# Mid Exam Fall 2023

**CSE 2233/CSI 233: Theory of Computation/Theory of Computing**
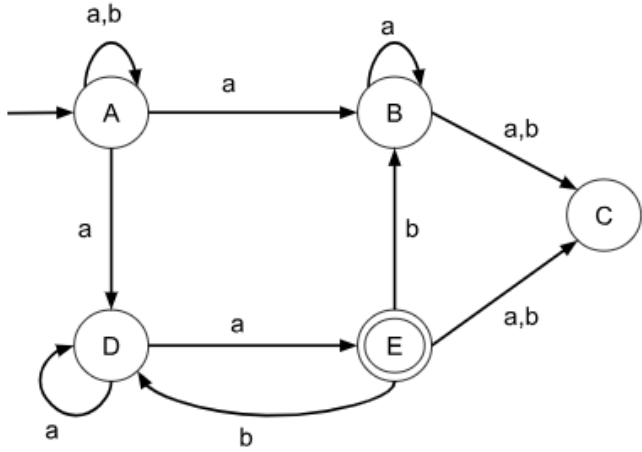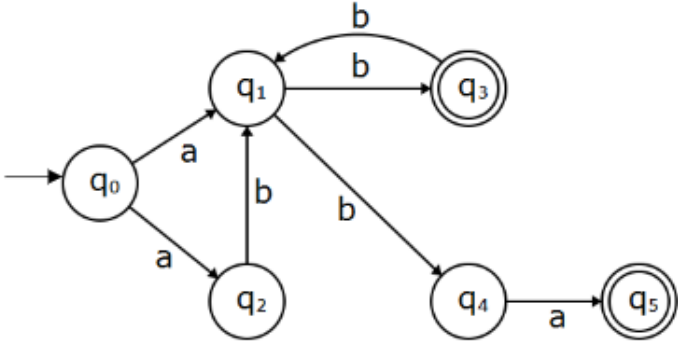Total Marks: **30**          Duration: 1 Hour 45 Minutes
**Answer all questions.** Figures in the right-hand margin indicate full marks.
*Any examinee found adopting unfair means will be expelled from the trimester/program as per UIU disciplinary rules.*

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|---|---|---|
| **1.** | Design DFAs that accept the following languages:<br><br>**a)** L = accepts any string that has an even number of 'a' or odd number of 'b' over alphabet {a, b}<br><br>**b)** L = accepts any string which starts with an odd number of 'r' and ends with 'brb' over the alphabet {b, r}<br><br>**c)** L = accepts any string where the last two symbols are different over the alphabet {a, b} | 3 x 3 |
| **2.** | Design NFAs that accept the following languages:<br><br>**a)** L= {w \| w starts with 'a' or 'b' *and* contains 'cca' *and* ends with 'b' or 'c'} \| Σ = {a, b, c}<br><br>**b)** L= {w \| w starts *and* ends with different symbols with a total length of at least 2} \| Σ = {0, 1}<br><br>**c)** L = {w \| w contains 'xyz' or 'yzx' or 'zxx' *and* ends with 'yz'} \| Σ = {x, y, z} | 3 x 3 |

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



| 4. | Convert the following NFA over the alphabet $\Sigma = \{0, 1\}$ to an equivalent DFA. | 4 |



| 5. | **a)** Convert the following regular expressions to finite automata: | 1.5 x 2 |

    **i)** $(ab)^* + (a + ab)^* b^* (a + b)^*$

    **ii)** $[a + ba (a + b)]^* a (ba)^* b^*$

**b)** Convert the following languages to their corresponding regular expression:     1 x 2

    **i)** $L = \{$strings such that the 4th symbol from the right is b over the alphabet $\{a, b\}\}$

    **ii)** $L = \{$strings such that they start and end with 'a' over the alphabet $\{a, b, c\}\}$