



BRAINWARE UNIVERSITY

LIBRARY
Brainware University
Barasat, Kolkata - 700125

BRUNIBU
BRAINWARE UNIVERSITY
BARASAT, KOLKATA - 700125

Term End Examination 2023

Programme – B.Tech.(CSE)-2018/B.Tech.(CSE)-2019/B.Tech.(CSE)-2020

Course Name – Formal Language and Automata Theory

Course Code - PCC-CS503

(Semester V)

Full Marks : 60

Time : 2:30 Hours

[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

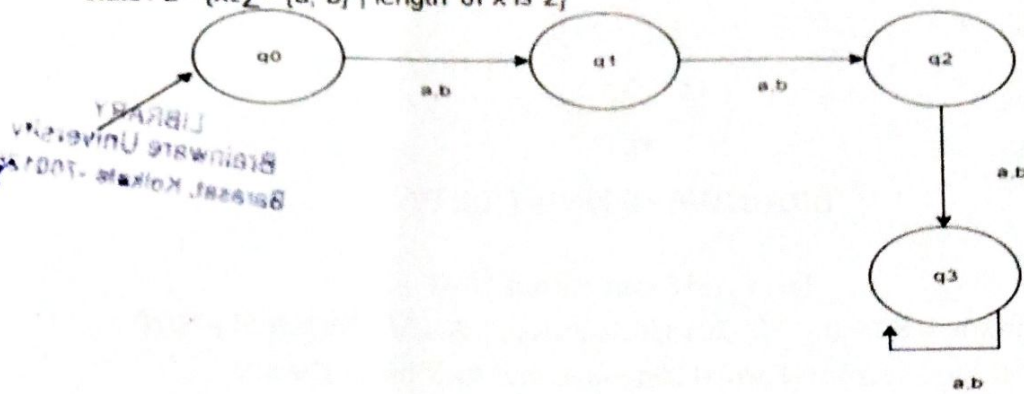
(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

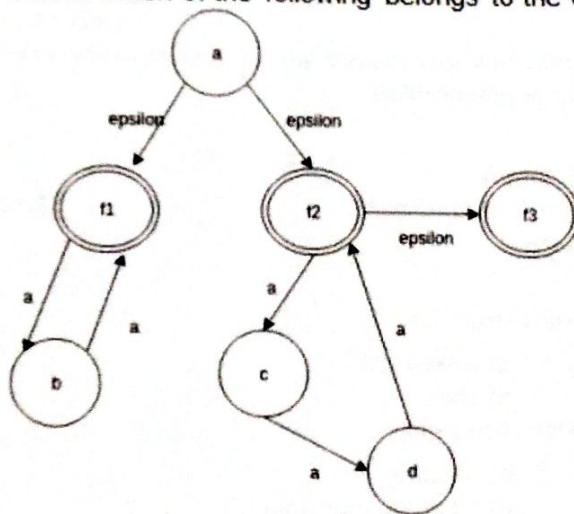
- (i) A push down automaton employs _____ data structure
 - a) Queue
 - b) Linked List
 - c) Hash Table
 - d) Stack
- (ii) Choose which of the following does not have left recursions?
 - a) Pushing
 - b) Popping
 - c) Replacing
 - d) All of the mentioned
- (iii) Choose the correct option: Statement 1: Recursive Inference, using productions from head to body. Statement 2: Derivations, using productions from body to head.
 - a) Statement 1 is true and Statement 2 is true
 - b) Statement 1 and Statement 2, both are false
 - c) Statement 1 is true and Statement 2 is false
 - d) Statement 2 is false and Statement 1 is true
- (iv) If w belongs to $L(G)$, for some CFG, then w has a parse tree, which tell us the _____ structure of w
 - a) semantic
 - b) syntactic
 - c) lexical
 - d) all of the mentioned
- (v) Select when a string is accepted by a PDA when
 - a) Stack is not empty
 - b) Acceptance state
 - c) All of the mentioned
 - d) None of the mentioned
- (vi) The context free grammar which generates a Regular Language is termed as:
 - a) Context Regular Grammar
 - b) Regular Grammar
 - c) Context Sensitive Grammar
 - d) None of the mentioned
- (vii) The non- Kleene Star operation accepts the following string of finite length over set $A = \{0,1\}$ | where string s contains even number of 0 and 1
 - a) 10011010101
 - b) 0011,11001100
 - c) $\epsilon, 0011, 11001100$
 - d) $\epsilon, 0011, 11001100$

(viii) Select which among the following states would be notated as the final state/acceptance state? $L = \{x \in \Sigma^* = \{a, b\} \mid \text{length of } x \text{ is } 2\}$



- a) q1
- b) q2
- c) q1, q2
- d) q3

(ix) Select which of the following belongs to the epsilon closure set of a?



- a) {f1, f2, f3}
 - b) {a, f1, f2, f3}
 - c) {f1, f2}
 - d) none of the mentioned
- (x) Select the minimum number of productions required to produce a language consisting of palindrome strings over input alphabets {a, b} is

- a) 3
 - b) 7
 - c) 5
 - d) 6
- (xi) Select which of the following is an application of Finite Automaton?
- a) Compiler Design
 - b) Grammar Parsers
 - c) Text Search
 - d) All of the mentioned

(xii) Validate, A DPDA is a PDA in which:

- a) No state p has two outgoing transitions
- b) More than one state can have two or more outgoing transitions
- c) Atleast one state has more than one transitions
- d) None of the mentioned

(xiii) Given Language: $\{x \mid \text{it is divisible by } 3\}$ Select the total number of final states to be assumed in order to pass the number constituting $\{0, 1\}$ is

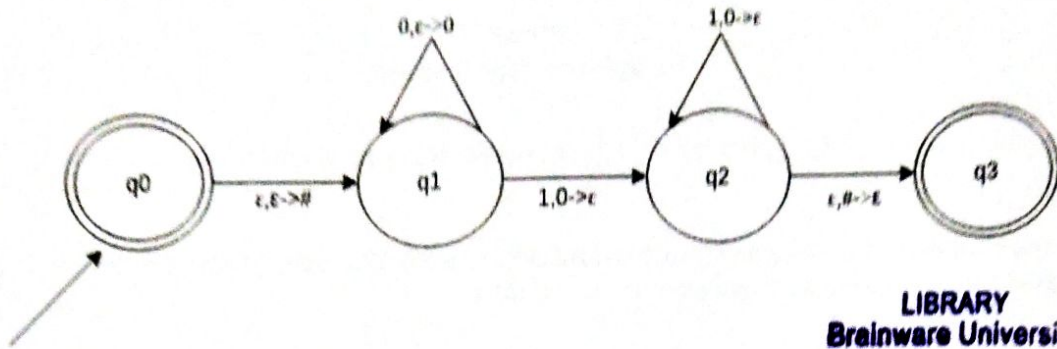
- a) 0
- b) 1
- c) 2
- d) 3

(xiv) Solve, Which of the following strings is not generated by the given grammar: $S \rightarrow SaSbS \mid e$

- a) aabb
- b) abab
- c) abaabb
- d) None of the mentioned

LIBRARY
Brainware University
Barpeta, Kolkata - 700125

(xv) Select which of the following option resembles the given PDA?



- a) $\{0^n 1^n \mid n \geq 0\}$
- c) $\{0^{2^n} 1^n \mid n \geq 0\}$

- b) $\{0^n 1^{2^n} \mid n \geq 0\}$
- d) None of the mentioned

LIBRARY
Brainware University
Barasat, Kolkata - 700125

LIBRARY
Brainware University
Barasat, Kolkata - 700125

Group-B
(Short Answer Type Questions)

3 x 5 = 15

2. Why simplification of CFG is important?

(3)

3. Discuss Chomsky's Hierarchy of formal languages.

(3)

4. Write the process for Convert the grammar into CNF?

(3)

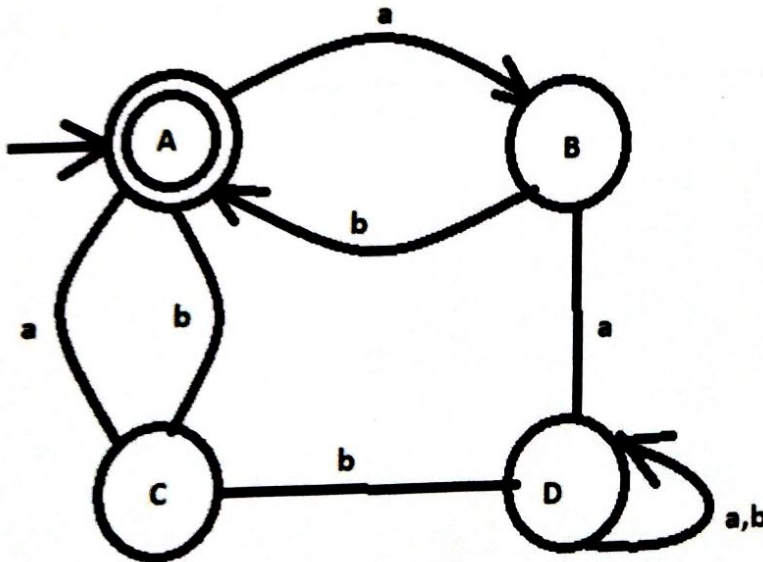
5. Find the parse tree for generating the string 11001010 from the given grammar

(3)

$S \rightarrow 1B/0A$
 $A \rightarrow 1/1S/0AA$
 $B \rightarrow 0/0S/1BB$

6. Find the regular expression from the following Finite automata:

(3)



OR

(3)

Construct a CFG from the following language:

$L = \{(ab)^n \mid n \geq 1\}$

Group-C
(Long Answer Type Questions)

5 x 6=30

7. Prove that the language $L = \{a^n b^n c^n \mid n \geq 1\}$ is not regular using pumping lemma. (5)
8. From the identities of RE, prove that $(0+011^*)+(0+011^*)(01+0100^*)(01+0100^*)^*=01^*(010^*)^*$ (5)
9. Design a FA from given regular expression $10 + (0 + 11)0^* 1$. (5)
10. Convert the following PDA into an equivalent CFG. (5)
- $\delta(q_0, a_0, z_0) \rightarrow (q_1, z_1 z_0)$
 $\delta(q_0, b, z_0) \rightarrow (q_1, z_2 z_0)$
 $\delta(q_1, a, z_1) \rightarrow (q_1, z_1 z_1)$
 $\delta(q_1, b, z_1) \rightarrow (q_1, \lambda)$
 $\delta(q_1, b, z_2) \rightarrow (q_1, z_2 z_2)$
11. Discuss the Halting Problem of Turing Machine (5)
12. Draw the NFA of the following regular expression using Thompson's rule and then convert it into its equivalent DFA using epsilon closure: $(0|1)^* 0$ (5)

OR

Design a Moore machine that will print 1 as as output for every occurrence of "abc" as its substring (5)