KING SAUD UNIVERSITY COLLEGE OF COMPUTER AND INFORMATION SCIENCES Computer Science Department		
CSC 339 **Theory of Computation**	**Tutorial # 3** Regular Languages and Regular Expression (RE)	**2^{nd} Semester 1443-2022**

Exercise 1.1

Each of the following languages is the intersection of two simpler languages. In each part, construct DFAs for the simpler languages, then combine them in one DFA simulates in parallel M1 and M2 In all parts, Σ = {a, b}.

1. {w| w has an even number of a's and one or two b's}
2. {w| w has even length and an odd number of a's}

Exercise 2.1

Construct a regular expression representing the following languages:

1. Over the alphabet $\{a, b, c\}$, in which for every string w it holds that the number of a's is even.
2. Over the alphabet $\{0, 1\}$, in which w consists of alternating zeroes and ones.

Exercise 2.2

Consider the following regular expression: $(\mathbf{0}(\mathbf{23})^*\mathbf{1})^*$

1. Find a string over $\{0,1,2,3\}^4$ which matches the expression.
2. Find a string over $\{0,1,2,3\}^4$ which does not match the expression.

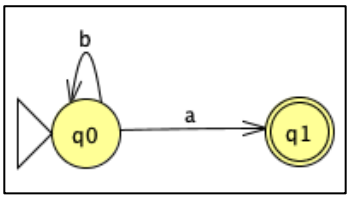
Exercise 3

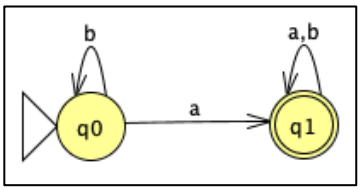
Construct a finite automaton (deterministic or non-deterministic) for the following regular expression:

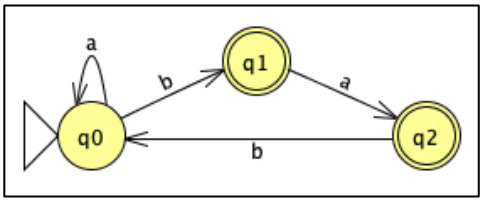
$$\boldsymbol{a}(\boldsymbol{a} \cup \boldsymbol{b})^*\boldsymbol{a} \cup \boldsymbol{b}(\boldsymbol{a} \cup \boldsymbol{b})^*\boldsymbol{b} \cup \boldsymbol{a} \cup \boldsymbol{b}$$

Exercise 4

Find out which regular expressions describes the following automata's languages:

1. 

2. 

3. 

Exercise 5

Consider the alphabet $\Sigma = \{a, b]$, give a RE for each of the following languages:

1. $L = \{w \in \Sigma^* | \, w \, contains \, the \, substring \, aaa\}$
2. $L = \{w \in \Sigma^* | \, w \, contains \, the \, substring \, aaa \, as \, a \, prefix\}$
3. $L = \{w \in \Sigma^* | \, w \, contains \, the \, substring \, aaa \, as \, a \, suffix\}$
4. $L = \{w \in \Sigma^* | \, w \, does \, not \, contains \, the \, substring \, aaa\}$

Exercise 6

Construct a regular expression which is equivalent to the following (deterministic) finite automata: