BRAINWARE UNIVERSITY

Term End Examination 2023
Programme – MCA-2022
Course Name – Formal Language and Automata Theory
Course Code - MCA203
(Semester II)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) select the correct one: A language can be generated from simple primitive language in a simple way if and only if

a) It is recognized by a device of infinite states
b) It takes no auxiliary memory
c) All of the mentioned
d) None of the mentioned

(ii) Judge from the following options that halting problem be approximated or bounded in any way

a)) Yes, it can be bounded by a finite number of steps.
b) Yes, it can be approximated with a probabilistic algorithm.
c) No, it cannot be approximated or bounded in any way.
d) Only for certain types of Turing machines.

(iii) Identify the following technique that can be used to prove that a language is non regular

a) Ardens theorem
b) Pumping Lemma
c) Ogden's Lemma
d) None

(iv) Choose the correct options Regular Expression for the language of words containing even number of a's is?

a) (a+b)aba(a+b)
b) a+bbaabaa
c) (a+b)ab(a+b)
d) (b+aba)

(v) Inspect the correct option for function of the head in a Turing machine?

a) a) It reads and writes symbols on the tape
b) b) It executes the instructions
c) It stores data
d) It performs arithmetic operations

(vi) Identify the following states from the correct options

a) Accept and Start
b) Accept and read
c) Accept and reject
d) Accept and write

(vii) Inspect the difference between a deterministic Turing machine and a non-deterministic Turing machine from the given alternatives

a) a) A deterministic Turing machine can only make one move at a time, while a non-deterministic Turing machine can make multiple moves at once.

b) b) A deterministic Turing machine can only perform simple arithmetic operations, while a non-deterministic Turing machine can perform complex operations.

c) A deterministic Turing machine can only recognize regular languages, while a non-deterministic Turing machine can recognize any language.

d) A deterministic Turing machine can only accept or reject an input, while a non-deterministic Turing machine can accept or reject an input with different probabilities.

(viii) Idetify the following options L = {aP | p ; } is prime is

a) regular
b) not regular
c) accepted by DFA
d) accepted by PDA

(ix) Identify from the following option that Finite state machine recognize

a) any grammar
b) only context-free grammar
c) Both (a) and (b)
d) only regular grammar

(x) Identify the correct alternatives Any given transition graph has an equivalent

a) regular expression
b) DFSM
c) NDFSM
d) NDFSM

(xi) Identify the total number of states and transitions required to form a moore machine that will produce residue mod 3.

a) 3 and 6
b) 3 and 5
c) 2 and 4
d) 2 and 4

(xii) Choose the correct alternatives: RR* can be expressed in which of the forms:

a) R+
b) R-
c) R+ U R-
d) R

(xiii) Show that the following is not an example of finite state machine system?

a) Control Mechanism of an elevator
b) Combinational Locks
c) Traffic Lights
d) Digital Watches

(xiv) Show that ∑= {a, b, …. z} and A = {Hello, World}, B= {Input, Output}, then (A*∩B) U (B*∩A) can be represented as:

a) {Hello, World, Input, Output, ε}
b) {Hello, World, ε}
c) {Input, Output, ε}
d) {}

(xv) Choose from following which is a nonterminal symbol in a context-free grammar?

a) . a
b) b
c) S
d) None of the above

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Illustrate DFA, NFA & Language? (3)
3. Show a DFA to accept strings of a's and b's starting with the string ab (3)
4. Show a DFA to accept string of 0's and 1's ending with the string 011. (3)
5. Deduct useless symbols from the grammar with productions S -> AB | CA, B ->BC | AB, A ->a, C -> AB | b (3)
6. Compare the basic difference between 2-way FA and TM. (3)

OR

Discover a Turing Machine to recognize 0n1n2n (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Explain the term formal language? (5)
8. Construct a Moore machine that takes strings comprising 0, 1, 2 and 3 as input (base 4 number) whose decimal equivalent modulo 7 is given as output. (5)
9. Discover a RE for all the strings of 0 and 1, but not containing the substring 001 (5)
10. Analyze the following terms with example: (i) Ambiguous Grammar. (ii) Left Recursion (5)
11. Examine the concept of Universal Turing Machine (5)
12. Discover that the following grammar is ambiguous S->aSbS|bSaS|ε (5)

OR

Let G be the grammar S→0B | 1A, A→0 | 0S | 1AA, B→1 | 1S | 0BB. For the string 00110101, Evaluatethe leftmost and rightmost derivation. (5)

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