



**Daffodil International University**  
**Department of Software Engineering**  
**Faculty of Science & Information Technology**  
**Midterm Examination, Fall 2024**

**Course Code: SE234 ; Course Title: Theory of Computing**

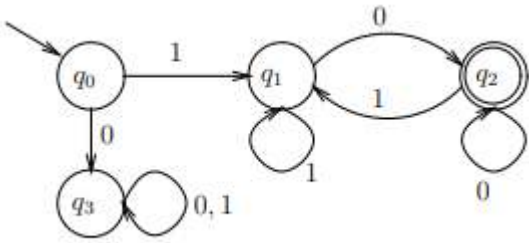
**Sections & Teachers: All & FBR**

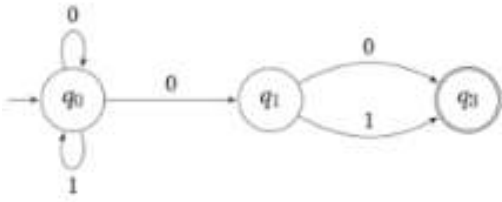
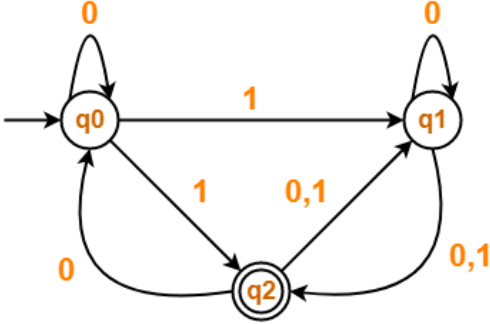
**Time: 1 Hour 30 Mins**

**Marks: 25**

**Answer ALL Questions**

*[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]*

|    |    |                                                                                                                                                                                                                 |           |                  |
|----|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------|
| 1. | a) | Identify the system in the following case. Are they finite or context free?<br>a) Automated ticket booking system<br>b) Automated Door<br>c) Self driving Car<br>d) ChatGPT                                     | [Marks-2] | CLO-1<br>Level-4 |
|    | b) | Let $\Sigma = \{a, b\}$ and let $L = \{ w \in \Sigma^* \mid \text{the first and last character of } w \text{ are not the same} \}$ . Construct a DFA for L.                                                     | [Marks-3] |                  |
|    | c) | Identify the following finite automata by mentioning the significant difference between determinism and non-determinism.<br> | [Marks-3] |                  |
|    | d) | Choose the method that is best suited for implementation from DFA and NFA, the two approaches to building finite automata, and provide an explanation.                                                          | [Marks-2] |                  |
| 2. | a) | Use formal definition to precisely identify the following automata, and demonstrate computation for the string "0000.".                                                                                         | [Marks-3] | CLO-2<br>Level-4 |

|    |                                                                                                                                                                                                                                                                     |           |                  |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------|
|    | <div><p><math>Q = \{q_0, q_1, q_2\}</math></p></div>                                                                                                                               |           |                  |
|    | <div><p>b) <b>Apply</b> “Subset construction” method to convert the following Non-Deterministic Finite Automata (NFA) to Deterministic Finite Automata (DFA)-</p><div></div></div> | [Marks-4] |                  |
|    | <div><p>c) <b>Design</b> a non-deterministic finite automata for the following language of binary input<br/><math>L = \{w : w \text{ contains three consecutive } 111\}</math></p></div>                                                                            | [Marks-3] |                  |
| 3. | <div><p>a) <b>Explain</b> Regular Expression with examples .</p></div>                                                                                                                                                                                              | [Marks-3] | CLO-3<br>Level-3 |
|    | <div><p>b) <b>Construct</b> Regular Expression for the language of all strings over <math>\{a, b\}</math> where:<br/><math>L = \{\epsilon, a, b, aa, ab, ba, bb\}</math></p></div>                                                                                  | [Marks-2] |                  |