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Fifth Semester B.E. Degree Examination, December 2012

Formal Languages and Automata Theory

Time: 3 hrs.

Max. Marks:100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART – A

- 1 a. Define a DFA and the languages accepted by it. (05 Marks)
 b. Design a DFA to accept a string of a's and b's not ending with abb. (05 Marks)
 c. Design a DFA which accepts odd number of 0's and odd number of 1's. (05 Marks)
 d. Convert the following NFA to DFA. (05 Marks)

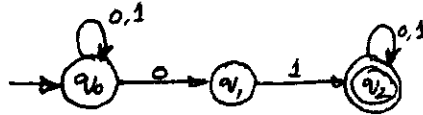


Fig.Q1(d)

- 2 a. Write a note on applications of finite automata. (04 Marks)
 b. Define an ϵ - NFA and ϵ - closure. (04 Marks)
 c. Prove that for every regular expression, there exists a finite automation which accepts the same language accepted by the regular expression. (08 Marks)
 d. Give regular expressions for the following languages:
 i) $L = \{W/W \text{ is in } \{a, b\}^* \text{ and } |W| \bmod 3 = 0\}$
 ii) $L = \{W/W \text{ is a string of even number of 0's followed by odd number of 1's}\}$. (04 Marks)
- 3 a. Prove that regular languages are closed under homomorphism. (05 Marks)
 b. State and prove pumping lemma of regular languages. (05 Marks)
 c. Prove that the language $L = \{WW^R : W \in \{a, b\}^*\}$ is not a regular language. (05 Marks)
 d. Write a note on table filling method. When two states are equivalent or distinguishable? (05 Marks)
- 4 a. Define the following terms:
 i) Leftmost derivation
 ii) Rightmost derivation
 iii) Sentential form
 iv) Yield of a tree
 v) Parsing (05 Marks)
 b. Design a context free grammar for the language $L = \{W = W^R : W \text{ is in } \{a, b\}^*\}$ (05 Marks)
 c. Design a context free grammar for the language $L = \{a^n b^m c^k \text{ where } k = m + n, n, m, k \geq 0\}$. (05 Marks)
 d. Show how ambiguity in grammars are verified with an example. (05 Marks)

PART – B

- 5 a. Explain the working of a PDA with a diagram. (05 Marks)
 b. Design a PDA for accepting $a^{2n}b^n$. (05 Marks)
 c. Define two languages of a PDA. Show that they are equivalent. (05 Marks)
 d. Convert the following CFG to PDA:
 $E \rightarrow E + E \mid E * E \mid id$. (05 Marks)

- 6 a. Define CNF. Give an example. (05 Marks)
b. Define the following:
i) Generating symbol
ii) Reachable symbol
iii) Unit production
iv) Null production
v) Nullable production (05 Marks)
c. Convert the following CFG to CNF:
 $E \rightarrow E + E \mid E * E \mid (E) \mid id.$ (05 Marks)
d. Show that $a^n b^n c^n$ is not a context free language using pumping lemma of CFL. (05 Marks)
- 7 a. Define a Turing machine. Explain the working of a Turing machine. (06 Marks)
b. Design a Turing machine to accept $a^n b^n c^n$. (08 Marks)
c. Show that a multi tape TM is equivalent to a basic TM. (06 Marks)
- 8 a. Write a detailed note on halting problem of Turing machine. (06 Marks)
b. Prove that complement of a recursively enumerable language is recursive. (06 Marks)
c. Write a note on universal Turing machine and show that simulate a computer. (08 Marks)

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