



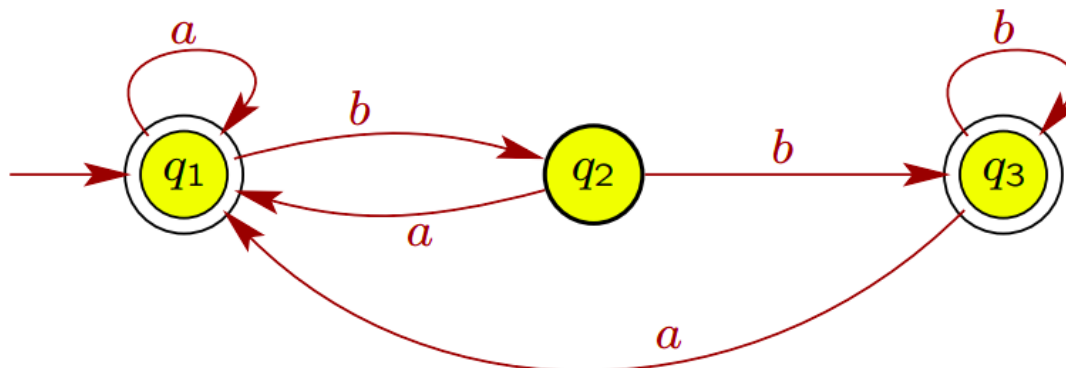
**GHANA COMMUNICATION TECHNOLOGY UNIVERSITY (GCTU), ACCRA**  
**END OF FIRST SEMESTER ACADEMIC YEAR 2024/2025**  
**DEPARTMENT OF COMPUTER SCIENCE**  
**M.SC. / M.PHIL. IN COMPUTER SCIENCE**  
**THEORY OF COMPUTATION (CSSD 609)**  
**TAKE HOME ASSIGNMENT**

**INSTRUCTIONS:** This is a group assignment. All questions should be answered using Microsoft Word (font size 12 for all text, line spacing 1.5) with names and index numbers of students in the group listed. Four (4) students in a Group should submit one assignment. Your Microsoft Word file should be named “Group X-CSSD 609-Course Assignment I, 2024-2025”, where X should be replaced with your group number.

**SUBMISSION:** Convert your MS Word file to a Portable Document Format (PDF) and submit to [yawasabere2011@gmail.com](mailto:yawasabere2011@gmail.com) (Cc: [kuubooremarcellinus@gmail.com](mailto:kuubooremarcellinus@gmail.com)) by **6 PM, 19<sup>th</sup> April, 2025**. Late submissions will be rejected.

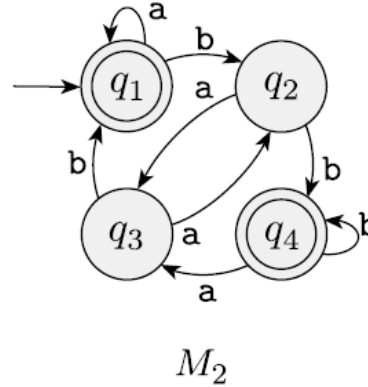
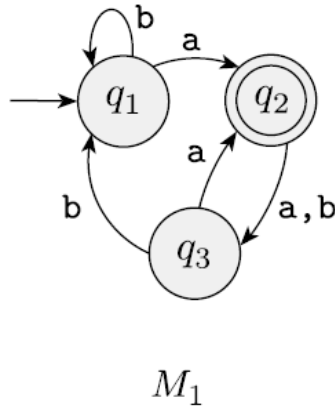
**QUESTION ONE (1)**

- i. Design a Finite State Machine (FSM) that accepts all strings over input symbols  $\{0, 1\}$  having three consecutive 1's as a substring.
- ii. For the state diagram of the DFA  $M$  below, give its formal definition as a 5-tuple.



**QUESTION TWO (2)**

With the following *state diagrams* of two DFAs,  $M_1$  and  $M_2$ , Provide the solution to the questions about each machine.



- Indicate and explain the start state.
- What is the set of accepted states? explain
- With explanations, what sequence of states does the machine go through on input ***aabb***?
- Does the machine accept the string ***aabb***? **Explain your answer**
- Does the machine accept the string  $\epsilon$ ? **Explain your answer**

### **QUESTION THREE (3)**

- Demonstrate the formal description of the machines  $M_1$  and  $M_2$  in **QUESTION ONE (2)**
- Explain the Chomsky normal form theorem.

### **QUESTION FOUR (4)**

- Consider that language ***I*** is recognized by an NFA ***N***, and language ***J*** is the collection of strings ***not*** accepted by some DFA ***M***. Show that ***I · J*** as a regular language.
- Write short on the concept of Complex Theory

### **QUESTION FIVE(5)**

- Prove that if you add a finite set of strings to a regular language, the result is a regular language.
- Prove that if you add a finite set of strings to a nonregular language, the result is nonregular.