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NMCA-214

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID :214221

Roll No. | | | | | | | | | | |

MCA

(SEM-II) THEORY EXAMINATION, 2014-15

INTRODUCTION TO AUTOMATA THEORY AND LANGUAGES

Time : 3 Hours] *[Total Marks : 100*

Note: Attempt all questions.

1. Attempt any four parts of the following. 4×5=20

   (a) Define deterministic finite automation. Explain with an example.

   (b) Differentiate between Mealy machine and moore machine.

   (c) Write down the procedure for converting a Mealy machine to its equivalent Moore machine with an example.

   (d) Define regular expression. Find the regular expression corresponding to the language of all strings over the alphabet {0,1} that contains at least two 0's.

$$\delta(q_0,1,Z_0)=(q_0,XZ_0)$$
$$\delta(q_0,1,X)=(q_0,XX)$$
$$\delta(q_0,0,X)=(q_0,X)$$
$$\delta(q_0,\varepsilon,X)=(q_1,\varepsilon)$$
$$\delta(q_1,\varepsilon,X)=(q_1,\varepsilon)$$
$$\delta(q_1,0,X)=(q_1,XX)$$
$$\delta(q_1,0,Z_0)=(q_1,\varepsilon)$$

   (c) Prove that every language accepted by a PDA by final state is also accepted by some PDA by empty stack.

5. Attempt any two parts of the following:- 2×10=20

   (a) Construct a Turing machine for reversing a string.

   (b) Proved that recursively enumerable languages closed under intersection.

   (c) Write short notes on any two of the following:

      i) Universal Turing machine

      ii) Halting Problem

      iii) Church's Thesis

—x—

(e) Give the Chomsky Hierarchy of grammars specifically giving form of production rules in each class. of grammar.

(f) Define ambiguous grammar and un-ambiguous grammar with an example.

2. Attempt any four parts of the following. 4×5=20

(a) Draw a NFA that accepts all strings of 0 and 1 and convert this NFA to DFA.

(b) What do you mean by instantaneous description of Turing machine? Discuss with an example.

(c) Construct a grammar for the following language:

$\left(a^m b^m c^i / m \geq 1, i \geq 0\right)$

(d) What is Arden's theorem? State and prove.

(e) State pumping lemma for regular language. Use pumping lemma to prove that the language L, defined as following is not regular :

L={$0^m 1^n$ / m and n are positive integers and $m \neq n$}

3. Attempt any two parts of the following : 2×10=20

(a) Given the following CFG having S as start symbol, find an equivalent CFG with no useless symbols:

$S \rightarrow aAa / bSb / \varepsilon$

$A \rightarrow C / a$

$B \rightarrow C / b$

$C \rightarrow CDE / \varepsilon$

$D \rightarrow A / B / ab$

(b) What is difference between Chomsky normal form (CNF) and Greibach normal (GNF)? Convert the following grammar in Greibach normal form:

$S \rightarrow AB$

$A \rightarrow BSB / BB / b$

$B \rightarrow a / aAb$

(c) Use of pumping lemma to prove that the following is not CFG:

$\{ a^n b^m \; a^n b^{n+m} / m, n \geq 0\}$

4. Attempt any two parts of the following:- 4×5=20

(a) Convert the following grammar to a Push down automata (PDA) that accepts the same language:

$S \rightarrow 0S1 / A$

$A \rightarrow 1A0 / S / \varepsilon$

(b) Convert the given PDA machine (M) to equivalent context free grammar. The PDA M is defined as $(\{q_0, q_1\} , \{0,1\} , \{X, Z_0\} , \delta, Z_0, \{q_1\}$ where δ is given as follows: