BRAINWARE UNIVERSITY

Term End Examination 2018 - 19

Programme – Master of Computer Applications

Course Name – Formal Language and Atomata Theory

Course Code - MCA203 / MCA203(BL)

(Semester – 2)

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 Question) 10 x 1 = 10

1. *Choose the correct alternative from the following*

(i) A solution of the equation R=Q+RP is

a. R=QP* b. Q=RP*

c. P=RQ* d. R=PQ*

(ii) Which of the following set is a regular?

a. $\{a^i : i=n^2, n>1\}$ b. $\{a^p : p \text{ is prime}\}$

c. {ww:w is in {a,b}*} d. $\{a^{2n} : n>=1\}$

(iii) A finite automaton accepts which type of language:

a. Type 0 b. Type 1

c. Type 2 d. Type 3

(iv) Arden's theorem is true for:

a. More than one initial states b. Null transitions

c. Non-null transitions d. None of the mentioned

(v) The value of L(Φ*) is

a. Σ b. {ε}

c. {} d. None of these

(vi) Pumping Lemma for CFL is used to show that

a. A given language is regular
b. A given language is Context Free
c. A given language is Context Sensitive
d. None of these

(vii) The basic limitation of the finite state machine is that

a. It cannot remember arbitrary large amount of information
b. It cannot recognize grammars that are regular
c. It sometimes recognize grammars that are not regular
d. All of these

(viii) Production Rule: aAb->agb belongs to which of the following category?

a. Regular Language
b. Context free Language
c. Context Sensitive Language
d. Recursively Ennumerable Language

(ix) Which of the expression is appropriate?
For production p: a->b where a∈ V and b∈ _____

a. V
b. S
c. (V+∑)*
d. V+ ∑

(x) For S->0S1|e for ∑={0,1}*, which of the following is wrong for the language produced?

a. 0^n1^n | n>=0
b. 0^n1^n | n>=1
c. Non regular language
d. None of these

Group – B

(Short Answer Type Questions) 3 x 5 = 15

Answer any *three* from the following

2. State and prove the Arden's theorem. 5
3. List any four closure properties of regular languages. 5
4. Show that the following grammar is ambiguous- 5

   S->aSbS|bSaS|ε
5. What is unrestricted grammar? Give an example. 5
6. Give the formal definition of Finite Automata. 5

Group – C

(Long Answer Type Questions) 3 x 15 = 45

Answer any *three* from the following

7. (a) Prove that the family of regular languages is closed under the following operations: 5

i)Union.

ii)Intersection.

iii)Complementation.

iv)Reversal.

v)Concatenation.

(b) Define the following terms: (i) Useless symbol. (ii) Null – production. (iii) Unit production. 6

(c) Remove Null – productions in the following grammar. 4

S→ABaC

A→BC

B→B|ε

C→D|ε

D->ε

8. (a) Write the procedure to convert a given CFG into equivalent grammar in CNF. 7

(b) Let G be the grammar S→0B|1A,A→0|0S|1AA,B→1|1S|0BB. For the string 00110101, find: (i) The leftmost derivation. (ii) The rightmost derivation. (iii) The derivation tree. 3+3+2

9. (a) Let G be S→AB,A→α,B→C|b,C→D,D→E,E→α. Eliminate unit productions and get an equivalent grammar. 5

(b) Draw the merger graph, merger table, compatibility graph and then minimize the following machine. 3+3+2+2

Present State	Next State, o/p		Next State , o/p	
	I/p=0	i/p=1	i/p=2	i/p=3
A	-	C,1	E,1	B,1
B	E,0	-	-	-
C	F,0	F,1	-	-,1
D	-	-	B,1	-
E	-	F,0	A,0	D,-
F	C,-	-	B,0	C,1

10. (a) Construct a PDA that recognizes strings (over alphabet 0 and 1) that contain equal number of 0s and 1s. 8

(b) Explain the concept of Universal Turing Machine. 7

11. (a) What are undecidable problems? Explain why PCP problem is considered undecidable. 4+4

(b) Write variations of Turing machine. 7
