

**National Institute of Technology Calicut**  
**Department of Computer Science and Engineering**  
**Fourth Semester B. Tech.(CSE)-Winter 2021-22**  
**CS2094D Data Structures Laboratory**  
**Assignment #3 - Modification Question**

**Instructions:** For the question given below, write the design in the shared doc. Upload your design as a .pdf file in the eduserver strictly by 2.30 pm in the link provided for *submitting the design of the Modification question*. After submitting the design, implement your design using *C Language* and show the output of your program to the evaluator for the test cases given for the Modification question in eduserver. In any case, you should submit your C Program in the eduserver strictly by 3.15 pm in the link provided for *submitting the C Program for the Modification question*. In case of clarifications, your evaluator will help you.

Marks (Design + Implementation + Viva): 3 + 3 + 2

The marks for implementation will be based on the results for the test cases. The evaluator will be conducting a viva for a maximum of 5 minutes. The source code must be named as:

ASSG<NUMBER>\_Mod\_<ROLLNO>\_<FIRST-NAME>\_<PROGRAM-NUMBER>.c

(For example: ASSG3\_Mod\_BxyyyyCS\_LAXMAN\_1.c).

**QUESTION**

1. A Red-Black tree is said to be *beautiful* if all nodes in the alternate levels of the tree are of the same color. Write a program to check whether a Red-Black tree created from the given input is *beautiful* or not. Your program should include the following functions.

- INSERTREDBLACK(struct node\* root, key): Inserts a new node with the 'key' into the tree.
- CHECKBEAUTIFUL (struct node\* root): Checks whether the given tree is beautiful or not.

**Input format:**

- The first line of input will be an integer '*n*' which is the number of nodes in the tree.
- After which '*n*' integer inputs will be given subsequently which will be the keys of nodes of the tree. The keys are unique and values are in the range [1,1000].

**Output format:**

- The output will be 1 if the Red-Black tree is *beautiful* else -1.

**Sample Input 1:**

9  
12  
8  
25  
3  
5  
27  
22  
32  
9

**Sample Output 1:**

1

**Explanation:** The tree given below, based on the input data mentioned above, is *beautiful* as level 0 and level 2 contain all black nodes and level 1 and level 3 contain all red nodes.

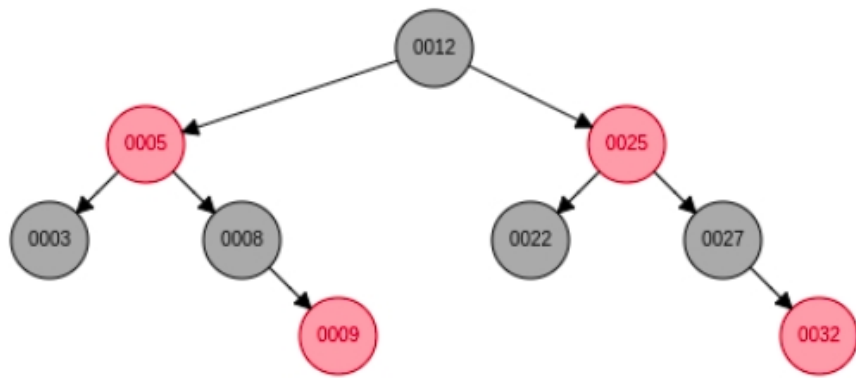


Figure 1: Sample Beautiful Red-Black Tree

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