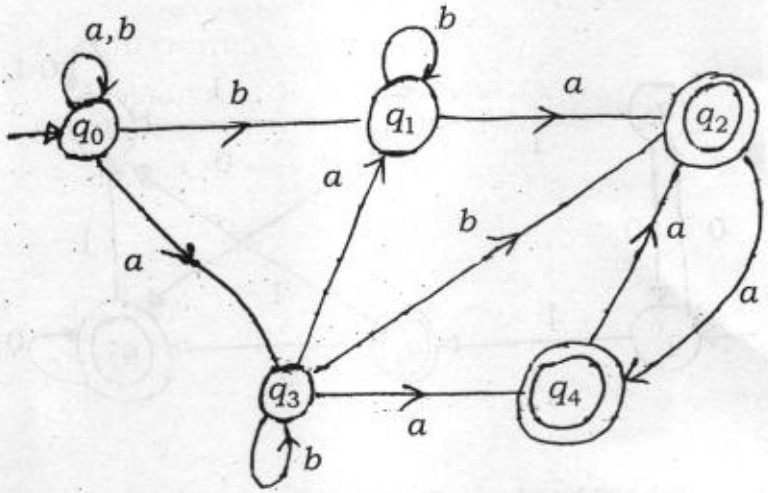
6. *(a)* Obtain Greibach normal from equivalent of the following context free grammar. 8

$S \rightarrow 0 \mid AA$

$A \rightarrow 1 \mid SS$

(b) Determine the DFA equivalent to the following NFA and by taking suitable example prove that both will accept or reject the same set of strings.

6+2



(c) Differentiate between the following : 2+2

(i) δ and $\delta*$

(ii) Σ and $\Sigma*$

7. (a) What a language is said to be recursive or recursively enumerable ? 4

(b) Define Turing Machine (TM). Differentiate the Deterministic and Non Deterministic Turing Machine. 4+4

(c) Consider the language $L = \{WW^R \mid W \in \{0, 1\}\}$, construct a Turning Machine for a Language *L*. 8
