Algorithms – Assignment 3

(Data Structures)

Prof. Eunwoo Kim

Due: 7th May

Submit a pdf file to the e-class that contains your **results** for the following exercises including **codes** written in the C or Python programming language (screenshots okay).

Note: Once you choose a programming language, you should solve the problems using the chosen language. Do not use built-in and library functions (e.g., numpy) when solving the problems.

1. Write a code to reverse a linked list. Write also the following functions: append, insert, traverse, remove, and reverse. Generate a linked list of size 10 whose elements are chosen randomly.

2. Write a code to remove duplicates from an unsorted linked list. Generate a linked list of size 20 whose elements are from 1 to 50. Write a function to check and remove duplicate numbers.

3. Write a code to check if the following binary tree is a valid binary search tree (BST) or not.

[8, 3, 9, null, null, 4, 7]

4. Write a code to find the lowest common ancestor between two given nodes in the following binary search tree.

[6, 2, 8, 1, 3, 7, 9]

Write a function to find the lowest common ancestor by taking two inputs from the console. Show the results for three different pairs of inputs.

5. Write a code to construct a red-black tree by successively inserting the keys 41, 38, 31, 12, 19, 8 into an initially empty red-black tree. You should implement some functions to build the tree, such as left-rotate and right-rotate. Each key should be accompanied by its corresponding color (red or black) in your code.