

AV121 – Data Structures and algorithms

Assignment 1

Due 19th May 2023

Part 1

Answers to this section can be hand-written and scanned or typed in.

1.1 Given the following mathematical expression:

$$(4*8) - (9 + (8-3))$$

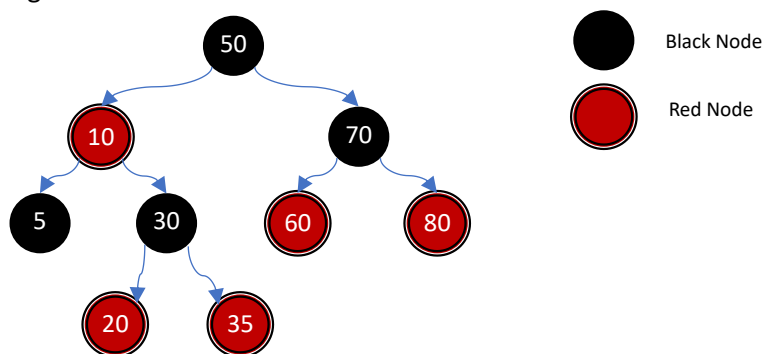
- Construct the equivalent expression tree.
- Write down the inorder, preorder and postorder traversals of the tree.
- If the postorder traversal is given as input to a computer for evaluation using a stack, list down the steps and the content of the stack after each step.

1.2 Construct an AVL tree from the following elements (in the order given below)

10, 20, 50, 90, 80, 5, 1

- Show the tree after inserting each number.
- After inserting the last number, what is the height of the resulting AVL tree?

1.3 Given the following Red-Black tree:



- Show the steps required in inserting the following numbers and the steps required (if any) to maintain the Red-Black tree rules:
 - Insert 1
 - Insert 85
 - Insert 6

Show the tree after each step.

Part 2

Please write programs in C++ for 2.1 and 2.2. For 2.3, the given C++ program can be corrected or augmented as per the problem statement.

2.1 Write a C++ program that does the following:

- Read 10 integers from the user.
- Insert the 10 integers into an STL set container.
- Print the size of the STL set container after inserting the integers.
- Read 5 integers from the user.
- For each of the 5 integers provided above, print “Element found” if the given integer is present in the set. If the given integer is not present, print “Element not found”.

2.2 Write a C++ program that stores the mapping shown below in an STL map container:

Student ID	Student Name
1	Divya
2	Yohan
3	Rachel
4	John

After constructing the STL map using the above data, the following has to be done:

- Read an integer input from the user.
- If a key corresponding to the integer is present in the map, print the corresponding value. Else, print “Student ID not found”.

2.3 You are provided with an implementation of the Binary Search Tree class and a main program that uses it. Do the following tasks:

- Read and understand the overall structure of the program.
- The findMinElement() and findMaxElement() functions are not working correctly. Identify the flaws in the program and correct them.

Associated Documentation

Along with your code you must also submit a document in which you briefly describe the code you have written (Each line of code need not be explained, but the overall logic you followed for solving the given problem shall be mentioned).

Documentation for C++ / STL

- <https://cplusplus.com/doc/tutorial/>
- <https://cplusplus.com/reference/stl/>

Group Work Policy

You may discuss possible solutions and implementations among your peers. However, each submission must be done independently and completely by each student.

Submission Format

- Source code and corresponding documentation for 2.1, 2.2 and 2.3 should be in separate folders.
- Scanned / typed in solutions for 1.1, 1.2 and 1.3 shall be in a separate folder.
- The above folders shall be compressed to a **single zip/tar/7z file** and submitted.
- **The name of the submitted file shall start with your student ID.**