Birla Institute of Technology and Science-Pilani, Hyderabad Campus
Second Semester 2021-2022
Tutorial-2
Course No CS F351
Course Title: Theory of Computation

General Instructions: *Argue logically. Write it in a manner that explains your logic very clearly. Do not miss steps in between.*

1. Consider the following languages over the alphabet $\Sigma = \{a, b\}$

$$L_1 = \{a^n \mid n \geq 1\}$$

$$L_2 = \{b^n \mid n \geq 1\}$$

Describe the following languages as per the set notation as well as the precise definition in english.

- $L_3 = \overline{L_1}$
- $L_4 = (L_1 L_2)^+$

2. Give DFA's on $\Sigma = \{0, 1\}$ accepting the following strings.

   (a) $\{0^n \mid n \geq 0, n \neq 3\}$

   (b) The set of all strings divisible by 5

   (c) $\{01^4x1^3 \mid x \in \{0,1\}^*\}$

3. Prove that if L is regular then the language

$$Pre(L) = \{x \in \Sigma^* \mid \exists y \in \Sigma^* \text{ such that } xy \in L\}$$

is regular.

4. Let L_1 and L_2 be the languages. Then $L_1L_2 = \{xy \mid x \in L_1, y \in L_2\}$ and $L_1^R = \{x^R \mid x \in L_1$ where x^R is the string obtained by reversing $x\}$. Prove that $\forall L_1, L_2$, $(L_1L_2)^R = L_2^R L_1^R$. The equality $(xy)^R = y^R x^R$ where x and y are string on any alphabet can be used without proving. By using induction try to prove this equality by yourself.