KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR

SPECIAL/SUPPLEMENTARY EXAMINATIONS

SECOND YEAR SECOND SEMESTER

FOR DEGREE IN
COMPUTER SCIENCE

COURSE CODE: CSC 220

COURSE TITLE: AUTOMATA THEORY

DATE: 13/01/2022 **TIME:** 02.00 P.M – 04.00 P.M

INSTRUCTIONS

ANSWER **QUESTION ONE** AND **ANY** OTHER **TWO QUESTIONS.**

a.i) An automaton that produces outputs based on current input and/or previous state

a.ii) an abstract self-propelled computing device which follows predetermined sequence of operations automatically.

QUESTION ONE (COMPULSORY) [30 MARKS]

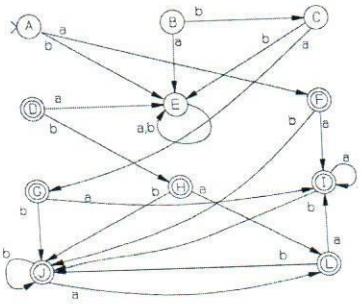
a) Define the following terms as used in automata theory. [2Mks]

i. Transducer

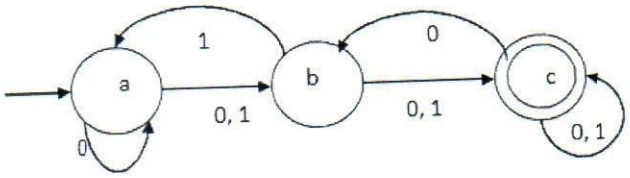
ii. Automata

b) DFA and NDFA are Finite Automata. Sighting reasons, which one is superior. [4Mks]

c) Given the following state diagram, draw its transitional table. [6Mks]



d) Convert the following NDFA 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]

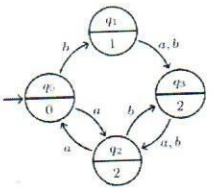
a) Define the following terms. [2Mks]

i) Moore Machine (Mo) The output depends only on the current state.

ii) Grammar denote syntactical rules for conversation in natural languages.

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]



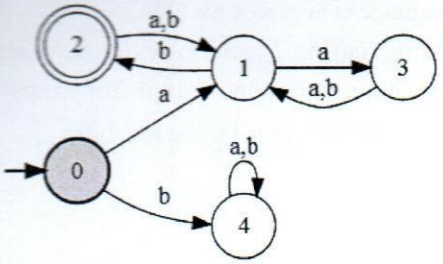
d) Given Grammar G=({S},{0,1},S,{ $S \rightarrow 0S1S \mid 1S0S \mid \varepsilon$ }), show how you can derive String **1001101100** [4Mks]

QUESTION THREE[20 MARKS]

a) Explain the following concepts used in Automata Theory. [2Mks]
   a. Regular Grammar
   b. Null Moves

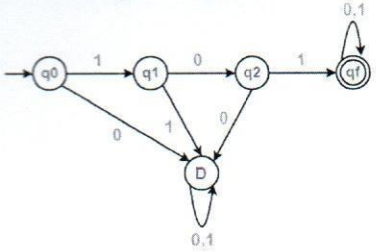
b) Give Regular Set generated by the following Regular Expression. [4Mks]
   i) $(a^*b)^*ab^+bb$
   ii) $(0+1)^*1(0+1)+(0+1)^*1(0+1)(0+1)$

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 $S \rightarrow 0S1S/1S0S/\varepsilon$, 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]
   i) Push Down Automata (PDA)
   ii) 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) Explain the role of checking of Symbols in a Turing Machine. [2Mks]

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