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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Computer Science and Engineering

Semester End Examination; June - 2017

Theory of Computation

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Design a DFA for the following :

i) To accept string of 0's and 1's that either starts with 01 or ends with 01 — 10

ii) To accept the language L = {W(ab+ba) | W∈ {a, b}*}.

b. Convert the following NFA into DFA.

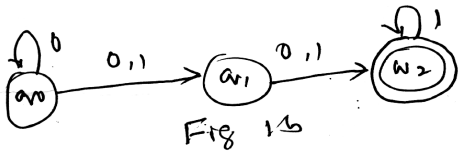


Fig 1b — 10

2 a. Convert ∈-NFA into DFA.

Fig 2(a) — 10

b. Minimize the below given DFA.

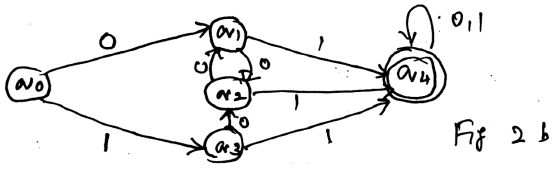


Fig 2 b — 10

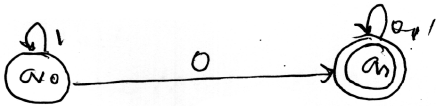
UNIT - II

3 a. Let R be a regular expression, then prove that there exists a finite automata A. — 6

b. Write the regular expressions for the following : — 4

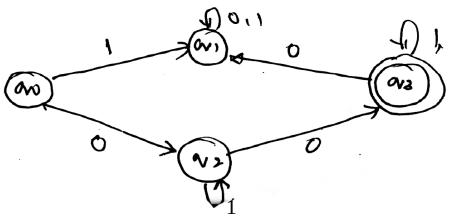
i) Strings of a's and b's of even length ii) Strings of a's and b's with no substring aa.

c. Obtain a regular expression using Kleen's algorithm for the below given finite automata.



10

4 a. Obtain the regular expression for the following DFA using state elimination method.



6

b. Explain the various applications of regular expressions. — 4

c. State and explain Kleen's theorem to regular expressions for finite automata. — 10

Contd…2

UNIT - III

5 a. Define CFG, write the CFG for the following languages :

i) $L = \{WW^R \mid W \in \{a, b\}^*$ and W^R is the reverse of $W\}$

ii) $L = \{0^{n+2}1^n \mid n \geq 1\}$. 5

b. Prove that the following grammar is ambiguous using the string "ibtibtaea"

$S \rightarrow iCtS|iCtSeS|a$

$C \rightarrow b$ 5

c. Define left most derivation and right most derivation and find the same for the following grammar :

$E \rightarrow E+E \mid E-E \mid E*E \mid E/E \mid (E)$

$E \rightarrow a \mid b \mid c$

Leftmost for the string a+b+c

Rightmost for the string (a+b)*c. 10

6. a Remove all useless productions, unit productions and $\in$ productions from the grammar :

$S \rightarrow ABC \mid BaB \quad A \rightarrow aA \mid BaC \mid aaa \quad B \rightarrow aBa \mid a \mid D$

$C \rightarrow CA \mid AC \quad D \rightarrow \in$ 10

b. If L_1 and L_2 are CFL then prove that they are closed under union and concatenation operations. 6

c. Convert the following CFG to CNF :

$S \rightarrow ABa \quad A \rightarrow aab \quad B \rightarrow Ac$ 4

UNIT - IV

7 a. Design a PDA to accept a string of balanced parenthesis and also show the string acceptance for the string W = [( )]. 12

b. Construct a PDA for the grammar :

$A \rightarrow aBB \mid a$

$S \rightarrow aABB \mid aAA \quad B \rightarrow bBB \mid A$

$C \rightarrow a$ 8

8 a. Construct a PDA for the language $L = \{WW^R \mid W \in (a+b)^*\}$ and show the string acceptance for the string abbbba. 12

b. Convert the following grammar into PDA :

$S \rightarrow aSa \mid aa$

$S \rightarrow bSb \mid bb$ and also show the string acceptance. 8

UNIT - V

9 a. Design a Turing machine to accept the language having string of palindromes over $\{0,1\}$. 10

b. Design a Turing machine to accept the language consists of equal number $0's$ *and* $1's$. 10

10a. Explain ID, acceptance of language with respect to Turing machine with an example. 8

b. Explain the following :

i) Post correspondence problem ii) Undecidable problems iii) Multi track Turing machine. 12

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