S-782

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MCA-E4

Formal Language and Theory of Automata

Master of Computer Application (MCA)

4th Semester, Examination 2022(Dec.)

Time: 2 Hours Max. Marks: 70

Note : This paper is of Seventy (70) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

Section – A

(Long Answer – type questions)

Note: Section 'A' contains Five (05) long-answer-type questions of Nineteen (19) marks each. Learners are required to answer any two (02) questions only.

[2 x 19 = 38]

P.T.O.

Q.1. (a) Let $\sum = \{a, b\}$ and $L_1 = \{a^n : n \geq 0\}$ and $L_2 = \{b^m : m \geq 0\}$ be two languages over $\sum$. Find the following: (10)

(i) $\sum^*$ (ii) $\sum^+$ (iii) $L_1 \cup L_2$

(iv) $L_1 \cap L_2$ (v) $L_1 L_2$

(b) Define the grammar of formal languages. Write the grammar of the language

$L = \{a^n b^n : n \geq 0\}$ over the alphabet $\sum = \{a,b\}$. (9)

Q.2. (a) Define deterministic finite automation (DFA). Let $\sum = \{a, b\}$, design a DFA that accepts all the words that start with ab. (10)

(b) Describe pumping lemma for context free languages. (9)

Q.3. (a) Define a regular expression. Let $\sum = \{a, b\}$, write regular expressions for the following languages: (10)

(i) set of all the words starting with a and ending with b.

(ii) set of all the words containing the substring ab.

(b) Explain CYK Algorithm. (9)

Q.4. (a) Describe Moore machine. Design a Moore machine that gives a 1 as its output if the input string contains baa as a substring 0 otherwise, so that number of times the substring appears can be counted by counting number of 1's in the output string. Here $\sum = \{a, b\}$ is the input alphabet and $\Pi = \{0,1\}$ is the output alphabet. (10)

(b) Prove that if L is a context-sensitive language, then L is accepted by some linear bounded automaton M. (9)

Q.5. (a) What is DPDA and DCFL? Explain their difference with suitable example. (10)

(b) Describe Chomsky normal form and Greibach normal form. (9)

P.T.O.

Section – B

(Short-answer-type questions)

Note: Section 'B' contains Eight (08) short-answer-type questions of Eight (08) marks each. Learners are required to answer any Four (04) questions only.

[4 x 8 = 32]

Q.1. Define non deterministic finite automaton (NFA). Difference between DFA and NFA.

Q.2. Define regular grammar. Let $\sum = \{a, b\}$, design a DFA corresponding to the regular expression $abba*$.

Q.3. Describe Turing machine, its basic model and working.

Q.4. Design a pushdown automaton that accepts the language L = $\{a^n b^n : n \geq 0\}$.

Q.5. Describe recursive and recursively enumerable languages.

Q.6. Explain Chomsky hierarchy.

Q.7. Explain Post's Correspondence Problem (PCP).

Q.8. Prove that if L_1 and L_2 are context free languages, then $L_1 \cup L_2$ is also a context free language.

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