REV-01
MCA/45/50

2022/07

MASTER OF COMPUTER APPLICATION
SECOND SEMESTER
THEORY OF COMPUTATION
MCA – 204

(Use Separate Answer Scripts for Objective & Descriptive)

Duration: 3 hrs. Full Marks: 70

(PART-A: Objective)

Time: 20 min. Marks: 20

Choose the correct answer from the following: ***1X20=20***

1. The transition function of the NFA machine is given by.
   a. $\sum \times Q \rightarrow \sum$ b $Q \times \sum \rightarrow \sum$
   c. $Q \times \sum \rightarrow Q$ d $Q \times \sum \rightarrow 2$ power Q

2. A regular expression for the set of the string starting with 'a' and ending with 'a,b' is
   a. a*(a+b)*b b. a(a+b)*ab
   c. a*ab d. $a^{+}(a+b)b*$

3. Consider the following two statements:
   S1: { 0^2n | n >= 1} is a regular language
   S2: { 0^m 0^n 0^(m+n) | m >= 1 and n >= 2} is a regular language
   Which of the following statements is correct?
   a. Only S1 is correct b. Only S2 is correct
   c. Both S1 and S2 are correct d. None of S1 and S2 is correct

4. Which of the following is false for FA, M=({q0, q1},{a,b},δ, q0,{q1})
   a. q0∈ Q b. q0 ∈F
   c. abb ∈ $\sum^*$ d. None of the above

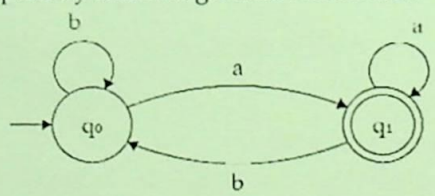
5. The number of states that requires accepting string ends with aaba.
   a. 4 b. 5
   c. 6 d. Only one state is enough.

6. A transition system accepts a string w ∈ $\sum^*$ if
   a. There exists a path that originates from some initial state
   b. There exists a path that terminates at some final state.
   c. There exists a path that originates from some initial state, goes along the arrows, and terminates at some final state
   d. None of the above

7. A FA(Finite Automata) that is capable of accepting a null string is known as
   a. NFA b. DFA
   c. NFA with ∈ moves d. All (a), (b) and (c)

8. Regular expression for the set of string which have exactly a single 1 that end after any no. of zeroes followed by 1.
   a. 1(0)* b. 0*1
   c. 10(0)* d. 10^{+}

9. When will the behavior of a NFA can be simulated by a DFA ?
   a. always
   b. sometimes
   c. never
   d. Depends on NFA
10. Pumping lemma is used for proving
   a. A given grammar is regular
   b. A given language is regular
   c. A given language is not regular
   d. All the above
11. A grammar G = (V, T, P, S) in which T is
   a. Set of variables
   b. Set of terminals
   c. Set of variables and terminals
   d. None of these
12. Turing machine was invented by:
   a. Alan Turing
   b. Turing Man
   c. Turing taring
   d. None of these
13. Context- free languages are not closed under
   a. Union
   b. concatenation
   c. closure
   d. iteration
14. The set of all strings over {0,1}starting with 00 & ending with in 11 is
   a. 0011
   b. 00(0+1)*11
   c. (00)*(11)*
   d. 0*1*
15. Which of the following a turing machine does not consist of?
   a. Input tape
   b. Head
   c. State register
   d. None of these
16. All string having equal number of a's and b's can be recognized by
   a. DFA
   NDFA
   c. PDA
   All the above
17. A Context free grammar A→BC | a is in which normal form
   a. Greibach normal form
   b. Chomsky normal form
   c. Both a) and b)
   d. Neither a) nor b)
18. Which Language is accepted by following Finite Automata ?



   a. (a+b)*(a+b)
   b (a+b)*a
   c. (a+b)*b
   d. a*b
19. The regular expression having all strings of 0's and 1's with two consecutive 0's is
   a. (0+1)
   b. (0+1)*
   c. (0+ε)(1+10)*
   d. (0+1)*011
20. A context-free grammar G is said to be ambiguous if.
   a. It has two or more left most derivations for terminal string S∈ L(G).
   b. It has two or more right most derivation for terminal string S∈L(G).
   c. Neither A or B is true
   d. Both A and B are true

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PART-B: Descriptive

Time : 2 hrs. 40 min. **Marks : 50**

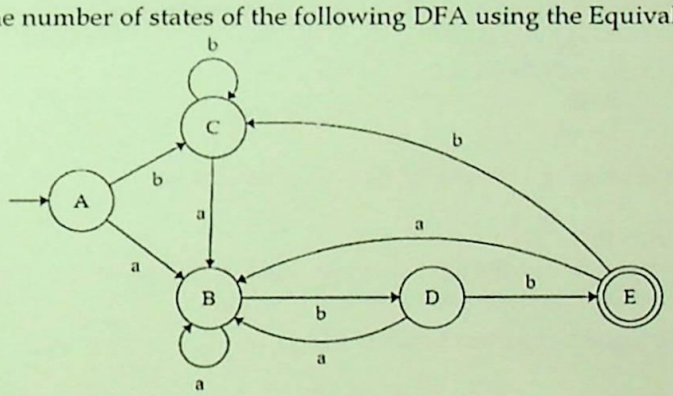
[Answer question no.1 & any four (4) from the rest]

1. What is the main concept of automaton theory? Explain Chomsky Hierarchy with a neat and Clean diagram **2+8=10**

2. Construct a DFA that accepts a language L over input alphabets ∑ = {a, b} such that L is the set of all strings having **2×5=10**
   i. Odd numbers of a's.
   ii. A string having exactly one b
   iii. Number of b which is divisible by 3
   iv. String ending with aaba
   v. String starting with aba

3. Draw DFA for language **5+5=10**
   a. Accepting strings ending with 'abba' over input alphabets ∑={a,b}.
   b. For the language accepting strings ending with 'ab'over input alphabets ∑={a,b}.

4. Reduce the number of states of the following DFA using the Equivalance **10**



theorem,

5. What do you mean by grammar Ambiguity or Ambiguous Grammar? also check whether the given grammar is ambiguous or not-for string w = **aabbccdd** 4+6=10

S → AB / C

A → aAb / ab

B → cBd / cd

C → aCd / aDd

D → bDc / bc

6. a. Write down the formal definition of PDA.Why PDA is considered more powerful than FA?Explain briefly the basic components of PDAwith a proper diagram. 2+2+2+4=10

b. Design a machine using PDA for the language
$L=\{0^n 1^{2n}, n \geq 1\}$

7. Answer the following questions: 5+5=10

a. What are the types of normal forms? Define Chomsky's Normal Form(CNF) with an example. Convert the given grammar to CNF.

S→aAD
A→aB/bAB
B→b
D→d

b. Show that the language $L=\{a^n b^n c^n / n > 0\}$is not regular.

8. Answer the following: 1+4+5=10

a. Write down the name of the data structure used in the case of the Turing Machine. Also,explain the types of Turing Machine.

b. Construct Turing Machine for $L=\{0^n 1^n / n \geq 1\}$

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