BRAINWARE UNIVERSITY

Term End Examination 2018 - 19

Programme – Bachelor of Science (Honours) in Computer Science

Course Name – Introduction to Automata Theory

Course Code – BCS 503

(Semester - 5)

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

[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 Questions) 10 x 1 = 10

1. *Choose the correct alternative from the following*

(i) The output of a Moore machine depends on

a. The present state only
b. The present state and the input symbol
c. The input symbol only
d. Stack symbol

(ii) Which of the following in not a regular language over {0,1}?

a. Set of all strings containing 1110011 as substring
b. Set of all palindromes
c. Set of all strings beginning with 0110
d. Set of all strings ending with 1101

(iii) An FSM

a. Can recognize only natural language such as Hindi
b. Can recognize all types of languages
c. Cannot recognize any language
d. Can recognize only regular language

(iv) The string 1111 can be generated through the regular expression:

I. (11)*
II. (1+01)*
III. (11+01)
IV. (00+1)*

a. I only
b. I and II only
c. I,II,IV only
d. Using all

(v) The Regular set denoted by the regular expression (a+b)(a+b) is

a. {aa,ba}
b. {aa,ab,ba,bb}
c. {a,b}
d. {a,b,ab,ba}

(vi) Which of the following regular expression represents the language $L=\{a^{2n} \mid n>=0\}$?

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

(vii) A pumping lemma is used for proving that

a. a language is natural
b. two regular sets are equivalent
c. a language is not regular
d. a language is recursively enumerable

(viii) The language accepted by finite automata is

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

(ix) The language $L=\{a^n b^{2n} | n>=1\}$

a. Can be accepted by both PDA and finite automaton
b. Can be accepted neither by PDA nor by a finite automaton
c. Can be accepted by a finite automaton but not by a PDA
d. Can be accepted by a PDA but not by a finite automaton

(x) For the standard Turing Machine

a. $\sum$ is a proper subset of Γ
b. $\Gamma \subseteq \sum$
c. $\sum \subseteq \Gamma$
d. $\sum = \Gamma$

Group – B

(Short Answer Type Questions) 3 x 5 = 15

Answer any *three* from the following

2. Write a brief note on Chomsky classification of grammars. 5

3. Construct a Mealy machine which can output EVEN , ODD according as the total number of 1's encountered is even or odd. The input symbols are 0 and 1. 5

4. What do you meant by Deterministic Finite Accepter? Find a deterministic finite accepter that recognizes the set of all strings on $\sum=\{a,b\}$ which contains even number of a's and odd number of b's. 2+3

5. Prove that there exists an algorithm for determining whether a regular language, given in standard representation, is empty finite or infinite. 5

6. Find the highest type number which can be applied to the following productions:

   $S \rightarrow Aa$, $A \rightarrow c \mid Ba$, $B \rightarrow abc$ 5

Group – C

(Long Answer Type Questions) 3 x 15 = 45

Answer any *three* from the following

7. (a) What do you meant by Push Down Automata? Explain with example. 5

   (b) Construct a Push Down Automata accepting $\{ a^n b^m c^n \mid m,n >=1\}$ by Final state. 10

8. (a) Show that the family of regular languages is closed under differences. 5

   (b) Explain the Pumping Lemma in the context of Regular Language. 5

   (c) Using Pumping Lemma show that $L=\{a^n b^n \mid n>=0\}$ is not regular. 5

9. (a) What do you meant by Context Free Languages? 5

   (b) Construct a context free grammar G generating all integers with sign. Use the grammar to obtain -35 5

   (c) Let G={V,T,P,S} be given by the productions

   $S \rightarrow AB$, $A \rightarrow a$, $B \rightarrow b$, $B \rightarrow C$, $E \rightarrow c$. Find G' such that every variable in G' derives some terminal string. 5

10. (a) Describe Turing Machine with example. 5

    (b) Design a Turing Machine over {1,b} which can compute concatenation function over $\Sigma=\{1\}$. If a pair of words (w_1,w_2) is the input, the output has to be w_1w_2. 10

11. (a) What do you meant by an Uncountable set? Give example of uncountable set. 5

    (b) Prove that the set of all strings over any finite alphabets are countable. 10
