



United International University

Department of Computer Science and Engineering

CSE 2233 - Theory of Computation, Mid Exam, Fall 2020

Total Marks: 20, Time: 1 hour

Answer all the questions

1. Define **Regular Expressions** for each of the following Regular Languages: [2+2+2]

- a) $L_1 = \{ w \mid w \text{ contains at least two 0's and at most one 1} \}$ over $\Sigma = \{0, 1\}$
- b) $L_2 = \{ w \mid w \text{ does not start with 01 and the 3rd last character is 1} \}$ over $\Sigma = \{0, 1\}$
- c) $L_3 = \{ w \mid w \text{ starts and ends with different characters and the length of } w \text{ is even} \}$ over $\Sigma = \{0, 1\}$

2. a) Design the state diagram of a **NFA/ε-NFA** for the following language **L**: [2]
 $L = \{ w \mid w \text{ either starts with either 11 or 10, and } w \text{ contains 001 as substring} \}$ over $\Sigma = \{0, 1\}$

b) Consider the following transition table of an **ε-NFA**: [1+3]

Input → States ↓	a	b	ε
1	{3}	{}	{2}
2	{1,4}	{}	{}
3	{}	{4}	{}
4	{}	{}	{1}

Here, start state = 1 and set of final states = {4}

- i) From the above transition table, draw the corresponding state diagram of the **ε-NFA**.
- ii) Now convert this **ε-NFA** to equivalent **DFA**. (Show each simulation steps clearly)

3. a) Convert the following **Regular Expression** to an equivalent **ε-NFA**: [4]
(Show each simulation steps clearly)

$$1^* (0|\epsilon) (0|1)^*$$

b) Convert the following **DFA** to an equivalent **Regular Expression**: [4]
(Show each simulation steps clearly)

