BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – MCA-2024
Course Name – Formal Language and Automata Theory
Course Code - MCA20201C
(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)   Choose correct options for the application of Moore Machine.

   a) Finite automata without input   b) Finite automata with output
   c) Non- Finite automata with output   d) None of the mentioned

(ii) Identify there are _____ tuples in the finite state machine

   a) 4   b) 5
   c) 6   d) Unlimited

(iii) Show the number of states required to accept string ends with 10

   a) 3   b) 2
   c) 1   d) Can't be determined

(iv) A regular language over an alphabet Σ is one that cannot be obtained from the basic languages using the operation

   a) Union   b) Concatenation
   c) Kleene*   d) All of the mentioned

(v)   Identify that the Language of finite automata is

   a) Type 0   b) Type 1
   c) Type 2   d) Type 3

(vi) Choose the correct alternatives from the following: Regular expression for all strings starts with ab and ends with bba is

   a) aba*b*bba   b) ab(ab)*bba
   c) ab(a+b)*bba   d) All of the mentioned

(vii) Which of the following is a not a part of 5-tuple finite automata?

a) Input alphabet   b) Transition function

c) Initial State   d) Output Alphabet

(viii) Select an automation that presents output based on previous state or current input:

  a) Acceptor   b) Classifier

  c) Transducer   d) None of the mentioned

(ix) Choose the correct answer :If NFA of 6 states excluding the initial state is converted into DFA, the maximum possible number of states for the DFA is

  a) 62   b) 32

  c) 128   d) 127

(x) Choose that NFA, in its name has 'non-deterministic' :

  a) The result is undetermined   b) The choice of path is non-deterministic

  c) The state to be transited next is non-deterministic   d) Statement 1 is false because Statement 2 is false

(xi) Select the correct alternatives According to the 5-tuple representation i.e. FA= {Q, Σ, δ, q, F} Statement 1: q $\in$ Q'; Statement 2: F$\in$Q

  a) Statement 1 is true, Statement 2 is false   b) Statement 1 is false, Statement 2 is true

  c) Statement 1 is false, Statement 2 may be true   d) Statement 1 may be true, Statement 2 is false

(xii) Choose the possible remainders for a DFA accepting binary numbers whose decimal equivalent is divisible by 4.

  a) 0   b) 0,2

  c) 0,2,4   d) 0,1,2,3

(xiii) Choose that the basic limitation of finite automata is

  a) It can't remember arbitrary large amount of information.   b) It sometimes recognize grammar that are not regular.

  c) It sometimes fails to recognize regular grammar.   d) All of the mentioned

(xiv) Choose the correct answer:In NFA, this very state is like dead-end non final state----------

  a) ACCEPT   b) REJECT

  c) DISTINCT   d) START

(xv) Select which one of the following statements is False ?

 a) Context-free languages are closed under union.   b) Context-free languages are closed under concatenation.

  c) Context-free languages are closed under intersection.   d) Context-free languages are closed under Kleene closure.

Group-B
(Short Answer Type Questions)   3 x 5=15

2. Sketch a Finite Automata from given regular expression 10 + (0 + 11)0* 1.   (3)

3. Illustrate a Minimal DFA that accepts all string over the Alphabet Σ = {a, b} such that every accepts string starts and end with same symbol.   (3)

4. Let G = ({S, A1, A2}, {a, b}, P, S), where P consists of S-> aA1A2a, A1->baA1A2b, A2->A1ab, aA1->baa, bA2b->abab. Test whether the string y = babababababababa belongs to L(G) or not.   (3)
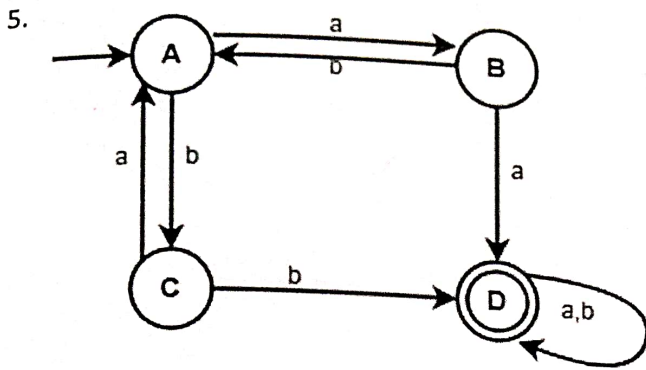
5.

Discover the regular expression from the finite Automata.

(3)

6. Find any two representative strings with minimum length 4 from following context free
   grammar. G= ({S,A,B},{a,b},P,S) S->bA | aB , A->bAA | aS | a , B->aBB | bS | b .   (3)

OR

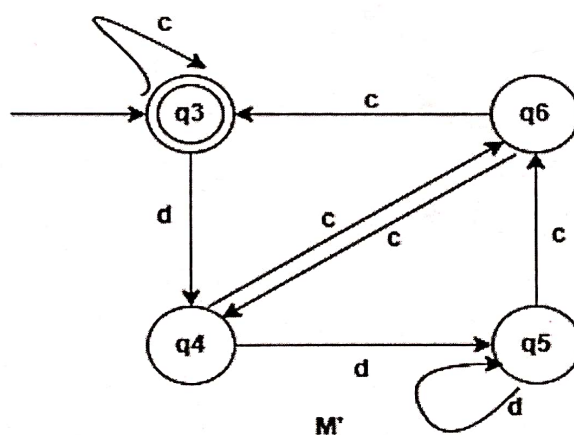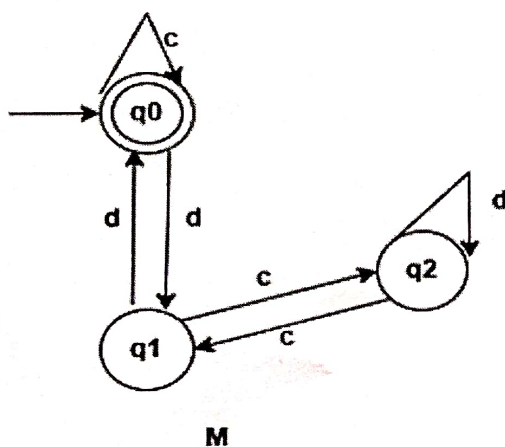Justify TYPE-1 grammar with examples.   (3)

Group-C
(Long Answer Type Questions)   5 x 6=30

7.   (5)

   Identify whether the two DFAs are equivalent or not.

8. Explain Chomsky's Classification with an example.   (5)
9. Deduct a reduced grammar equivalent to grammar: S->aAa , S->bBB , B->ab , C->aB .   (5)
10. Explain Universal Turing Machine and define the Halting Problem of Turing Machine.   (5)
11. Evaluate a grammar to generate the language L = { 0^m1^m2^n | m≥1 and n≥0}.   (5)
12. Consider the following transition diagram of a FA. Justify that the strings recognized are (a + a(b +aa)*   (5)
    b)* a (b +aa)*a.
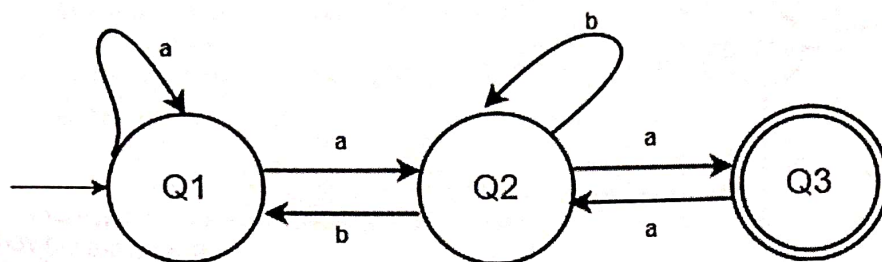
<div align="center">OR</div>

State and prove Arden's theorem. (5)

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