ELIZADE UNIVERSITY
ILARA-MOKIN
ONDO STATE

FACULTY: BASIC AND APPLIED SCIENCES

DEPARTMENT: MATHEMATICS AND COMPUTER SCIENCE

2nd **SEMESTER EXAMINATION**

2018 / 2019 **ACADEMIC SESSION**

COURSE CODE: CSC 420

COURSE TITLE: Theory of Automata and Computing

COURSE LEADER: Dr. K. Agbele

DURATION: 2 Hours

HOD's SIGNATURE

INSTRUCTION:

Candidates should answer any THREE (3) Questions.

Students are warned that possession of any unauthorized materials in an examination is a serious assessment offence

Students are permitted to use ONLY a scientific calculator.

1(a) What is an automaton? List and explain the types of Automaton.
(b) Explain the following components of a Finite Machine (i) Input (ii) Return (iii) State (iv) Start State (v) Accepting State (vi) Rejecting State (viii) Dead State (viii) Transition
(c) When is a string accepted by a Non-Finite State Automaton (NFA)?
(d) List five applications of Finite Machine **(20 marks)**

2. (a) Explain the following terms with examples:
(i) Alphabet (ii) Strings (iii) concatenation (iv) reverse of a string (v) length of a string (vi) Empty string (vii) Derivation of sentence (viii) Sentential form (ix) Positive closure
(b) Convert the transition table below to DFA

	a	b
{1, 3}	{1, 3}	{2}
{2}	{2, 3}	{3}
{2, 3}	{1, 2, 3}	{3}
{3}	{1, 3}	ϕ
{1, 2, 3}	{1, 2, 3}	{2, 3}
ϕ	ϕ	ϕ

(c) Construct a DFA which recognizes the set of all strings on $\Sigma = \{a,b\}$, starting with the prefix 'ab'.
(d) Construct a FA accepting all string over {0,1} having even number of 0's and even number of 1's. **(20 marks)**

3. (a) Design a DFA, *M* which accepts the language $L(M) = \{w \varepsilon \{a,b\}^* :$ w does not contain three consecutive b's}.

Let M = {Q, Σ, δ, q_o, F}
Where:
Q = { q_o, q_1, q_2, q_3}, Σ={a,b}, q_o is the initial state, F = { q_o, q_1, q_2, } are final states and δ is defined as follows:

Initial state	Symbol	Final state
q_o	a	q_o
q_o	b	q_1
q_1	a	q_0
q_1	b	q_2
q_2	a	q_o
q_2	b	q_3
q_3	a	q_3
q_3	b	q_3

(b) Let M=({q_1,q_2,q_3}, {0,1}, {q_1}, {q_3} is a NDFA where δ is given by

δ (q_1, 0) = {q_2, q_3) δ (q_1, 1) = {q_1)
δ (q_2, 0) = {q_1, q_2) δ (q_2, 1) = {Φ)
δ (q_3, 0) = {q_2) δ (q_3, 1) = {q_1, q_2)

(i) Construct an equivalent DFA and draw the transition diagram
(ii) Check whether the string '011010' is accepted by DFA and NFA

(c) Obtain the state table diagram and state transition diagram (DFA Schematic) of the finite state Automaton M = {Q, S, δ, q_o, F}, where Q = { q_o, q_1, q_2, q_3,}, S={a,b}, q_o is the initial state, F is the final state with transition defined by

$\delta(q_o, a) = q_2$ $\delta(q_3, a) = q_1$ $\delta(q_2, b) = q_3$
$\delta(q_1, a) = q_3$ $\delta(q_o, b) = q_1$ $\delta(q_3, b) = q_2$
$\delta(q_2, a) = q_o$ $\delta(q_1, b) = q_0$

(20 marks)

4. (a) Construct a DFA that accept the language L = {010, 1} ($\sum = \{0, 1\}$)
(b) Construct a DFA over alphabets {0, 1} that accept all strings that end in 101.
Hint: The DFA must remember the last 3 bits of the string it is reading.
(c) Build an automaton that accepts all and only those strings that contain 101
(d) Consider the following grammar:

S $\longrightarrow$ SA/A
A $\longrightarrow$ aAb/λ

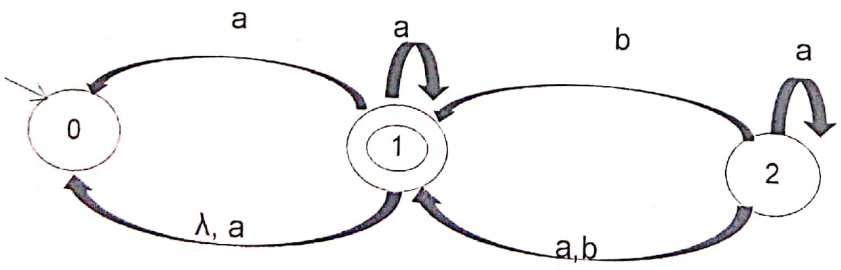
Show the left-most-derivation, rightmost, and derivation tree for the string

(20 marks)

5. (a) (f) Draw an NFA that accepts the language defined by the following grammar:

S $\longrightarrow$ aaA/λ
A $\longrightarrow$ bbB/ccC
B $\longrightarrow$ Bb/Bc
C $\longrightarrow$ Cc/S

(bi) Draw an example of a graph that has six vertices and six edges. Mark all simple cycles in your graph.
(bii) Draw an example of a tree that has seven vertices, five of which are leaves. How many edges are in your tree.
(c For the alphabet $\sum = \{a, b\}$, draw a deterministic finite accepter that is equivalent to the following accepter:



(20 marks)