



**United International University (UIU)**  
**Dept. of Computer Science & Engineering (CSE)**

**Mid Exam Spring 2024**

**CSE 2233/CSI 233: Theory of Computation/Theory of Computing**

**Total Marks: 30**

**Duration: 1 Hour 30 Minutes**

**Answer all questions.** Figures in the right-hand margin indicates full marks.

*Any examinee found adopting unfair means will be expelled from the trimester / program as per UIU disciplinary rules.*

1. Design DFAs that accepts the following languages:

3x3

- $L = \{ w \mid w \text{ starts with "23", contains "443" as a substring and ends with "32" } \}$   
Where,  $\Sigma = \{2,3,4\}$
- $L = \{ w \mid w \text{ ends with either "01" or "10" } \}$  Where,  $\Sigma = \{0, 1\}$
- $L = \{ w \mid w \text{ contains an odd number of b's, and ends with 'ac' } \}$  Where,  $\Sigma = \{a, b, c\}$

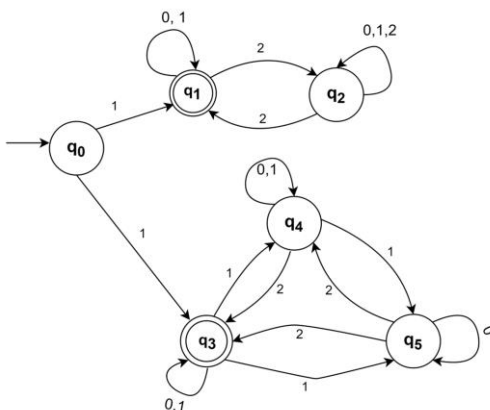
2. Design NFAs that accepts the following languages:

3x3

- $L = \{ w \mid w \text{ ends with 'b' and contains 'bca' } \} \mid \Sigma = \{a,b,c\}$
- $L = \{ w \mid w \text{ starts and ends with different symbols when the total length is a multiple of 2} \}$   
 $\mid \Sigma = \{0,1\}$
- $L = \{ w \mid w \text{ starts with 'xy' and contains 'xxy' or 'yyz' or 'zzx' and ends with 'yz' } \}$   
 $\mid \Sigma = \{x, y, z\}$

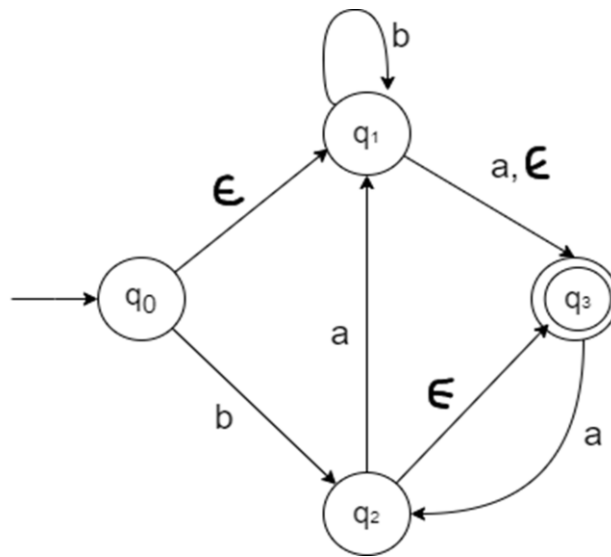
3. Consider the following NFA, and show with the help of NFA-tree whether the string "1012212" is accepted or not.

3



4. Convert the following  $\epsilon$ -NFA over the  $\Sigma = \{a,b\}$  to an equivalent DFA.

6



5. Design Regular Expression for the following languages where  $\Sigma = \{a, b\}$ :

3

- $W \mid W$  contains not more than one occurrence of the substring '**aa**'
- $W \mid W$  does not end with '**ab**'
- $W \mid W$  starts with **b** and ends with **b**