National University of Computer and Emerging Sciences, Lahore Campus

Course:	Theory of Automata	Course Code:	
Program:	BS(Computer Science)	Semester:	Spring 2024
Due Date:	10th Feb, 2024 (Google Classroom)	Total Marks:	180
Section:	6A	Weight	%
Exam:	Assignment 1	Page(s):	1
		Reg. No	

Instruction/Notes: This is handwritten assignment, which should be submitted in Google classroom. Show proper working.

Problem # 1:

Suppose $\Sigma=\{a,b\}$, $n_a(x)$ is the number of a's in string x and $n_b(x)$ is the number of b's in string x. The following languages are defined over Σ as (all languages are a subset of Σ^*) :

$L_1 = \{x|\ n_a(x) \text{ is even}\}$
$L_2 = \{x|\ n_a(x) = 2\ \&\ n_b(x) = 2\}$
$L_3 = \{x|\ n_a(x) = 0\ \&\ n_b(x) \text{ is odd}\}$
$L_4 = \{x|\ n_a(x) \text{ is odd}\}$
$L_5 = \{x|\ |x| <= 2\}$
$L_6 = \{x|\ |x| = 1\}$
$L_7 = \{aa,ab,aba,bb\}$
$L_8 = \{aaa,bb\}$

a. Which of the above are infinite/finite sets. Read about countable and uncountable sets and identify which ones are countable.
b. Write down all members of the countable finite set.
c. Write down L_7L_8, L_6L_8, L_5L_8,
d. Give L_8^0, L_8^1,L_8^2,
e. Find $L_7 \cap L_8$, $L_6 \cap L_8$, $L_5 \cap L_8$, $L_1 \cap L_2$, $L_3 \cap L_4$
f. Find the complement the first three languages
g. Find $L_7 \cup L_8$, $L_6 \cup L_8$, $L_5 \cup L_8$, $L_1 \cup L_2$, $L_3 \cup L_4$
h. Find $L_7 - L_8$, $L_6 - L_8$, $L_4 - L_5$, $L_1 - L_3$

Problem # 2: Draw **deterministic finite automata**

L = { x | x over {a, i, n, g}; x ends with 'ing' }
L = { x | x over {0,1} ; x's 2nd last digit must be '0' }
L = { x | x over {a, b} ; |x| is divisible by 2 }
L = { x | x over {a, b} ; |x| is divisible by 3 }
L = { x | x over {a, b, c} ; x contains 'aa' as a substring }
L = { x | x over {0,1} ; In every 'x' of sequence 3 it contains exactly one '0' }
L = { x | x over {0,1} ; x as decimal number divisible by 2 }

L = { x | x over {0,1} ; x as decimal number divisible by 3 }
L = { x | x over {0,1} ; x as binary number divisible by 2 }
L = { x | x over {0,1} ; x as binary number divisible by 3 }