CMPUT 175 - Lab 10: Binary Trees

Submit by: Nov 30, 2020 *Demo in your lab starting: Dec 1, 2020*

Goal:	Understand how Binary Trees work; become familiar with tree traversals; practice using recursion.

Download *binaryTree.py* from eClass. This file contains a fully implemented BinaryTree class for you to use with the following exercises. Also download and complete the lab's worksheet from eClass, in preparation for Exercise 3 below.

Exercise 1: Binary tree traversals

In this exercise, you will implement three recursive functions: **`preorder()`**, **`postorder()`** and **`inorder()`**, which print out the values of a binary tree using a preorder, postorder and inorder traversal, respectively.

Exercise 2: Max and min values

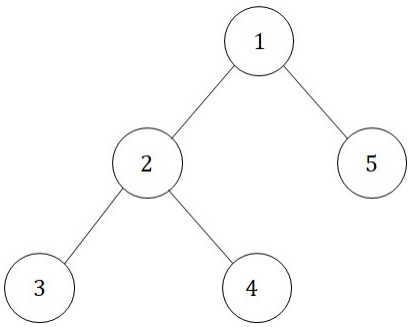
In this exercise, you will implement two functions using recursion: **`findMinKey()`** and **`findMaxKey()`**.

The **`findMinKey()`** function should return the minimum element of a given binary tree, while the **`findMaxKey()`** function should return the maximum one. When the input is an empty tree, both functions should return **`None`**. You can assume that the values stored in tree nodes are integers or float numbers (which can be directly compared using <, >, or ==).

Exercise 3: Construct a binary tree from inorder and preorder traversals

If all of the elements in a binary tree are unique, then the information from its inorder and preorder traversals can be used to reconstruct that unique binary tree.

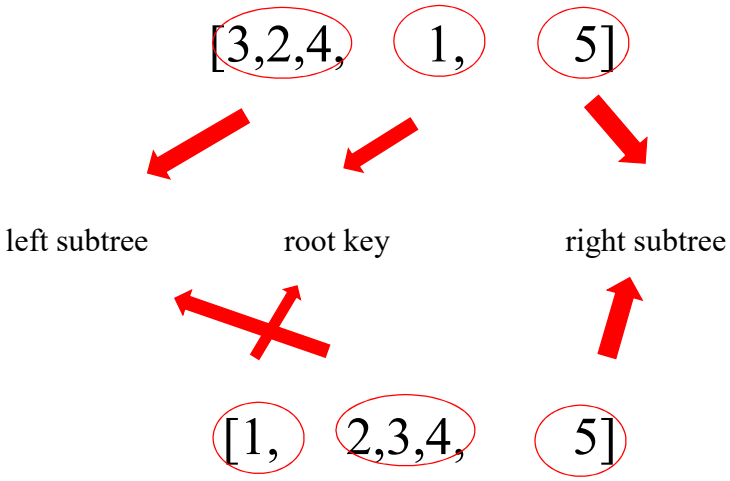
For example:
If we know that the inorder traversal is [3,2,4,1,5] and the preorder traversal is [1,2,3,4,5], then we know that the binary tree should look like:



Task 1:
Download and complete the practice worksheet on eClass.

Task 2:
Implement the recursive function **`buildTree(inOrder, preOrder)`.**

Hint:



Remember that the first element in a preorder traversal should always be the value of the root node. At the same time, that root value divides the inorder traversal list into two parts: its left subtree and its right subtree. With this knowledge, we can find the start index and end index for each subtree, and then build the subtrees recursively.