BRAINWARE UNIVERSITY

Term End Examination 2023-2024
Programme – MCA-2022/MCA-2023
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) Identify that, the language generated by finite automata is of:

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

(ii) Show that the number of final states requires accepting Φ in minimal finite automata:

a) 1 b) 2
c) 3 d) None of the mentioned

(iii) 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

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

a) Acceptor b) Classifier
c) Transducer d) None of the mentioned

(v) 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

(vi) Select the following option which is not notated as infinite language-

a) Palindrome b) Reverse
c) Factorial d) L={ab}*

(vii) Solve the following regular expression:ε+1*(011) *(1*(011) *) *

a) (1+011) * b) (1*(011) *)
c) (1+(011) *) * d) (1011) *

(viii) Select the correct answer: In order to represent a regular expression, the first step to create the transition diagram is:

a) Create the NFA using Null moves
b) Null moves are not acceptable, thus should not be used
c) Predict the number of states to be used in order to construct the Regular expression
d) None of the mentioned

(ix) 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) 1 and 4

(x) John is asked to make an automaton which accepts a given string for all the occurrence of '1001' in it. Evaluate the number of transitions would John use such that, the string processing application works:

a) 9
b) 11
c) 1
d) 15

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

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

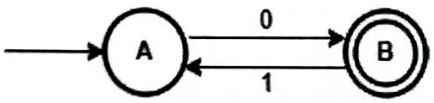
(xii) Choose the following pairs of regular expressions are equivalent:

a) 1 (01)* and (10)* 1
b) x (xx) * and (xx) * x
c) x+ and x+x*+
d) All of these

(xiii) Choose the word 'formal' in formal languages means:-

a) The symbols used have well-defined meaning
b) They are unnecessary, in reality
c) only form of the string of symbols is significant
d) Both (a) and (b)

(xiv) Find the regular expression of the following finite automata.



a) $(0\ 1)(01)^*$
b) $0(01)^*$
c) $0(10)^*$
d) None of these.

(xv) Choose the correct answer Which of the following a turing machine does not consist of,

a) input tape
b) head
c) state register
d) none of the mentioned

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Develop a DFA from the following regular expression a + bb + bab*a. (3)
3. Construct the regular expressions represent the following: a)The set of all strings over {0,1}, beginning with 00. b)The set of all strings over {0,1}, ending with 00 and beginning with 1. (3)
4. Compare DFA with NFA. (3)
5. S → AB | aaB A → a | Aa B → b Explain whether the grammar G is ambiguous or not. If G is ambiguous, construct an unambiguous grammar equivalent to G. (3)
6. 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 = bababababababa belongs to L(G) or not. (3)

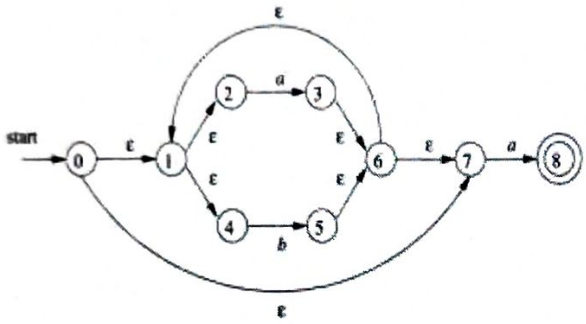
OR

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

Group-C

(Long Answer Type Questions) 5 x 6=30

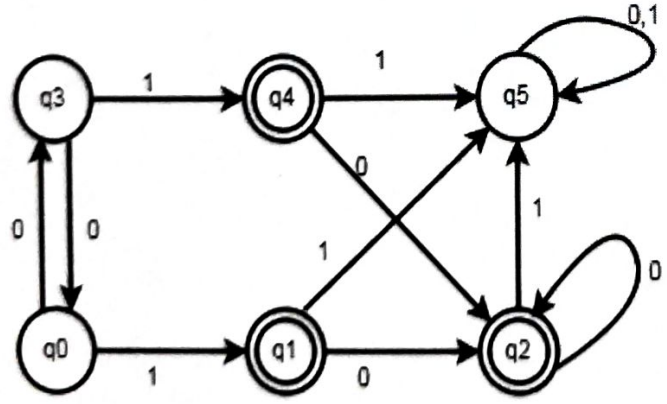
7. Define Ambiguous grammar with an example. (5)
8. Evaluate the following grammar into CNF . S->bA|aB A->bAA|aS|a B->aBB|bS|a (5)
9. Convert the following NFA to the equivalent DFA by using ε-closure operation. (5)



10. Examine that the language L = { $a^n b^n$ | n ≥ 0 } is not regular. (5)

11. (5)

Evaluate the minimization of the given Deterministic Finite Automaton (DFA) using the table filling algorithm, and subsequently, illustrate the resulting equivalent DFA.



12. Remove the unit production from the CFG. s->0A|1B|C A->0S|00 B->1|A C->01. (5)

OR

Evaluate a grammar to generate the language L = { $0^m1^m2^n$ | m≥1 and n≥0} (5)

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