National University of Computer and Emerging Sciences, Lahore Campus

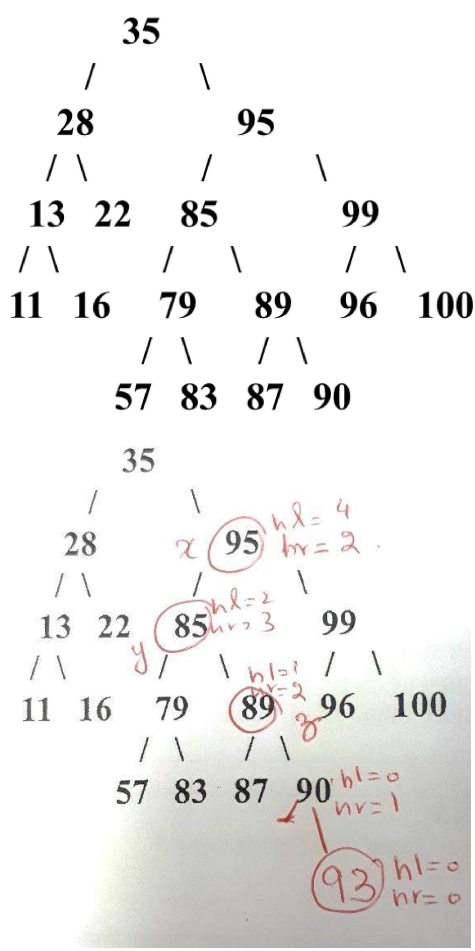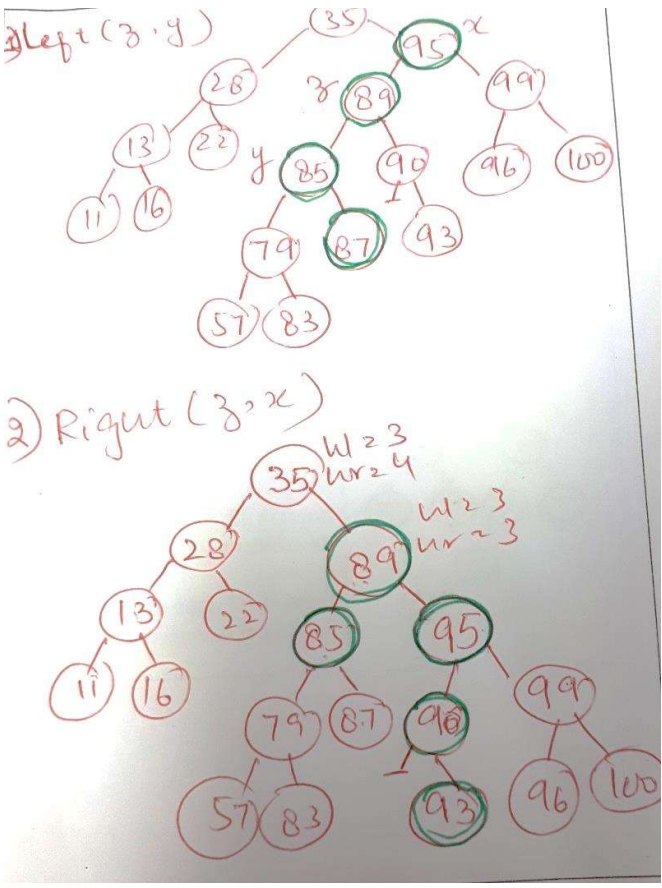| Course Name:	Data Structures	Course Code:	CS2001
Degree Program:	BS (CS, SE, DS)	Semester:	Fall 2022
Exam Duration:	60 Minutes	Total Marks:	20
Paper Date:	12-Nov-2022	Weight	15
Section:	ALL	Page(s):	5
Exam Type:	Midterm-II		

Student: Name: _____ Roll No._____ Section: _____

Instruction/Notes:	Attempt all questions. Answer in the space provided. You can ask for rough sheets but will not be attached with this exam. **Answers written on rough sheet will not be marked**. Do not use pencil or red ink to answer the questions**.** In case of confusion or ambiguity make a reasonable assumption.

Question 1:   (Marks: 5+5)

a) Insert the value **93** in the following AVL tree and redraw the tree after rebalancing. You must show all working with the names of imbalance cases, nodes, and rotations performed.

Imbalance Node:	95
Imbalance Case:	LR
Rotations Performed:	**2 Left Right**

b) For each of the scenarios given below, suggest the most appropriate data structure chosen from the list and give appropriate reason of your choice.
(Arrays, linked-list (single, double, circular), Queue, Stack, tree(BST, AVL))

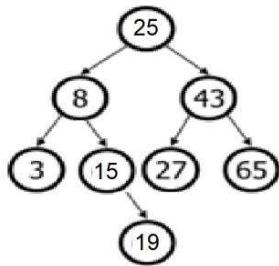|	
To create an index of important terms in a an electronic book	Tree (BST or AVL)
To check whether a given seat is reserved in an airplane or not	Arrays 1D or 2D
To implement play list in repeat mode of a music player	Linked List Circular
To implement undo and redo functionality in a text editor	Stack
To implement token system at bank.	Queue

Question 2: (Marks: 10)

Write a **RECURSIVE** C++ function FINDVALUE in an Integer-based AVL tree class that takes a positive integer value as input and find the node with the _smallest integer larger than or equal to_ the given input value. The function returns the node's data value and it must not take more than O(lgn) time.

EXAMPLE	
AVL- Tree	Input is 8, then the value returned is 8 _As 8 is the smallest integer larger than or equal to the given value 8_ Input is 26, then the value returned is 27 _As the integer 26 does not exists and 27 is the smallest integer larger than 26 in the given AVL tree_ Input is 22, then the value returned is 25 _As 22 does not exists and 25 is the smallest integer larger than 22_ Input is 67, then the value returned is -1 _As there is no integer equal to or larger than 67 in the given tree AVL tree_

```cpp
template <typename T>
T BST<T>::findValue(T value) {
            return findValue(root,value);
}


template <typename T>
T BST<T>::findValue(Node* curr, T value) {
      if (curr == nullptr)
            return -1;
      else if (curr->data == value)
            return value;
      else if (curr->data > value) {
            T temp = findValue(curr->left, value);
            if (temp == -1)
                  return curr->data;
            else
                  return temp;
      }
      else
            return findValue(curr->right, value);
}
```

Rough Sheet

Rough Sheet