MCA-18

Formal Language and Automata

Master of Computer Application

(MCA-11/16/17)

5th Semester Examination June 2022

Time: 2 Hours   Max. Marks: 80

Note : This paper is of Eighty (80) 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 Twenty (20) marks each. Learners are required to answer any two (02) questions only.

$[2 \times 20 = 40]$

Q.1.

a. Design a Turing Machine to accept a language

$L = \{0^n 1^n \mid n >= 1\}$

b. Explain the different types of representation of Turing machine.

P.T.O.

Q.2.

a. Differentiate with suitable example between recursive and recursively enumerable language.

b. Show that the set $L = \{0^n : n$ is prime number$\}$ is not regular using the pumping lemma.

Q.3.

a. What do you mean by PDA? Compare PDA with FA.

b. Draw a PDA for the language $L = \{wCw^R| w\epsilon(0, 1)^*\}$

Q.4.

a. What are the rules for conversion of regular expression into finite automata?

b. Construct an NFA for the regular expression $(a + b)^*ab$.

Q.5. What do you mean by regular expression and regular language? Obtain the regular expression for the following language:

i. $L = \{w|w\epsilon \{0, 1\}^*$ and w has only one 0$\}$

ii. $L = \{a^n| n$ is divisible by 2 or 3 or 5$\}$

Section – B
(Short-answer-type questions)

Note: Section 'B' contains Eight (08) short-answer-type questions of Ten (10) marks each. Learners are required to answer any Four (04) questions only. [4 x 10 = 40]

Q.1. Write down the CFG generating the language accepted by the following PDA:

$M = (\{q_0, q_1\}, \{0, 1\}, \{Z_0, x\}, \delta, q_0, Z_0, \phi)$

$\delta (q_0, 1, Z_0) = \{(q_0, Z_0)\}$ $\qquad$ $\delta (q_0, \epsilon, Z_0) = \{(q_0, \epsilon)\}$

$\delta (q_0, 1, x) = \{(q_0, xx)\}$ $\qquad$ $\delta (q_1, 1, x) = \{(q_1, \epsilon)\}$

$\delta (q_0, 0, x) = \{(q_1, x)\}$ $\qquad$ $\delta (q_1, 0, Z_0) = \{(q_0, z_0)\}$

Q.2. Construct the NFA for the following regular expression
$10 + (0 + 11)$

Q.3. Prove that $L = \{0^n 1^{2n} \mid n > 1\}$ is not a regular language.

Q.4. What do you mean by PCP? Obtain the solution for the following system of PCP
$A = \{b, babbb, ba\}$ and $B = \{bbb, ba, a\}$

Q.5. Design a DFA for the language $L = \{0^m 1^n \mid m, n > 0\}$

Q.6. Find the union of the following languages:
a. $L_1 = (0, 01, 001)$ and $L_2 = \{1, 11, 1111\}$ over
$\Sigma = \{0,1\}$
b. $L_1 = (a, b, ab)$ and $L_2 = \{a, ab, abb, abbbb\}$ over
$\Sigma = \{a, b\}$

Q.7. Define the term Automata with block diagram. what are the types of Automata?

Q.8. Explain the closure properties of CFL.