# University of Colombo School of Computing
# SCS 1208 - Data Structures and Algorithms II

Lab Sheet 11

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**1)** Implement the insertion operation for Red-Black trees in the C programming language. Your program should include the following:

I. Struct definition for a red-black tree node containing fields for key value, color (red or black), and pointers to left child, right child, and parent nodes.

II. Function prototypes for insertion operations.

III. Functions for left rotation, right rotation, and fixing violations of red-black tree properties after insertion.

IV. The main function should create an empty red-black tree, insert a series of integers into the tree using the insertion operation, and print the resulting tree after each insertion to demonstrate the proper functioning of insertion and rebalancing operations.

**2)** Imagine you are developing a system to manage a library's book inventory. The ISBN (International Standard Book Number) uniquely identifies each book. Implement a red-black tree-based data structure to store book information, where each node represents a book, and the key is the book's ISBN. Include functions to:

A. Insert a new book into the inventory, ensuring no duplicates.

B. Display an error message if a duplicate book is attempted to be inserted.

C. Print the updated inventory after each insertion to demonstrate the proper functioning of the insertion operation.

D. Test your implementation by inserting several books with unique ISBNs into the inventory and verifying that duplicates are properly handled.

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***Submit one file for all the questions by renaming your document as,***
***Index_Number_Practical_No.***