



KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR**

**END OF SEMESTER EXAMINATIONS
YEAR TWO SEMESTER TWO EXAMINATIONS
FOR DEGREE IN
(COMPUTER SCIENCE)**

COURSE CODE: CSC 220

COURSE TITLE: AUTOMATA THEORY

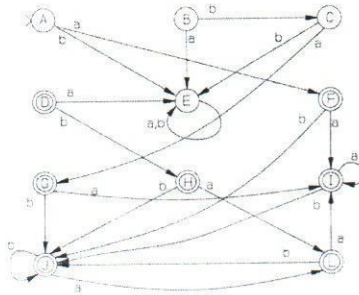
DATE: 13/5/2022 TIME: 02.00 P.M – 04.00 P.M

INSTRUCTIONS

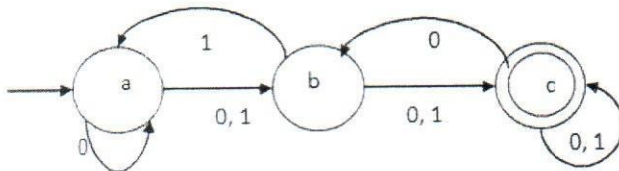
ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS.

QUESTION ONE (COMPULSORY) [30 MARKS]

- a) Define the following terms as used in automata theory. [2Mks]
 i. DFA
 ii. NFA
- b) Discuss the applications of Finite Automata. [4Mks]
- c) Given the following state diagram, draw its transitional table. [6Mks]



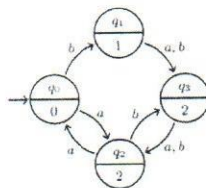
- d) Convert the following NFA to DFA? [6Mks]



- e) Minimize the following DFA resulting from d) above using Equivalence Theorem showing tables after each step. [8Mks]
- f) Describe criteria used to decide on the equivalence of two states. [4Mks]

QUESTION TWO [20 MARKS]

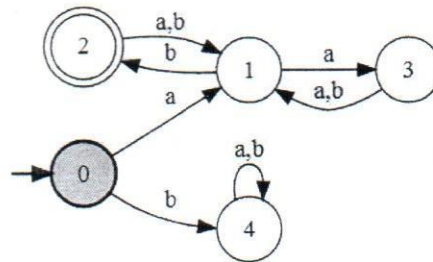
- a) Define the following terms. [2Mks]
 i) Moore Machine (Mo)
 ii) Grammar
- b) Describe conditions that must be satisfied for a grammar to be in Type-1. [4Mks]
- c) Convert the following Moore Machine to Mealy Machine. [6Mks]



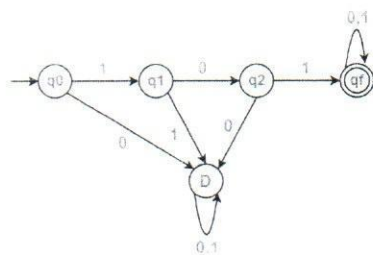
- d) Given Grammar $G = (\{S\}, \{0,1\}, S, \{ S \rightarrow 0S1S \mid 1S0S \mid \epsilon \})$, show how you can derive String **1001101100** [4Mks]

QUESTION THREE [20 MARKS]

- a) Explain the following concepts used in Automata Theory. [2Mks]
 a. Regular Grammar
 b. Null Moves
- b) Give Regular Set generated by the following Regular Expression. [4Mks]
 i) $(a^*b)^*ab^+bb$
 ii) $(0+1)^*1(0+1)+(0+1)^*1(0+1)(0+1)$
- c) Arden's Theorem is used to find a regular expression of a finite automaton, using this theorem construct a regular expression corresponding to the following automata. [6Mks]



- d) Construct a Finite Automaton from the following Regular Expression. [4Mks]
 $(0+1)^*1(0+1)+(0+1)^*1(0+1)(0+1)$
- e) Find the complement of the following DFA. [4Mks]



QUESTION FOUR [20 MARKS]

- a) Explain the following terms as used in Automata Theory. [4Mks]
 i) Context-free grammar
 ii) Sentential Form
- b) Let any set of production rules in a CFG $S \rightarrow 0S1S / 1S0S / \epsilon$, generate Rightmost derivation of **1001101100** and draw equivalent derivation tree. [6Mks]

- c) Remove Unit Productions from the following production rules. [6Mks]

$$\begin{aligned} S &\rightarrow WX \\ W &\rightarrow aWb \mid X \\ X &\rightarrow XY \mid Z \\ Y &\rightarrow cY \\ Z &\rightarrow dZd \mid d \end{aligned}$$

- d) Convert the following Grammar G to Chomsky Normal Form. [4Mks]

$$S \rightarrow ABa \mid AC$$
$$A \rightarrow Ab \mid a$$
$$B \rightarrow b \mid C \mid \lambda$$
$$C \rightarrow aa \mid AA$$

QUESTION FIVE [20 MARKS]

- a) Define the following terms. [2Mks]
- Push Down Automata (PDA)
 - Turing Machine(TM)
- b) Explain how context free language is accepted by PDA? [8Mks]
- c) Show that L is recognized by Turing Machine with a two infinite tape if and only if it is recognized by a Turing Machine with a one way infinite tape. [8Mks]
- d) What is the purpose of studying Turing Machine? [2Mks]