BRAINWARE UNIVERSITY

Course – MCA

Formal Language and Automata Theory (MCA203)

(Semester – 2)

Time allotted:3 Hours **Full Marks : 70**

[The figures 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) Choose the correct alternative for the following: (*Any Ten*) 10x1=10

(i) The logic of pumping lemma is a good example of
a) The pigeon-hole principle
b) The divide and conquer technique
c) Recursion
d) Iteration

(ii) A pushdown automaton is different from a finite automaton because of
a) A read head
b) A memory in the form of stack
c) A set of states
d) All of these

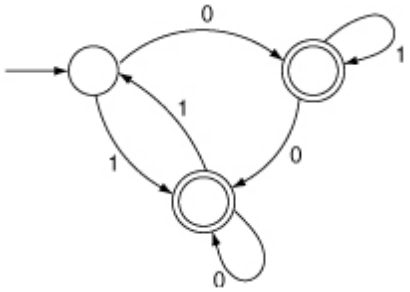
(iii) The production grammar { S→aSbb, S→abb}is
a) type-3 grammar
b) type-2 grammar
c) type-1 grammar
d) type-0 grammar

(iv) Consider the following regular expression : R = (ab + abb)*bbab
Which of the following is not in the set denoted by R?
a) ababab
b) ababbabbbab
c) abbbab
d) abbabbbab

(v) a*(a+b)* is equivalent to
a) a* + b*
b) a*b*
c) (ab)*
d) None of these

(vi) The class of context free language is not closed under
a) Concatenation
b) Union
c) Intersection
d) None of these

(vii) Which string is not accepted by the following FSA?



a) 00111
b) 00110
c) 01010
d) 11010

(viii) The solution of the equation R=Q+RP
a) R=QP*
b) R=Q*P
c) P=RQ*
d) R=P

(ix) If G=({S},{0,1},{S →0S1,S→λ },S) the L(G) is
a) $0^n1^n \mid n\geq 0$
b) $(01)^n \mid n\geq 0$
c) $0^m1^n \mid m,n\geq 0$
d) None of these

(x) By pumping lemma we can prove that a language is
a) regular
b) is not regular
c) Cannot say anything
d) None of these.

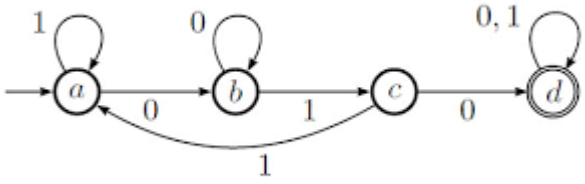
(xi) Moore machine output depends on
a) Input only
b) Input and Present State
c) Present State only
d) None of these

Group – B

(Short Answer Type Question)

Answer *any three* of the following 3x5=15

2. Construct the RE corresponding to the state diagram given below: [5]



3. Design a PDA which accepts the language L={ww^R : w belongs to (0,1)*} [5]

4. Construct a RE for all the strings of 0 and 1, but not containing the substring 001 [5]

5. Write the differences between- [3+2]
   a) Mealy Machine and Moore Machine
   b) NDFA and DFA

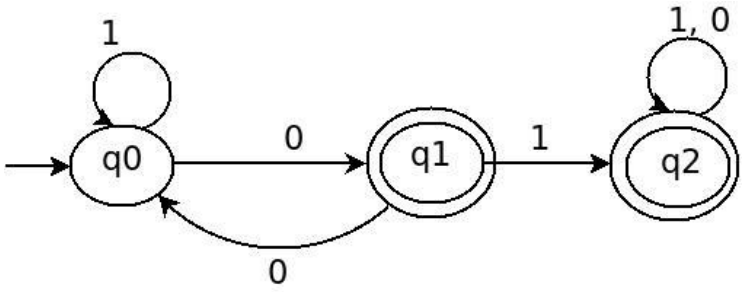
6. Write the production form of different types of grammar. [5]

Group – C

(Long Answer Type Question)

Answer *any three* of the following 3x15=45

7. a) Give a formal definition of DFA. Construct a DFA from the NFA given below: [3+5]



b) Let the production rules of a grammar G is given below: [2+2+3]

$X \rightarrow X + X \mid X * X \mid X \mid a$

Find out the following for the string "a+a*a"

(i) Leftmost derivation

(ii) Rightmost derivation

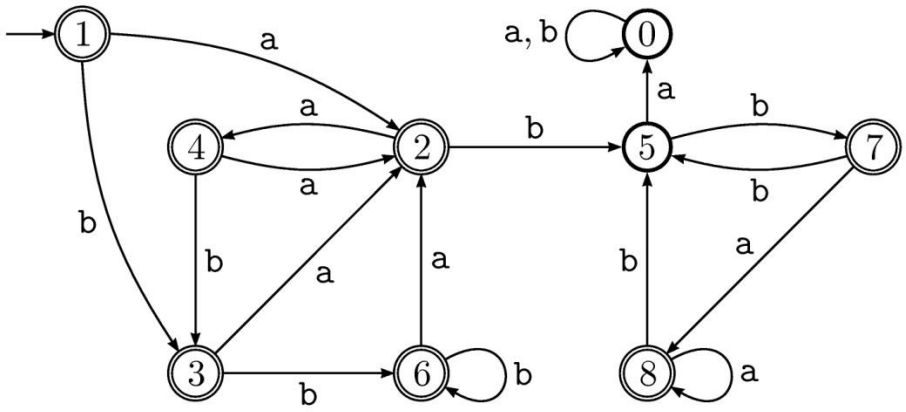
(iii) Parse tree and decide whether the grammar is ambiguous or not.

8. a) Construct a FA equivalent to the RE : (0+1)*(00+11)*(0+1)*. Show all steps [7]
b) Define Pumping lemma. Show that the language $L=\{a^n \mid n \text{ is prime}\}$is not regular [3+5]

9. a) Why simplification of CFG is necessary? [2]
b) Convert the following CFG to CNF: S→ - S | [S ∩ S] | p | q [7]
c) Remove the Null production from the following CFG [6]

S→ ABd
A→ a | λ
B→ b | λ

10. Minimize the following DFA by Myhill Nerode theorem [15]



11. Write Short Notes of the following (Any three) [3x5]
a) Ambiguous Grammar
b) Components of PDA
c) Arden's Theorem and Proof of the theorem
d) Finite State Automata with Output