



**KIBABII UNIVERSITY**

**UNIVERSITY EXAMINATIONS  
2020/2021 ACADEMIC YEAR**

**END OF SEMESTER EXAMINATIONS  
YEAR TWO SEMESTER TWO EXAMINATIONS**

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

**COURSE CODE : CSC 220**

**COURSE TITLE : AUTOMATA THEORY**

**DATE: 05/10/2021 TIME: 02.00 P.M – 04.00 P.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.

[2Mks]

- i. String
- ii. Automata

b) Describe two categories of Finite Automaton.

[4Mks]

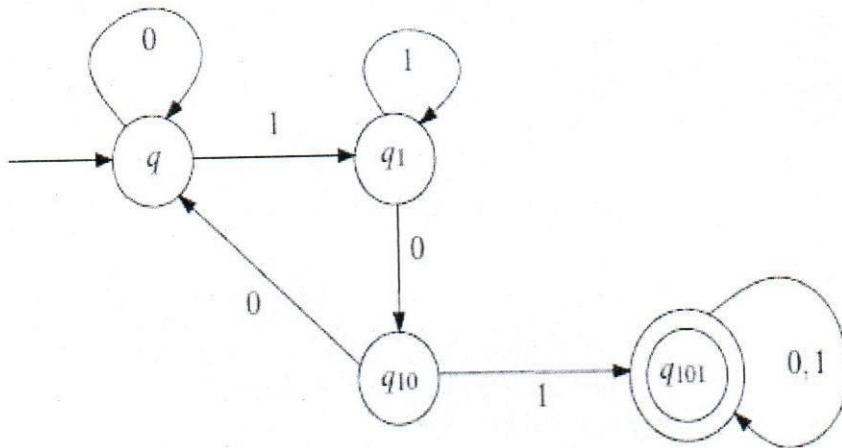
c) Explain two conditions that must be satisfied for a string to be accepted by DFA/NDFA.

[4Mks]

d) Generate the transition table for the following Automaton.

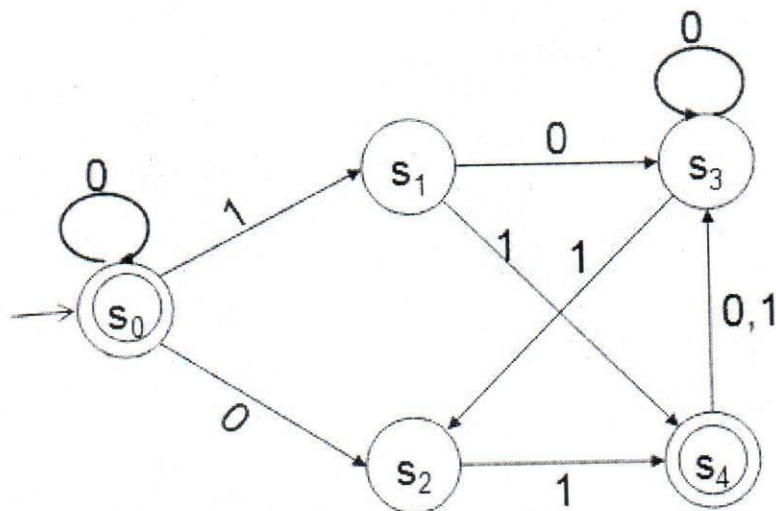
[4Mks]

[6Mks]



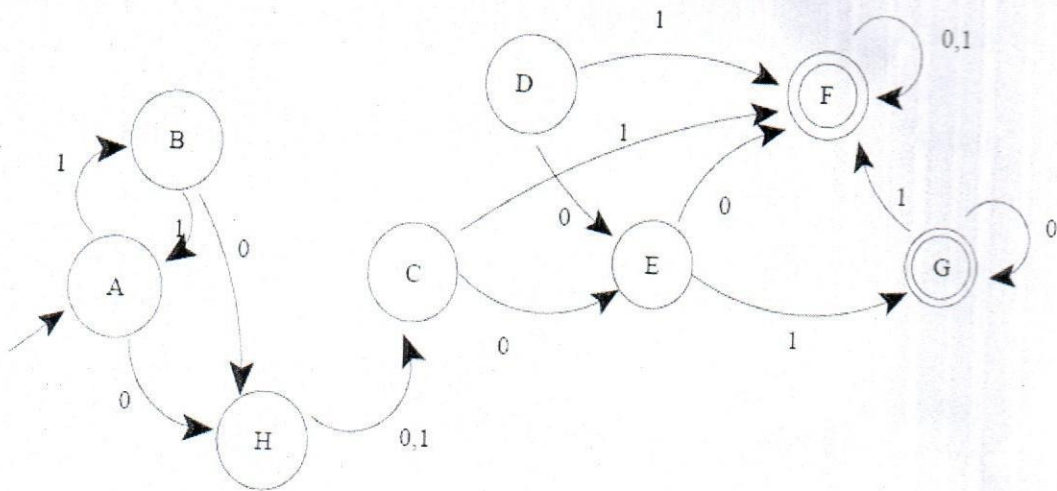
e) Convert the following NDFA to DFA?

[6Mks]



f) Minimize the following DFA using Equivalence Theorem showing tables after each step.

[8Mks]



**QUESTION TWO [20 MARKS]**

a) Define the following terms.

- i) Moore Machine
- ii) Transducer

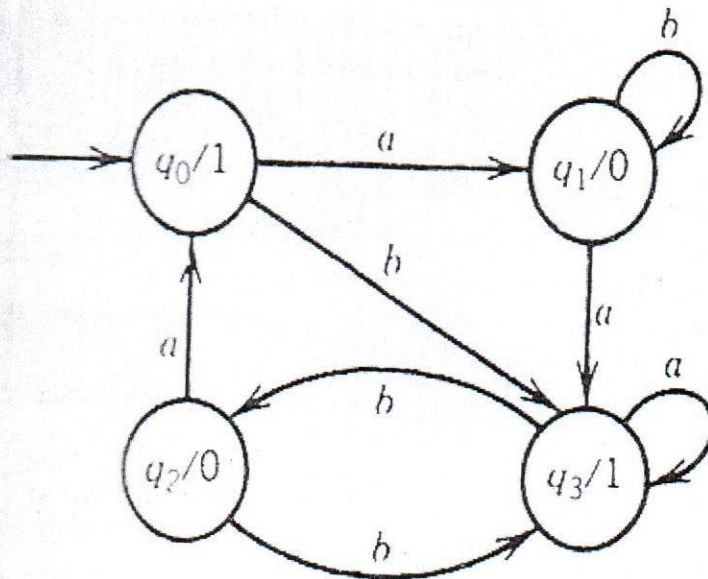
[2Mks]

b) Differentiate Mealy Machine from Moore Machine.

[6Mks]

c) Convert the following Moore Machine to Mealy Machine.

[6Mks]



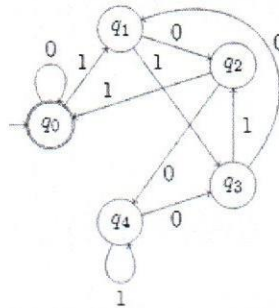
d) Given Grammar  
derive String **aaabbb**

show how you can  
[4Mks]

G:  $(\{S, A, B\}, \{a, b\}, S, \{S \rightarrow aS \mid B, B \rightarrow b \mid bB\})$

**QUESTION THREE [20 MARKS]**

- a) Describe the following terms as used in Automata Theory. [2Mks]  
 a. Arden's Theorem  
 b. DFA Complement
- b) Give Regular Set generated by the following Regular Expression. [4Mks]  
 i)  $(aa)^*(bb)^*b$   
 ii)  $(aa+ab+ba+bb)^*$
- c) Using Pumping Lemma, show that language  $L=\{a^{3x}b^{2y} / x>y>0\}$  is not Regular. [6Mks]
- d) Construct a Finite Automaton from the following Regular Expression. [4Mks]  
 $11^*0(00+1)^*01(10)^*$
- 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) Parse Tree  
 ii) Yield of a Parse Tree
- b) Let any set of production rules in a CFG  $S \rightarrow 0S1S / 1S0S / \epsilon$ , generate Leftmost derivation of  $0101$  and draw equivalent derivation tree. [6Mks]
- c) Find a reduced grammar equivalent to the grammar G, having production rules P:  $S \rightarrow aB$ ,  $A \rightarrow aaA / abBc$ ,  $B \rightarrow aA / b$  [6Mks]
- d) Convert the following productions of CFG to Chomsky Normal Form. [4Mks]

$$\begin{aligned}
 S &\rightarrow aXbX \\
 X &\rightarrow aY|bY|\epsilon \\
 Y &\rightarrow X|c
 \end{aligned}$$

**QUESTION FIVE [20 MARKS]**

- a) Draw notation of a Turing Machine. [2Mks]
- b) i. Design a Turing Machine to accept the set of all palindrome over  $\{0,1\}^*$ . [5Mks]  
 ii. Draw a transition diagram for the Turing Machine of the above. [5Mks]
- c) Construct a PDA that accepts the languages by empty stack  $\{a^n b^{2n} / n \geq 1\}$ . [8Mks]