U.S.N | | | | | | | | | | |

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; May/June - 2018

Theory of Computation

Time: 3 hrs *Max. Marks: 100*

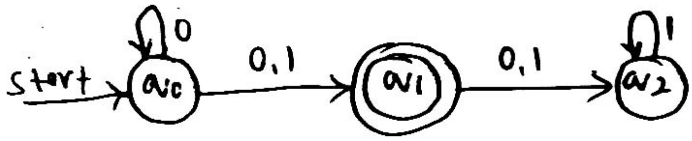
***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Design a DFA for the following languages :

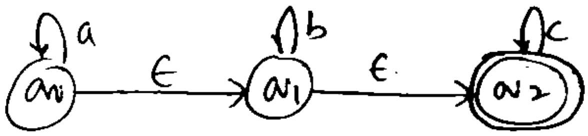
i) $L = \left\{ w(ab+ba) \mid w \in \{a,b\}^* \right\}$ ii) $L = \left\{ w \mid |w| \bmod 5 \neq 0 \quad \text{where } w \in \{a,b\}^* \right\}$ 10

b. Convert the below NFA into its equivalent DFA. 7



c. Mention the difference between DFA, NFA and $\in$-NFA. 3

2 a. Convert the $\in$-NFA to equivalent DFA. 10

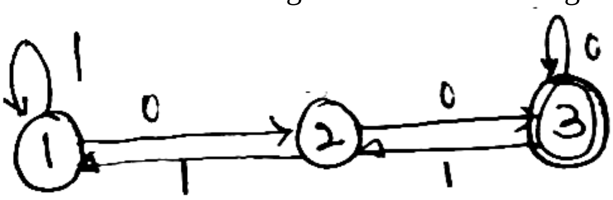


b. Define distinguishable and indistinguishable pairs: Minimize the following DFA. 10

	0	1
$\rightarrow Q_1$	Q_2	Q_3
Q_2	Q_3	Q_5
Q_3	Q_4	Q_3
Q_4	Q_3	Q_5
$* Q_5$	Q_2	Q_5

UNIT - II

3 a. Obtain the regular expression for the following finite automata using Kleen's theorem. 10



b. Obtain the regular expression for the following :

i) Strings of 0's and 1's with no two consecutive Zero's 4

ii) Strings *a*'s and *b*'s whose length is either even or multiple of 3 or both

c. Prove that if R is a regular expression, then there exists a finite automation that accepts L(R). 6

4 a. State and prove Pumping Lemma for regular language. 8

b. Show that $L = \left\{ ww^R \mid w \in \{0+1\}^* \right\}$ is not regular. 6

c. Show that regular languages are closed under compliment and difference. 6

UNIT - III

5 a. Define CFG. Obtain the CFG for the following languages : 5

i) $L=\{a^n b^n \mid n \geq 0\}$ ii) $L=\{ww^R \mid w \in \{a,b\}^*\}$

b. Obtain the leftmost and rightmost derivation for the string 'abababa' from the grammar 5

$S \rightarrow SbS \mid a$

c. Define the term ambiguity and show that $E \rightarrow E + E \mid E * E \mid a$ is ambiguous. 5

d. Show that CFL are not closed under intersection. 5

6 a. Eliminate epsilon unit and useless production from the following grammar : 10

$S \rightarrow ABC \mid BaB$
$A \rightarrow aA \mid BaC \mid aaa$
$B \rightarrow bBb \mid a \mid D$
$C \rightarrow CA \mid AC$
$D \rightarrow C$

b. Define CNF and GNF. Convert the following grammar into CNF : 10

$S \rightarrow aBa \mid abba$
$A \rightarrow ab \mid AA$
$B \rightarrow aB \mid a$

UNIT - IV

7 a. Construct a PDA for the language $L=\{ww^R \mid w \in \{a,b\}^*\}$ and show the string acceptance. 10

b. Construct a PDA for the language $L=\{a^n b^{2n} \mid n \geq 1\}$ and show the string acceptance. 10

8 a. Convert the following grammar: 10

$S \rightarrow aSa \mid aa$
$S \rightarrow bSb \mid bb$

to PDA that accepts the same language by empty stack.

b. Check whether the PDA for the language $L=\{w \subset w^R \mid w \in \{a,b\}^*\}$ is deterministic or not. 10

UNIT - V

9 a. Design a Turing machine to accept the language : 10

$L=\{n_a(w)=n_b(w),$ where $w \in \{a,b\}^*\}$.

b. Design a Turing machine to accept the language 10

$L=\{w \mid w$ is a palindrome, where $w \in \{a,b\}\}$.

10. Write a short note on the following : 20

i) Multi tape Turing machine

ii) Post correspondence problem

iii) Problem of decidable

iv) Halting problem

* * * *