National University of Modern Languages, Islamabad
Faculty of Engineering and Computer Science
Department of Computer Science

First Assignment
BS CS (6) Morning Fall-2022
Automata Theory
Faculty Name: Farhad Muhammad Riaz
Assignment Submission Date: 4-10-2022
Points: 10

Instruction:

- **Copied from any source leads to zero marks**
- **Hand written assignment is required.**

QNO1. Write Down the Regular Expression of the languages given bellow
   a. All words with b as a second letter
   b. Only those words that have even number of substrings ab
   c. All words with even lengths and in which each b is separated by some a's and a occupies all even positions
   d. language which has both 01 and 10 as substring.
   e. The language (or string) {an b m | n is divisible by 3 and m is divisible by 2 or n-m >=1}
   f. The languages only accept any sequence consisting of at least 3 one rupee coins over input alphabet {1,2, 5}
   g. The language {w ∈ Σ∗| w contains exactly one double letter}

QNO2. Prove that there are as many palindromes of length 2n, defined over Σ = {a,b,c}, as there are of length 2n-1, n = 1,2,3… . Determine the number of palindromes of length 2n defined over the same alphabet as well

QNO3. Consider the language S*, where S = {xx xxx}. In how many ways can x 19 be written as the product of words in S? This means: How many different factorizations are there of x 19 into xx and xxx?

QNO4. Suppose that for some language L we can always concatenate two words in L and get another word in L if and only if the words are not the same. That is, for any words w1 and w2 in L where w1 ≠ w2, the word w1w2 is in L but the word w1w1 is not in L. Prove that this cannot happen.

QNO5. Draw the DFA of the languages given bellow
   a. :-Λ+a+b+(a+b)*(ab+ba+aa)
   b. The language { w | w contains at least two a's, or exactly two b's }.
   c. The language { w ∈ Σ∗| w has an odd number of a's }
   d. The language of all words that have at least one a and at least one b.