United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Mid Exam Fall 2024

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

Total Marks: **30** Duration: 1 Hour 30 Minutes

Answer all questions. Figures are 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.

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1. Design DFAs that accepts the following languages: 3x3

a) L = { w | w **does not contain** 001 as substring but ends with 11 } where, ∑ = {0,1}

b) L = { w | w starts with **ab**, contains **bac** as substring and ends with **ba**} | ∑ = {a,b}

c) L = { w | w has input length divisible by 3 but not divisible by 2 } where ∑ = {a,b}

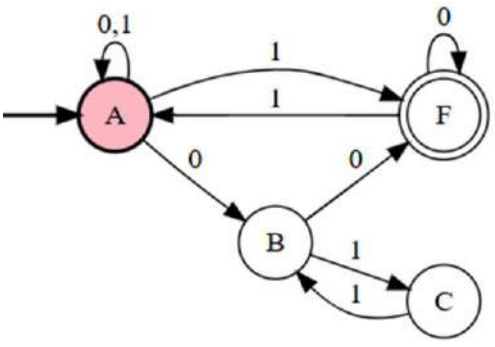
2. Design NFAs that accept the following languages: 3x3

a) L = { w | w **does not** start with **'x'**, contains **'yzx'** or **'zyz'** and ends with **'yx'** or **'yz'** } | Σ = {x, y,z}

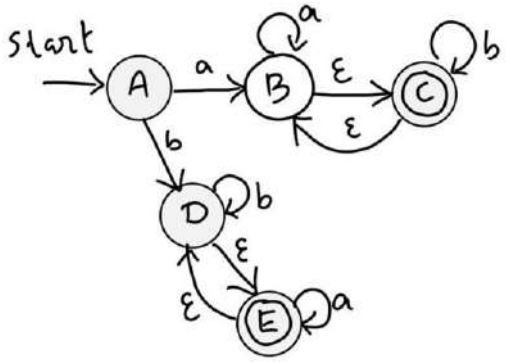
b) L= { w | w contains **'xx'** or **'yx'** or **'zz'** and ends with **'yz'** or **'y'** | Σ = {x,y,z}

c) L = { w | every **00** in w is followed by at least one **1**} | Σ = {0,1}

3. Consider the following NFA, and show with the help of NFA-tree whether the string "**00110"** is accepted or not 3



4. Convert the ε-NFA to equivalent DFA. Show both transition table and state diagram of the DFA. 6
Here, $\sum = \{a,b\}$:



5. Design Regular Expression for the following languages : 1x3

a) Three mobile phone operators are working in the country. Their **prefixes** are **011, 010, 001**. The phone numbers are **10 digits** in length, including the prefix. The rest of the digits in the numbers can be any of the digits from 0 to 9. Denote the alphabet set and design regular expressions that detect the language for this scenario.

b) A person can get a traffic ticket or not one per day. Getting a traffic ticket is denoted by **T**, and not getting one is denoted by **N**. Each symbol, based on its position in a string, represents the ticket status on that particular day. For example, **TNT** denotes that the person received tickets on the first and the third day. Denote the alphabet and design regular expressions for the following scenarios.

i) All strings where **at least three** tickets were received
ii) All strings where **less than three** tickets were received