CMPUT 175 - Lab 10: Binary Trees

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

Ensure that you write proper docstrings and follow the Software Quality Requirements.

Download **binaryTree.py** from eClass. This file contains a fully implemented Binary Tree 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 (be prepared to talk about your work with your TA).

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()*.

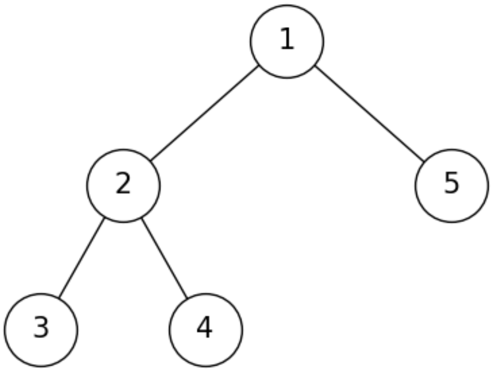
The *findMinKey()* function should return the minimum element of a given binary tree, while the *findMaxKey()* function should return the maximum one. When the input is an empty tree, both functions should return **None**. You can assume that the values stored in tree nodes are integers or float numbers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

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

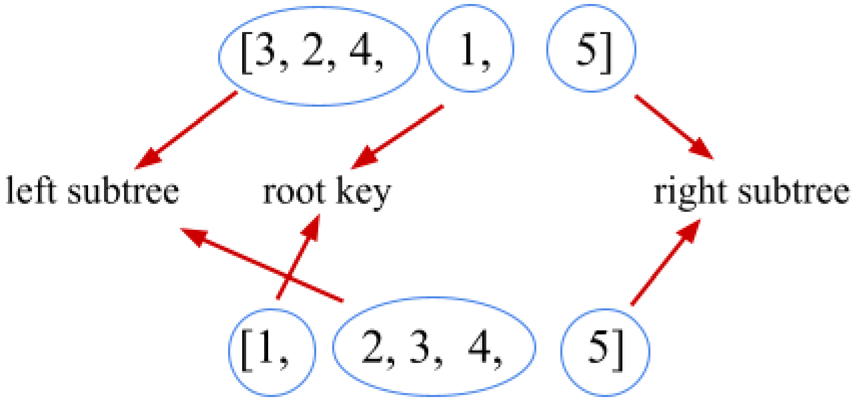
In this exercise, you will implement the recursive function *buildTree(inorder, preorder).*

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 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:



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.

Deliverables

You will produce and submit **one** Python (.py) file for this lab on eClass by the submission deadline:

- **binaryTree.py**: Python solution to exercises 1-3 of this lab