National University of Computer and Emerging Sciences, Lahore Campus

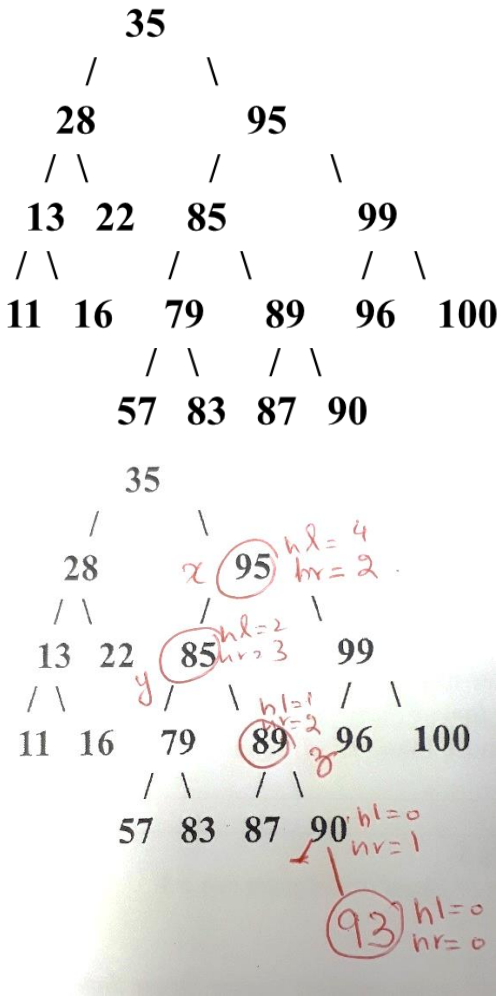
Course Name:	Data Structures	Course Code:	CS2001
Degree Program:	BS (CS, SE, DS)	Semester:	Fall 2022
Exam Duration:	60 Minutes	Total Marks:	20
Paper Date:	12-Nov-2022	Weight	15
Section:	ALL	Page(s):	5
Exam Type:	Midterm-II		

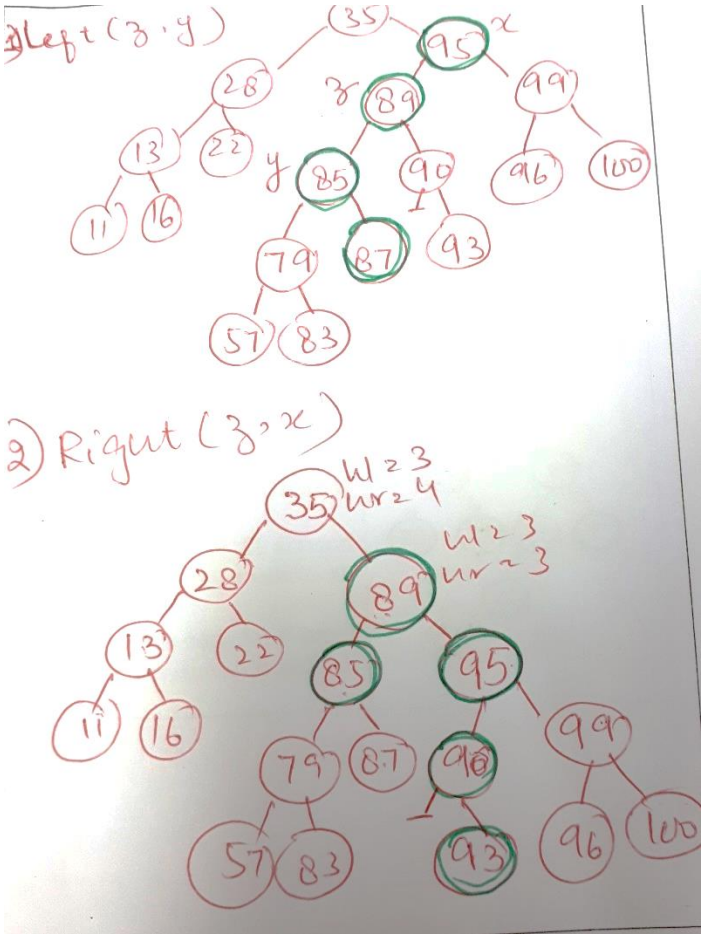
Student: Name: _____ **Roll No.**_____ **Section:** _____

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.





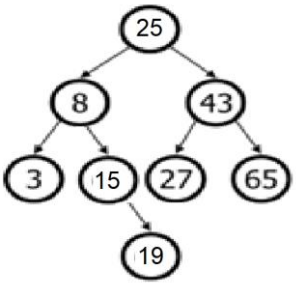
Imbalance Node:	95
Imbalance Case:	LR
Rotations Performed:	**2 Left Right**

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*

```
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

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