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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; May / June - 2019

Theory of Computation

Time: 3 hrs *Max. Marks: 100*

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

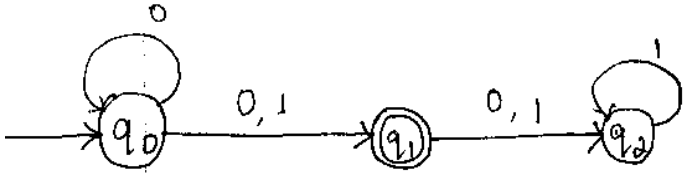
UNIT - I

1 a. Define DFSM for the following :

i) $L = \{w \in \{a, b\}^* : w$ has *bbab* as a substring $\}$ 10

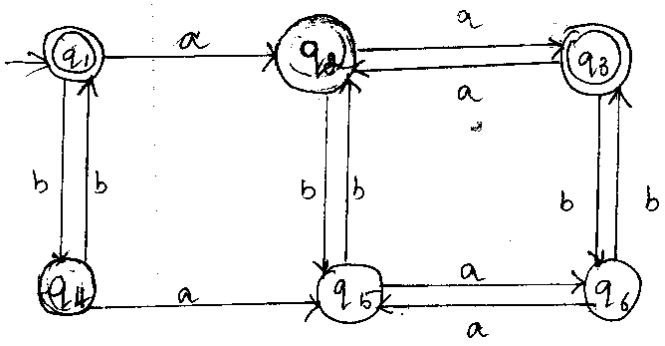
ii) $L = \{w \in \{a - z\}^* :$ all five vowels occur in w in alphabetical order$\}$

b. Design the following NFA to its equivalent DFA,



10

2 a. Minimize the following machine M,



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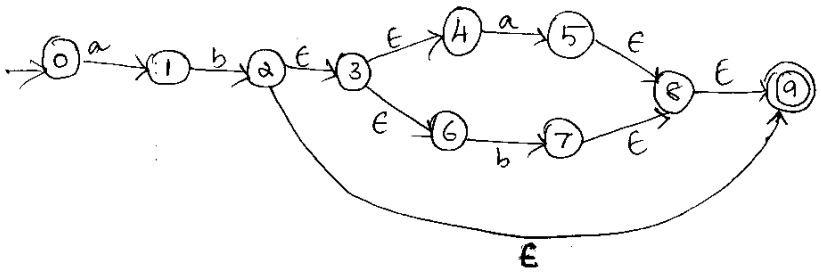
b. Convert the following NDFSM to DFSM,



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UNIT - II

3 a. Give regular expression to describe the following languages :

i) $L = \{w \in \{a, b\}^* :$ Every a in w is immediately preceded and followed by $b\}$ 5

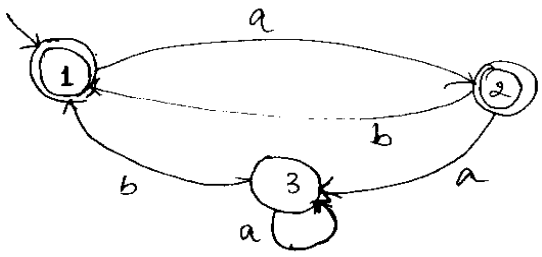
ii) $L = \{w \in \{a, b\}^* : |w|$ is even$\}$ iii) $L = \{w \in \{a, b\}^* :$ w has both *aa* and *aba* as substring?

b. Construct FSM for the given regular expressions : 6

i) *(ab)* (aab)** ii) *(b∪ab)**

Contd…2

c. Convert the following FSM to regular expression using state elimination method : 9



4 a. State and explain Kleene's theorem for regular expression. 10

b. Prove that the regular languages are closed under difference. 5

c. Prove that the language: $L = \{ww^R : w \in \{a,b\}\}$ are not regular languages. 5

UNIT - III

5 a. Define CFG. Construct CFG for the following languages : 7

i) $L = \{a^i b^j c^k \mid k = i + j, \quad i >= 0, \quad j > 0\}$ ii) $L = \{a^n b^m c^k \mid n + 2m = k, \text{ n}, \quad m > 0\}$

b. Consider the grammar: $E \to +EE \mid *EE \mid -EE \mid x \mid y$. Find the left most and right most derivation for the string $+*-x\,y\,x\,y$ and write the parse tree. 5

c. Convert the following grammar into CNF : 8

S→ABC A→ac|D B→bB|∈|A C→Ac/∈|Cc D→aa

6 a. Prove that the context free languages are closure under union, concatenation and Kleene star with example. 8

b. State and prove pumping lemma for CFG and prove that the following languages are not CFL: $L = \{wcw \mid w \in \{a,b\}^*\}$ 12

UNIT - IV

7 a. Design the pushdown automata for the language $L = \{wcw^R / w \in \{a,b\}^*\}$ 14

Also, draw the transition diagram. Show the string acceptance for the string *w* = '*abacaba*'

b. Define Deterministic Pushdown Automata with conditions and give an example. 6

8 a. Design Pushdown Automata for the language $L = \{a^n b^n \mid n \geq 0\}$. Show the string acceptance for *w* = '*aabb*'. 10

b. Obtain PDA from the following grammar : 10

i) S→aABC ii) A→aB/a iii) B→bA/b iv) C→a

UNIT - V

9 a. Construct a Turing machine to accept the language: $L = \{a^n b^n \mid n \geq 0\}$. Draw the transition table. 10

b. Construct a Turing machine to recognize the language: $L = \{0^n 1^n \mid n \geq 0\}$. Show that string acceptance for the string *w* = 0011. 10

10. Write a short notes on the following : 20

i) Undecidable problems ii) Recursively enumerable languages

iii) Multi-track turing machine iv) Post correspondence problem

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