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

(An Autonomous Institution affiliated to VTU, Belgaum)

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

Semester End Examination; June/July - 2015

Finite Automata and Formal Languages

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 Symbols, Alphabets, strings and languages, with analysis. 6

b. Construct a DFA to accept the language $L=\{w(ab+ba)|w\in\{a,b\}^*\}$ 6

c. Construct the following NFA to its equivalent DFA.

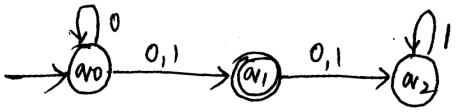

Fig Q1(c).

8

2 a. Convert the following NFA to equivalent DFA.

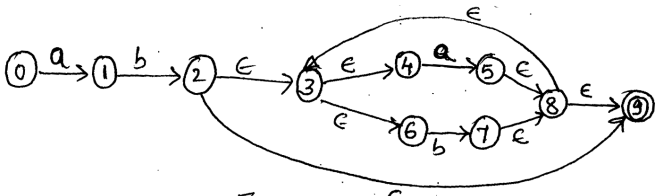

Fig. Q2(a)

10

b. Find the minimized DFA from the following DFA.

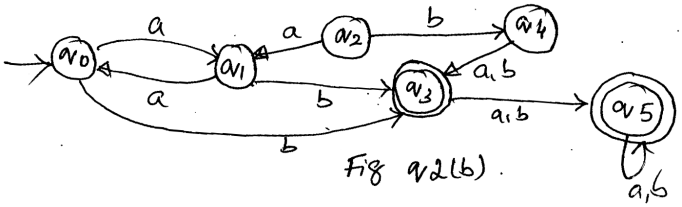

Fig q2(b).

10

UNIT - II

3 a. Write the regular expression for

(i) $L=\{a^n b^m | n\geq 4 \text{ and } m\leq 3$

(ii) $L=\{a^{2n}b^{2m} | n\geq 0 \text{ and } m\geq 0\}$ 8

(iii) $L=\{w\in\{a,b\}|$ ending with b and no substring aa}

(iv) $L=\{w\in\{a,b\}|$ starting with a and ending with b}

Contd…2

b. Obtain NFA for the following regular expression : 8

(i) R = ab(a+b)* (ii) R = (a+b)* aa(a+b)*

c. Explain the application of Regular expressions. 4

4 a. State and prove pumping Lemma for regular languages and show that $L=\{ww^R \mid w\in (0+1)^*\}$ is not regular. 10

b. Convert the following DFA to regular expression using Kleen's theorem. 10

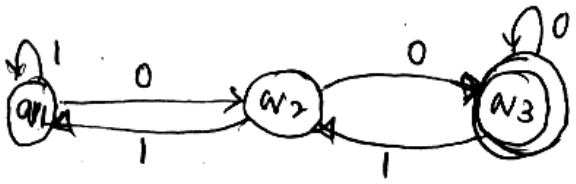

Fig. Q4 (b)

UNIT - III

5 a. Write a CFG for : 8

(i) $L=\{a^m b^n \mid m\neq n\}$ (ii) $L=\{a^n ww^R b^n \mid w\in \Sigma^* n\geq 1\}$

b. Obtain the left most derivation and parse tree for the string aaabbabbba using the following grammar. 6

S→aB|bA

A→aS|bAA|a

B→bS|aBB|b

c. What is ambiguous grammar? Show that the following grammar is ambiguous on the string aaaa. 6

S→aS|X

X→aX|a

6. a. Eliminate the useless symbols in the grammar. 6

S→aA|bB B→bB E→aC|d

A→aA|a D→ab|Ea

b. Define CNF and GNF. Convert the following grammar into CNF 8

S→0A|1B A→0AA|1S|1 B→1BB|0S|0

c. Prove that CFL are closed under union and concatenation. 6

Contd…3

UNIT - IV

7 a. Design a PDA to accept the language $L = \{ww^R \mid w \in (a,b)^*\}$ by final state and show the acceptance of string w = abbbba. 12

b. For the CFG :

S→aABC

A→aB|a

B→bA|b

C→a

obtain the corresponding PDA. 8

8.a. Obtain a PDA to accept the language $L = \{a^n b^{2n} \mid n > 1\}$ and show the acceptance of string w = aabbbb. 12

b. Define DPDA, Prove that PDA to accept the language $L = \{a^n b^n \mid n > 1\}$ by final state is deterministic. 8

UNIT - V

9 a. Explain with neat diagram, the working principle of TM model. 6

b. Design a Turing machine to accept all set of palindromes over {a, b}*. Also show that string acceptance for w = ababa. 14

10. Write a short notes on the following: 20

(i) Post's Correspondence problem (ii) Recursive languages

(iii) Multiple turing machine (iv) halting problem

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