# Birla Institute of Technology and Science-Pilani, Hyderabad Campus Second Semester 2021-2022

### **Tutorial-1**

## Course No CS F351

Course Title: Theory of Computation

Date:25/8/2021

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

- 1. Show that the following relations are equivalent relations and give their equivalence classes

  - (a)  $R_1$  on integers  $\rightarrow iR_1j$  iff i=j. (b)  $R_2$  on people  $\rightarrow pR_2q$  iff p and q were born on the same hour of same day of some year.
- 2. By using induction, prove that the following definitions of the palindrome is equivalent.

**Definition 1:** A string that reads the same forward and backward.

#### Definition 2:

- (a)  $\epsilon$  is a palindrome
- (b) If a is any symbol then the string a is a palindrome.
- (c) If a is any symbol and x is a palindrome then the string axa is a palindrome.
- d) Nothing is palindrome unless it follows from (a) to (c)
- 3. Prove that the following definitions for the strings of the balanced parentheses are equivalent.

### Definition 1:

- (a) A string w over alphabet  $\{(,)\}$  is balanced iff
  - i. w has an equal number of ('s as )'s.
  - ii. Any prefix of w has at least as many ('s as )'s.

#### Definition 2:

- (a) A string w over alphabet  $\{(,)\}$  is balanced iff
  - i.  $\epsilon$  is balanced.
  - ii. If w is balanced string then (w) is balanced.
  - iii. If w and x are balanced strings the wx is balanced.
  - iv. Nothing else is a balanced string