(Knowledge for Development)

KIBABII UNIVERSITY

(KIBU)

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

SUPPLEMENTARY/SPECIAL EXAMINATIONS
SECOND YEAR SEMESTER TWO EXAMINATIONS

FOR THE DEGREE OF
(COMPUTER SCIENCE)

COURSE CODE : CSC 220

COURSE TITLE : **AUTOMATA THEORY**

DATE: 29/07/2022   **TIME:**   08.00 A.M – 10.00 A.M

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE (COMPULSORY) [30 MARKS]

a) What do you understand by the following terms as used in automata theory?
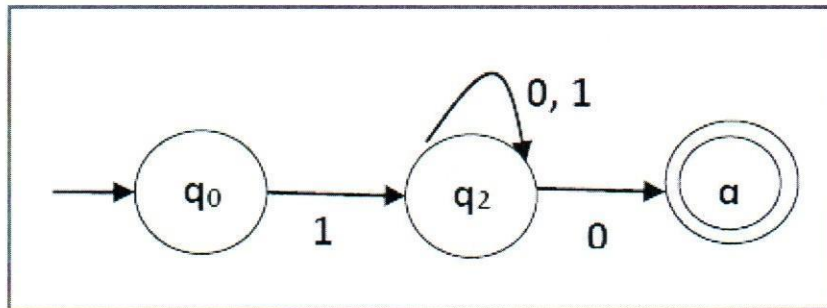
[3 Marks]

   i.   Alphabet

   ii.   Kleene Star

   iii.   Language

b) Using an example, describe the functioning of the following finite automata?

[6 Marks]

   i)   Deterministic Finite Automata

   ii)   Non-Deterministic Finite Automata

c) Automata theory knowledge can be used in computer science for various purposes, describe at least four of these purposes. **[4 Marks]**

d) 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 Myphill-Nerode Theorem, minimize the resulting DFA. **[4 Marks]**

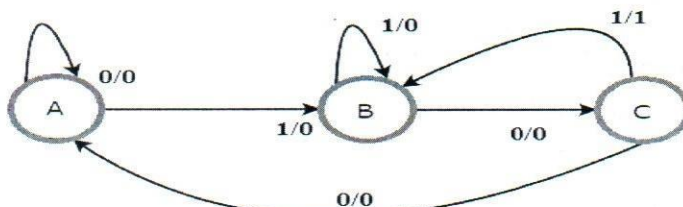   iv.   Represent this automaton in terms of a regular grammar. **[4 Marks]**

QUESTION TWO [20 MARKS]

a) Describe the principle difference between the following terms? **[4 Marks]**

   i.   Mealy Machine and Moore Machine

   ii.   Language and Grammar

b) Explain four characteristics of Moore Machine. **[4 Marks]**

c) Convert the following Mealy Machine to Moore Machine. **[6 Marks]**

d) Describe the following grammars as proposed by Noam Chomsky. **[6 Marks]**

   i.   Type 0

   ii.   Type 1

iii. Type 2

QUESTION THREE [20 MARKS]

a) Explain using examples the following terms as used in Automata Theory. **[4 Marks]**

   i. Yield of a Parse Tree
   ii. Ambiguity in Context-Free Grammars

b) Given grammar G with productions $S \to SaS \mid aSb \mid bSa \mid SS \mid \epsilon$ generate leftmost derivation for "**babba**" **[4 Marks]**

c) Find out whether the language $B = \{a^n b^n c^i \mid i \leq n\}$ is context free or not. **[6 Marks]**

d) Using examples, describe characteristics of a grammar that is in Chomsky Normal Form (CNF). **[6 Marks]**

QUESTION FOUR [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]**

   i. Strings with at least two b's that end in aa.
   ii. Strings whose third letter is an a.

c) Construct Finite Automaton from the following Regular Expression. **[6 Marks]**

   i. b*ab*ab* + a*ba*ba*
   ii. (a+b)*(aa+bb)
   iii. b*+ab*

d) Discuss the principles behind pumping lemma for Regular Languages. **[4 Marks]**

QUESTION FIVE [20 MARKS]

a) Define the use of the following machines. **[4 Marks]**

   i. Pushdown Automaton (PDA)
   ii. Turing Machine (TM)

b) Describe the functioning of PDA. **[4 Marks]**

c) Construct a PDA for language L = {0n1m | n >= 1, m >= 1, m > n+2} **[6 Marks]**

d) Design a Turing machine to recognize all strings consisting of even number of a's. **[6 Marks]**