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

Mid Exam Summer 2024

CSE 2233/CSI 233: Theory of Computation/Theory of Computing
Total Marks: **30**   Duration: 1 Hour 45 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 starts and ends with **different** symbol, having **even** length strings when starts with **a** or **odd** length strings when starts with **b}** where, ∑ = {a,b}

    b) L = { w | w starts with "**ab**", contains "**cca**" as a substring and ends with "**aba**" } where, ∑ = {a,b,c}

    c) L = { w | w **neither** contains two consecutive a's **nor** two consecutive b's } where ∑ = {a,b}

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

    a) L= {w | w starts with "**12**" or "**32**" and contains "**222**" or "**111**" or "**333**" and ends with "**31**" or "**23**"} | Σ = {1,2,3}

    b) L= {w | w double "**1**" is followed by triple "**0**" and starts with "**0**"} | Σ = {0,1}

    c) L= {w | w third symbol from the right end is always "**a**" and the second symbol is either "**b**" or "**c**"} | Σ = {a,b,c}

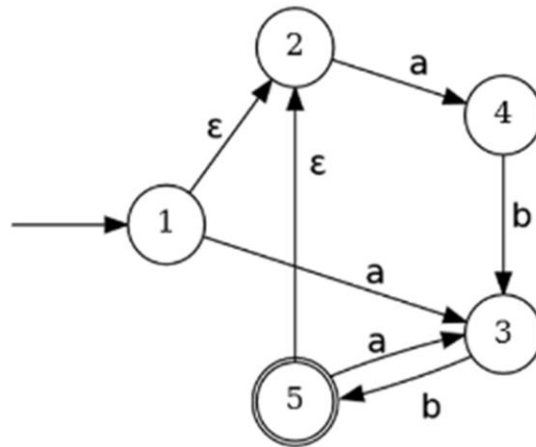**3.** Consider the following NFA, and show with the help of NFA-tree whether the string "**aabbbbaa**" is accepted.   3
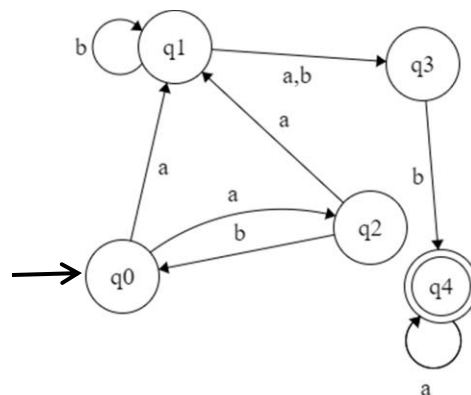
4. Consider the following **ε**-NFA over the ∑ = {a,b} :   [2+4]

(a) Compute the-closure of each state.

(b) Convert the e-NFA to equivalent DFA. Show both transition table and state diagram of the DFA.

5. Design Regular Expression for the following languages :   3

    a) L = {w | w does not contain **xxx** over the alphabet {x,y}}

    b) L = {w | w starts with **b** and contains at most 3 **a**'s over the alphabet {a, b, c}}

    c) L = {w | w contains an even number of **a**'s over the alphabet {a, b}}