Algorithms

(a) How do insertions and deletions in a 2-3-4 tree retain the structure’s perfect balance? [2 marks]

(b) Explain the structural relationship between 2-3-4 trees and red-black trees. [4 marks]

(c) Draw diagrams to illustrate left and right rotations at the root node of a binary search tree. Label the positions of all subtrees before and after the rotation. [4 marks]

(d) Write pseudocode for a recursive function `move_to_root(x, k)` which, given a binary search tree with root node `x` and a key value `k`, uses a sequence of rotations to move the node with key value `k` to the root of the tree and returns a pointer to the new root node. [10 marks]