National Institute of Technology, Calicut
Department of Computer Science and Engineering
Monsoon2021
CS2092D – PROGRAMMING LABORATORY (MCA-I A)
Assignment-7

Policies for Submission and Evaluation

You must submit your assignment on the moodle (Eduserver) course page on or before the submission deadline. Also, ensure that your programs in the assignment must compile and execute without errors in Athena server. During the evaluation your uploaded programs will be checked in Athena server only. Failure to execute programs in the assignment without compilation errors may lead to zero marks for that program.

Your submission will also be tested for plagiarism by automated tools. In case your code fails to pass the test, you will be straightaway awarded zero marks for this assignment and considered by the examiner for awarding F grade in the course. Detection of ANY malpractice regarding the lab course will also lead to awarding an F grade.

Naming Conventions for Submission

Submit a single ZIP (.zip) file (do not submit in any other archived formats like .rar or .tar.gz). The name of this file must be ASSG<NUMBER>_<ROLLNO>_<FIRSTNAME>.zip. (For example: ASSG4_BxxyyyyCS_LAXMAN.zip). DO NOT add any other files (like temporary files, inputfiles, etc.) except your source code, into the zip archive. The source codes must be named as
ASSG<NUMBER>_<ROLLNO>_<FIRSTNAME>_<PROGRAM-NUMBER>.<extension>
(For example: ASSG4_BxxyyyyCS_LAXMAN_1.c). If there are multiple parts for a particular question, then name the source files for each part separately as in
ASSG4_BxxyyyyCS_LAXMAN_1b.c.
If you do not conform to the above naming conventions, your submission might not be recognized by some automated tools, and hence will lead to a score of 0 for the submission. So, make sure that you follow the naming conventions.

Standard of Conduct

Violations of academic integrity will be severely penalized. Each student is expected to adhere to high standards of ethical conduct, especially those related to cheating and plagiarism. Any submitted work MUST BE an individual effort. Any academic dishonesty will result in zero marks in the corresponding exam or evaluation and will be reported to the department council for

record keeping and for permission to assign an F grade in the course. The department policy on academic integrity can be found at:
http://minerva.nitc.ac.in/cse/sites/default/files/attachments/news/Academic-Integrity_new.pdf .

Assignment 8
Questions

The Binary Search Tree (BST) data structure supports many of the dynamic-set operations.
A BST is organized as a binary tree in which each node is an object that contains a key value. In addition to a key and satellite data, each node contains attributes left, right, and p that point to the nodes corresponding to its left child, its right child, and its parent, respectively. If a child or the parent is missing, the appropriate attribute contains the value NIL(N). The root node is the only node in the tree whose parent is NIL. The keys in a binary search tree are always stored in such a way as to satisfy the binary-search-tree property.

- Let x be a node in a binary search tree. If y is a node in the left subtree of x, then y.key ≤ x.key. If y is a node in the right subtree of x, then y.key ≥ x.key.

Question 1

Write a program to create a Binary Search Tree T and print the in-order traversal of that T .

Your program should include the following functions:
Main() - creates the Binary Search Tree T with T as the root node (which is NIL initially) and repeatedly reads a number from the console and calls the sub-functions appropriately .
• Insert(T, x) - inserts the node x into the BST T.
• Inorder(T) - performs recursive inorder traversal of the BST T and prints the key in the nodes of T in in-order.

Sample Input & Output

Input(Inserted Nodes) : 2 1 3 4
Output(In-order Traversal): 1 2 3 4

Test cases

Test case 1	Test case 2
Input: 2 1 3 6 4 Output:1 2 3 4 6	Input: 7 5 1 8 3 6 0 9 4 2 Output: 0 1 2 3 4 5 6 7 8 9

Question 2

In the continuation of the above question, i.e you have BST, write an efficient function to search a given key in it. The function should return the parent node of the key and print if the key is the left or right node of the parent node. If the key is not present in the BST, then print *key not found* .

Sample Input & Output

Input: Nodes Inserted: 2 1 3 6 4

The key to be searched =1

Output: The given key is the left node of the node 2

Test cases

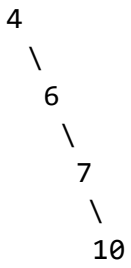
Test case 1	**Test case 2**
Input : 7 5 1 8 3 6 0 9 4 2 , key =6 Output: The given key is the right node of the node 5	Input : 2 1 3 6 9 4, key =5 Output: key not found

Question 3

Construct a Binary Search Tree T and print its in-order traversal. Based on its in-order output, modify the tree, T to make it a right-skewed tree, T'. Print the post-order traversal of the modified tree T'.

Note: Right skewed binary tree is a tree in which all the nodes of it have only a right child

Eg:



Sample Input & Output

Input: 10 6 14 4 7 11 16 (T)

Output:

In-order Traversal of T– 4 6 7 10 11 14 16

Post-order Traversal of T' –16 14 11 10 7 6 4

Test cases

Test case 1	**Test case 2**
Input: 2 1 3 6 4 Output: In-order Traversal of T :1 2 3 4 6 Post-order Traversal of T': 6 4 3 2 1	Input: 7 5 1 8 3 6 0 9 4 2 Output: In-order Traversal of T: 0 1 2 3 4 5 6 7 8 9 Post-order Traversal of T': 9 8 7 6 5 4 3 2 1 0