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

(An Autonomous Institution affiliated to VTU, Belgaum)

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

Make-up Examination; July - 2016

Theory of Computation

Time: 3 hrs *Max. Marks: 100*

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

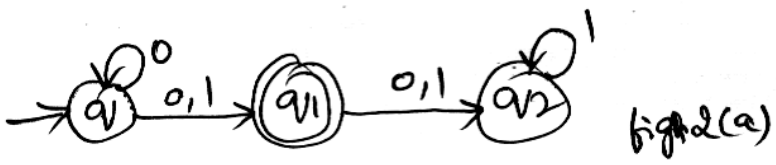
UNIT - I

1 a. Define the terms:

(i) Power of an alphabet (ii) Language (iii) Finite automata (iv) ε- closure. 10

b. Design DFA to accept strings of a's and b's ending with ab or ba and also compute $\hat{\delta} = (q_0, abba)$. 10

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



10

b. Define the equivalence states and minimize the following DFA using table-filling algorithm.

δ	0	1
→A	B	E
B	C	F
*C	D	H
D	E	H
E	F	I
*F	G	B
G	H	B
H	I	C
*I	A	E

10

UNIT - II

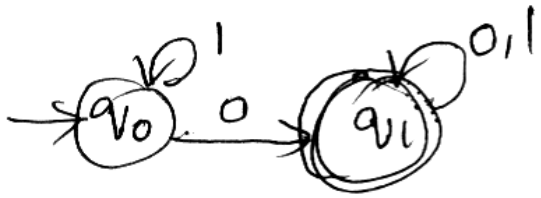
3 a. Define a regular expression and obtain a regular expression for,

$L = \{vuv : u, v \in (a,b)^* \text{ and } |v| = 2\}$. 6

b. Obtain NFA which accepts strings of a's and b's ending with the string 'ab' and obtain equivalent DFA. 6

Contd….2

c. Obtain a regular for the FA shown below using Kleen's algorithm. 8



What is the language corresponding to the regular expression?

4 a. State and prove the pumping lemma for the regular languages. 6

b. Construct the DFA for the following languages : 8

L_1 = {Set of 0's and 1's with atleast one 1}

L_2 = {Set of 0's and 1's with atleast one 0}

And draw DFA for the following :

(i) L1∪L2 (ii) $\overline{L_1}$ (iii) L_1L_2.

c. Mention the applications of Regular expression and describe any one in detail. 6

UNIT - III

5 a. Define context free grammar and obtain a grammar to generate the following language, 8

$L = \{a^n b^m c^k / n + 2m = k \text{ for } n \geq 0, m \geq 0\}$.

b. Describe Ambiguous grammar and Is the following grammar ambiguous. 6

$S \rightarrow aB / bA$

$A \rightarrow aS / bAA / a$

$B \rightarrow bS / aBB / b$

c. Consider the grammar $E \rightarrow +EE / *EE / -EE / x / y$. Find the leftmost and rightmost derivation for the string "$+*-xyxy$" and write the parse tree. 6

6 a. Explain Chomsky Normal form of CFG. 6

b. Convert the following grammar into GNF, 10

$S \rightarrow AB1 / 0$

$A \rightarrow 00A / B$

$B \rightarrow 1A1$

c. Explain the need for simplifying a grammar. 4

UNIT - IV

7 a. Explain the following terms : 10

(i) Working of Pushdown Automata (ii) Language acceptance of PDA

(iii) Instantaneous description (iv) Deterministic PDA.

b. Design the PDA for the following language $L = \{a^n b^{2n} / n \geq 1\}$ and show the instantaneous description of the PDA on the input string "aabbbb" 10

Contd….3

8 a. Design deterministic pushdown automata for the following language and draw the transition diagram $L = \{a^n c^m b^n / n, m \geq 1\}$. 10

b. Write the procedure used to convert the given PDA to CFG and 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, 10

$\delta(q_0, a, z_0) = (q_0, Az_0)$
$\delta(q_0, b, A) = (q_0, AA)$
$\delta(q_0, a, A) = (q_1, \varepsilon)$

UNIT - V

9 a. Explain the general structure of multi tape and non-deterministic turing machine and show that are equivalent to basic turing machine. 10

b. Design the turing machine to accept the language $L(M) = \{0^n 1^n 2^n / n \geq 1\}$ and also write its transition diagram and give instantaneous description for the input "000111222". 10

10 a. Write short notes on :
(i) Post Correspondence Problem 10
(ii) Recursive language.

b. Prove that if a language L and its complement are recursively enumerable, then L is recursive. 10

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