

*Knowledge for Development*

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**KIBABII UNIVERSITY**

**UNIVERSITY EXAMINATIONS  
2019/2020 ACADEMIC YEAR**

**END OF SEMESTER EXAMINATIONS  
YEAR TWO SEMESTER TWO  
FOR DEGREE OF  
COMPUTER SCIENCE**

**COURSE CODE: CSC 220**

**COURSE TITLE: AUTOMATA THEORY**

**DATE: 15/02/2021 TIME: 08.00 A.M – 10.00 A.M**

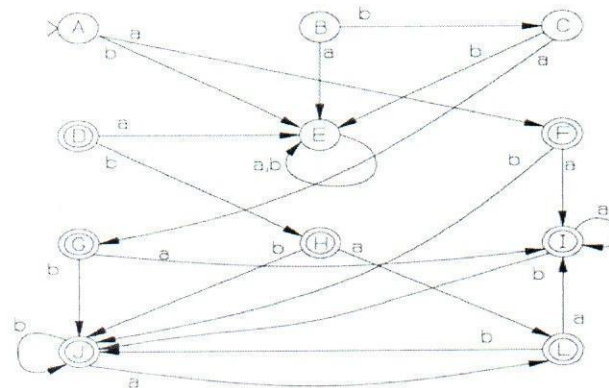
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**INSTRUCTIONS:**

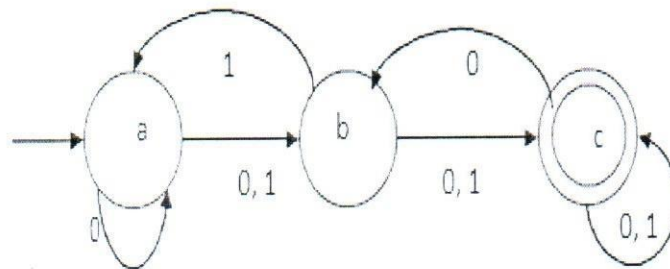
**ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS**

**QUESTION ONE [COMPULSORY] [30 MARKS]**

- a) Define the following terms as used in automata theory.
- i. Transducer [1 mark]
  - ii. Automata [1 mark]
- b) DFA and NFA are Finite Automata. Sighting reasons, which one is superior. [4 marks]
- c) Given the following state diagram, draw its transitional table. [6 marks]



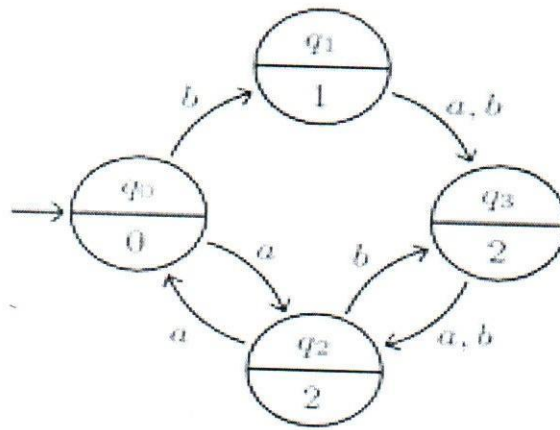
- d) Convert the following NFA to DFA? [6 marks]



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

**QUESTION TWO [20 MARKS]**

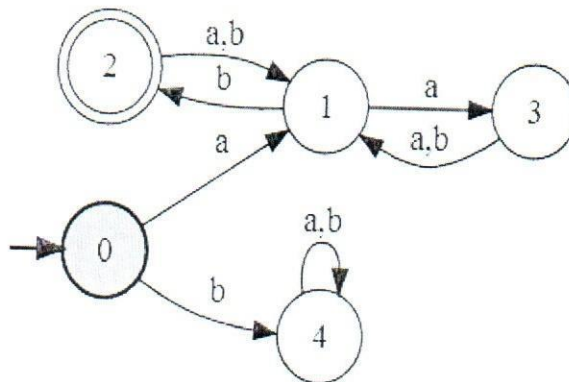
- a) Define the following terms.
- i) Moore Machine (Mo) [1 mark]
  - ii) Grammar [1 mark]
- b) Describe conditions that must be satisfied for a grammar to be in Type-1. [4 marks]
- c) Convert the following Moore Machine to Mealy Machine. [6 marks]



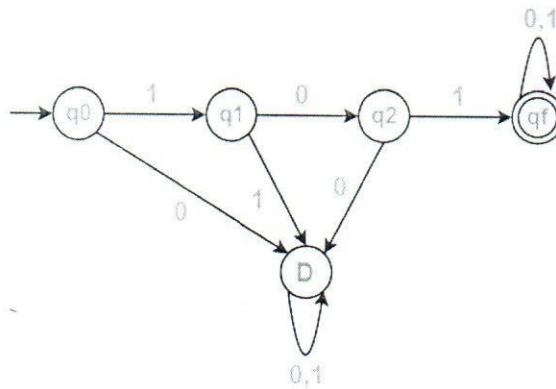
- d) Given Grammar  $G = (\{S\}, \{0,1\}, S, \{ S \rightarrow 0S1S \mid 1S0S \mid \epsilon \})$ , show how you can derive String **1001101100** [4 marks]

**QUESTION THREE [20 MARKS]**

- a) Explain the following concepts used in Automata Theory. [1 mark]  
 a. Regular Grammar [1 mark]  
 b. Null Moves [4 marks]
- b) Give Regular Set generated by the following Regular Expression. [4 marks]  
 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. [6 marks]



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



**QUESTION FOUR [20 MARKS]**

- a) Explain the following terms as used in Automata Theory.
- i) Context-free grammar [2 marks]
  - ii) Sentential Form [2 marks]
- 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. [6 marks]
- c) Remove Unit Productions from the following production rules. [6 marks]

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

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

$$\begin{aligned}
 S &\rightarrow ABa \mid AC \\
 A &\rightarrow Ab \mid a \\
 B &\rightarrow b \mid C \mid \lambda \\
 C &\rightarrow aa \mid AA
 \end{aligned}$$



**QUESTION FIVE [20 MARKS]**

- a) Define the following terms.
- i) Push Down Automata (PDA) [1 mark]
  - ii) Turing Machine(TM) [1 mark]
- b) Explain how context free language is accepted by PDA? [8 marks]
- 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. [8 marks]
- d) Explain the role of checking of Symbols in a Turing Machine. [2 marks]