



(Knowledge for Development)

KIBABII UNIVERSITY

(KIBU)

**UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR
END OF SEMESTER EXAMINATIONS
SECOND YEAR SEMESTER TWO EXAMINATIONS**

**FOR THE DEGREE OF
BACHELOR OF SCIENCE
(COMPUTER SCIENCE)**

**COURSE CODE : CSC 220
COURSE TITLE : AUTOMATA THEORY**

DATE: 20/04/2023

TIME: 2.00PM:4.00PM

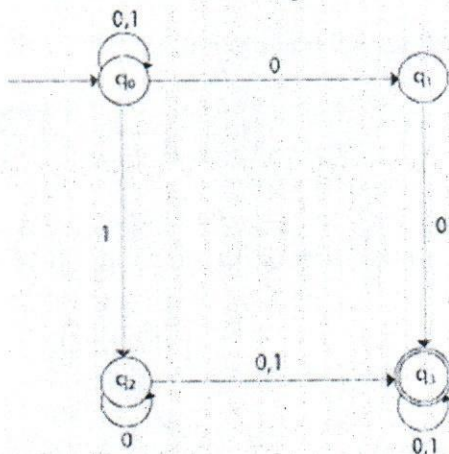
INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

SECTION ONE [COMPULSORY]

Question #1 [30 Marks]

- a) What do you understand by the following terms as used in automata theory? [3 Marks]
- i. Automaton
 - ii. DFA
 - iii. Grammar
- b) With the help of a transition table and State Diagram, describe features of the following Finite Automata. [6 Marks]
- i) Deterministic Finite Automata
 - ii) Non-Deterministic Finite Automata
- c) Describe four applications of automata theory. [4 Marks]
- d) Elucidate four limitations of finite automata. [4 Marks]
- e) Consider the following Non-Deterministic Finite Automaton (NDFA)

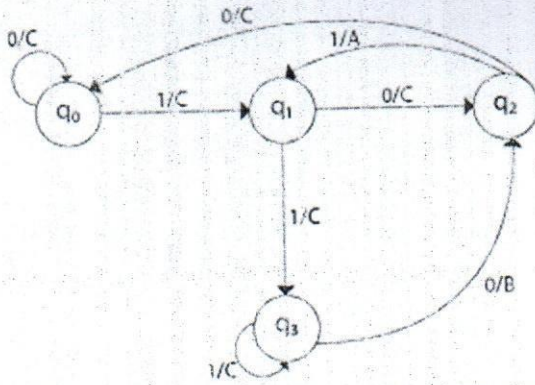


- i. Draw Transition Table for this NDFA. [3 Marks]
- ii. Convert this NDFA to equivalent DFA. [6 Marks]
- iii. Using Equivalence Theorem, minimize the resulting DFA. [4 Marks]

SECTION TWO [ANSWER ANY TWO]

Question #2 [20 Marks]

- a) Describe the principle difference between the following terms? [4 Marks]
- i. Input Alphabet and Output Alphabet
 - ii. Language and Grammar
- b) Develop a NDFA to accept strings ending with 'aba' over {a,b} [4 Marks]
- c) Convert the following Moore Machine to Mealy Machine. [6 Marks]



- d) Using examples, show production characteristics of the following grammars as proposed by Noam Chomsky. **[6 Marks]**
- Type 0
 - Type 1
 - Type 2

Question #3 [20 Marks]

- a) Explain using examples the following terms as used in Automata Theory. **[4 Marks]**
- Yield of a Parse Tree
 - Ambiguity in Context-Free Grammars
- b) Let G be the grammar. Find the Leftmost derivation, rightmost derivation and parse tree for the expression " $a*b+a*b$ ". **[6 Marks]**
- $G: S \rightarrow S + S \mid S * S$
 $S \rightarrow a \mid b$
- c) Find out whether the language $B = \{a^n b^n c^i \mid i \leq n\}$ is context free or not. **[4 Marks]**
- d) Using examples, describe characteristics of a grammar that is in Greibach Normal Form (GNF). **[6 Marks]**

Question #4 [20 Marks]

- a) Describe any four properties of Regular Sets. **[4 Marks]**
- b) Write a regular expression for each of the following languages (for each of them, the alphabet is $\{a,b\}$). **[6 Marks]**
- Strings that contain ab .
 - Strings whose second letter is an a .
- c) Construct Finite Automaton from the following Regular Expression. **[6 Marks]**
- $b^*ab^*ab^* + a^*ba^*+ba^*$
 - $(a+b)^*(aa+b^*b)$
 - b^*+a+b^*
- d) Discuss the principles behind pumping lemma for Regular Languages. **[4 Marks]**

Question #5 [20 Marks]

- a) Define the use of the following machines. **[4 Marks]**
- i. Pushdown Automaton (PDA)
 - ii. Turing Machine (TM)
- b) Construct deterministic PDA to recognize a^nabb^n , $n>0$ over $\{a,b\}$ **[10 Marks]**
- c) Design a Turing machine to recognize all strings consisting of odd number of a's. **[6 Marks]**