



# 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.*

1. Design DFAs that accepts the following languages:

3x3

- $L = \{ w \mid w \text{ starts and ends with different symbol, having even length strings when starts with a or odd length strings when starts with b} \}$  where,  $\Sigma = \{a,b\}$
- $L = \{ w \mid w \text{ starts with "ab", contains "cca" as a substring and ends with "aba"} \}$  where,  $\Sigma = \{a,b,c\}$
- $L = \{ w \mid w \text{ neither contains two consecutive a's nor two consecutive b's} \}$  where  $\Sigma = \{a,b\}$

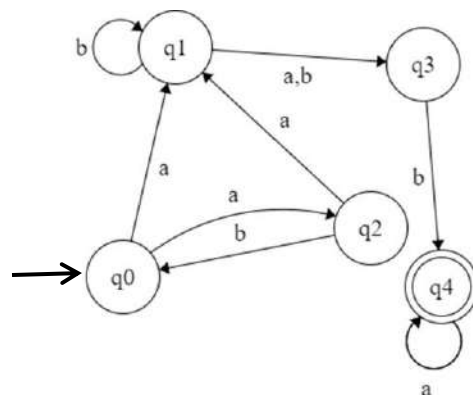
2. Design NFAs that accept the following languages:

3x3

- $L = \{ w \mid w \text{ starts with "12" or "32" and contains "222" or "111" or "333" and ends with "31" or "23"} \}$  |  $\Sigma = \{1,2,3\}$
- $L = \{ w \mid w \text{ double "1" is followed by triple "0" and starts with "0"} \}$  |  $\Sigma = \{0,1\}$
- $L = \{ w \mid w \text{ third symbol from the right end is always "a" and the second symbol is either "b" or "c"} \}$  |  $\Sigma = \{a,b,c\}$

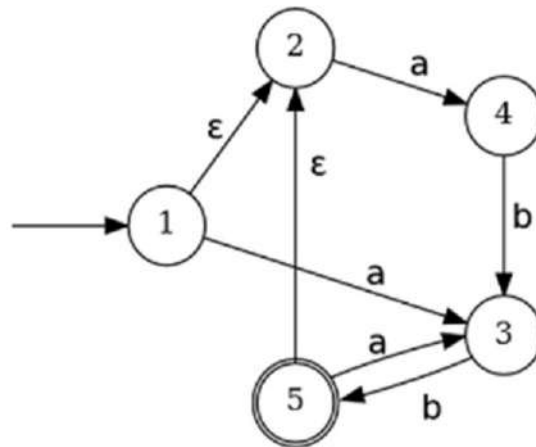
3. Consider the following NFA, and show with the help of NFA-tree whether the string "aabbbaa" is accepted.

3



4. Consider the following  $\epsilon$ -NFA over the  $\Sigma = \{a,b\}$  :

[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)  $L = \{w \mid w \text{ does not contain } \mathbf{xxx} \text{ over the alphabet } \{x,y\}\}$
- b)  $L = \{w \mid w \text{ starts with } \mathbf{b} \text{ and contains at most 3 } \mathbf{a}\text{'s over the alphabet } \{a, b, c\}\}$
- c)  $L = \{w \mid w \text{ contains an even number of } \mathbf{a}\text{'s over the alphabet } \{a, b\}\}$