



P.E.S. College of Engineering, Mandya - 571 401
(An Autonomous Institution affiliated to VTU, Belgaum)
Fourth Semester, B.E. - Computer Science and Engineering
Semester End Examination; June/July - 2015
Theory of Computation

Time: 3 hrs

Max. Marks: 100

Note: i) Answer **FIVE** full questions, selecting **ONE** full question from each **Unit**.
 ii) Assume suitable missing data if any.

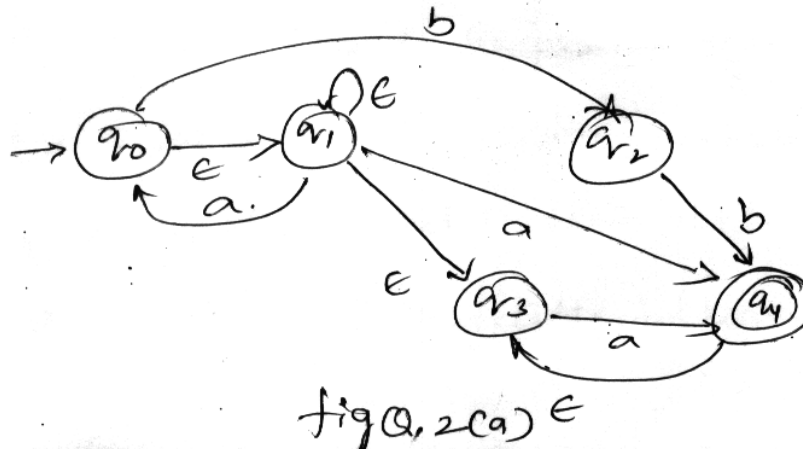
UNIT - I

1. a. Define the terms :

- i) Power of on alphabet 10
- ii) Language
- iii) Extended transition functions
- iv) ϵ -closure

b. Design DFA to accept set of all strings on the alphabet $\Sigma = \{0,1\}$ that either begin or ends or both with substring "01" and also compute $\hat{\delta} = (q_0, 0110)$. 10

2 a. Write subset construction algorithm and convert the following ϵ -NFA to DFA

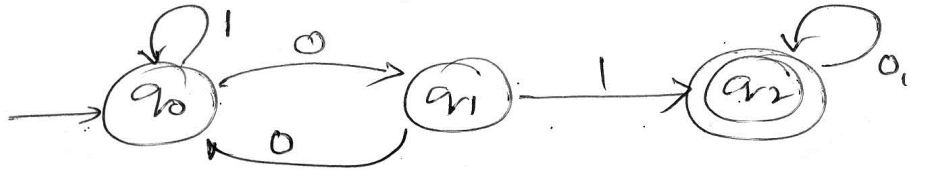


b. What is distinguishable state and minimize the following DFA using table filling algorithm. 10

	0	1
$\rightarrow A$	B	A
B	A	C
C	D	B
*D	D	A
E	D	F
F	G	E
G	F	G

UNIT - II

- 3 a. Define a Regular expression obtain a regular expression to accept the language L of all strings in $\{a,b\}^*$ that contain at least one of the two substring ab and bba. 6
- b. Prove that if $L = L(A)$ for some DFA A, then there is a regular expression such that $L = L(R)$. 7
- c. Obtain a regular expression for a finite Automata show below using state elimination. 7



- 4 a. State and prove the pumping lemma for regular languages. 7
- b. Construct the DFA for the following languages.
 $L_1 = \{ \text{set of 0's and 1's and with at least one 1} \}$
 $L_2 = \{ \text{set of 0's and 1's with at least one 0} \}$
 and draw DFA for the following : 8
 - i) $L_1 \cup L_2$ ii) $L_1 \cap L_2$ iii) $L_1 - L_2$
- c. Mention the application of Regular expression and describe any one in detail. 5

UNIT - III

- 5 a. Define context free grammar and construct the CFG for the following grammar 8
 $L = \{0^i 1^j 2^k \mid i = j \text{ or } j = k\}$.
- b. What is meant by ambiguous grammar? Is the following grammar is ambiguous 6
 $S \rightarrow aS \mid aSbS \mid \epsilon$.
- c. Consider the grammar $E \rightarrow +EE \mid *EE \mid -EE \mid x \mid y$. Find the leftmost and rightmost derivation 6
 for the string $+*xyxy$ and write parse tree.
- 6 a. Define CNF, and convert the following CFG to CNF 10
 $S \rightarrow aA \mid aB$
 $A \rightarrow aaA \mid B \mid \epsilon$
 $B \rightarrow b \mid bB$
 $D \rightarrow B$
- b. Mention the application of CFG and describe any two of them in detail. 10

UNIT - IV

- 7 a. Define the following terms:
- i) Pushdown Automata
 - ii) Language of PDA
 - iii) Instantaneous description
 - iv) Deterministic Pushdown Automata
- b. Design the PDA for the following Language $L = \{w \mid w \in \{a, b\}^* n_a(w) > n_b(w)\}$ and show the instantaneous description of the PDA on the input string aaabb. 10
- 8 a. Design deterministic Pushdown automata for the following language and draw the transition diagram. 10
- $$L = \{a^n c^m b^n \mid n, m \geq 1\}$$
- b. Write the procedure used to connect the given PDA to CFG, also obtain a CFG for the PDA
- $$M = (\{q_0, q_1\}, \{a, b\}, \{A, Z_0\}, \delta, q_0, z_0, q_1)$$
- with transitions
- $$\delta(q_0, a, Z_0) = (q_0, AZ_0)$$
- $$\delta(q_0, b, A) = (q_0, AA)$$
- $$\delta(q_0, a, A) = (q_1, \epsilon)$$

UNIT - V

- 9 a. Explain the general structure of multi tape and non deterministic turing machine and show that are equivalent to basic turning machine. 10
- b. Design the turing machine to accept all set of even length palindromes over $\{a, b\}^*$ also write its transitions diagram and give ID for the input “abba”. 10
- 10 a. Write short notes on :
- i) Post correspondence problem
 - ii) Recursive language
 - iii) Universal language
- b. Prove that if a language L and its complement are recursively enumerable, then L is recursive. 10

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