REV-01
MCA/04/09

2023/06

SET A

MASTER OF COMPUTER APPLICATION
SECOND SEMESTER (REPEAT)
THEORY OF COMPUTATIONS
MCA-204
[USE OMR SHEET FOR OBJECTIVE PART]

Duration: 3 hrs. **Full Marks: 70**

(Objective)

Time: 30 mins. **Marks: 20**

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

1. A Deterministic Finite Automata(DFA) is a simple:
   a. Function recognition device
   b. Language recognition device
   c. Routine recognition device
   d. None of the above

2. 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

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

4. Which of the following are true?
   a. All NFA are DFA
   b. All DFA are NFA
   c. Both a and b
   d. NFA and DFA have different power

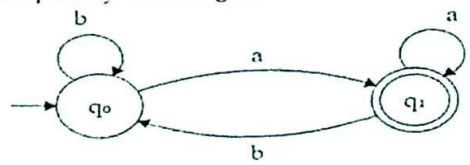
5. Pumping lemma is used for proving:
   a. A given grammar is regular
   b. A given language is regular
   c. A given language is not regular
   d. All the above

6. Context free language is recognized by:
   a. Finite state machine
   b. Linear bounded automata
   c. Push-down automata
   d. Both a and b

7. Which of the following pairs of regular expression are not equivalent?
   a. $(a^* + b^*)^*$ and $(a+b)^*$
   b. $(a^*+b)^*$ and $(a+b)^*$
   c. $(ab)^*a$ and $a(ba)^*$
   d. None of the above

8. All string having equal number of a's and b's can be recognized by:
   a. DFA
   b. NDFA
   c. PDA
   d. All the above

9. Which Language is accepted by following Finite Automata?

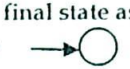
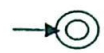


a. (a+b)*(a+b)
b. (a+b)*a
c. (a+b)*b
d. a*b

10. Which of the following is the correct representation of grammar for the given regular expression?
$\{a^n b^n : n \text{ is not multiple of } 3\}$
a. S→aS | ε
b. A→aAb | ε
B→bBc | ε
S→AB
c. S→ab | aabb | ε
d. S→ab | aabb | aaaSbbb

11. Finite automata are used for pattern matching in text editors, for:
a. Compiler lexical analysis
b. Programming in localized application
c. Both a and b
d. None of the above

12. The classic formalization of generative grammar was first proposed by:
a. Alexendar
b. Bill Gates
c. Noam Chomsky
d. Charles Babbage

13. A final state as well as an initial state in a transition diagram is denoted by:
a. 
b. 
c. 
d. None of the above

14. 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 of the above

15. When will the behavior of a NFA can be simulated by a DFA?
a. Always
b. Sometimes
c. Never
d. Depends on NFA

16. Which of the string can be denoted by the regular expression (a+b)(a+b)?
a. {a,b,ab,aa}
b. {a,b,ba,bb}
c. {a,b}
d. {aa,ab,bb,ba}

17. Context- free languages are not closed under:
a. Union
b. Concatenation
c. Closure
d. Iteration

18. Let R1 and R2 be regular sets defined over the alphabet ∑, then:
a. R1∩R2 is not regular
b. R1UR2 is regular
c. ∑*- R1 is regular
d. R1* is regular

19. A Context free grammar $A \rightarrow BC \mid a$ is in which normal form?
    a. Greibach normal form
    b. Chomsky normal form
    c. Both a and b
    d. Neither a nor b

20. 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. $(0+\varepsilon)(1+10)^*$
    d. $(0+1)^*011$

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(Descriptive)

Time : 2 hr. 30 mins. Marks : 50

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

1. What is the main concept of automaton? What do you mean by Alphabet, String, EmptyString and Language in automata theory? Give suitable example. 2+8=10

2. Show that the language $L=\{a^n b^n c^n / n > 0\}$ is not regular. 10

3. a) Write down the formal definition of PDA. Explain briefly the basic components of PDA with proper diagram. 2+3+5=10
   b) Design a machine using PDA for the language $L=\{0^n 1^n, n \geq 1, m \geq 1, m > n+2\}$

4. Draw DFA for language: 5+5=10
   a) Accepting strings ending with 'abba' over input alphabets $\sum=\{a,b\}$.
   b) For the language accepting strings ending with 'ab' over input alphabets $\sum=\{a,b\}$.

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

6. 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

7. a) Write down the name of data structure used in case of Turing Machine. Also write down the application of finite control and tape head used in TM. 1+2+7=10
   b) Construct a Turing Machine which accepts the language of $L=\{WcW/W \varepsilon (0,1)^*\}$.

8. Design a FA from the given regular expression: 5+5=10
   b(a+ab+abb)(ba(a+b)*). Also prove that the intersection of two regular set is regular.(Hint: consider L1=String that start with 0, L2=strings that end with 0, over$\sum=\{0,1\}$)

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