LAB 3

Lưu ý:

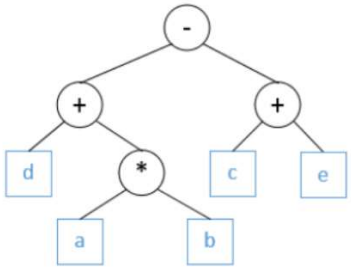
- Làm bài vào file word bằng tiếng Việt hoặc tiếng Anh
- Những bài làm giống nhau sẽ bị 0 điểm
- Với những bài lập trình, cần phải copy mã nguồn và chụp màn hình kết quả, đưa vào file word
- Địa chỉ nộp bài: ctdlgt.bku@gmail.com
- Hạn chót nộp bài: 23 giờ ngày 20/7/2023

Question 1:

Expression **(d + (a * b)) – (c + e)** can be described by the **Expression Tree** below (LNR traverse).

Draw the Expression Trees of the following expressions:

a) (3 – a) * (b + 4)
b) a – b – c * d – e – f
c) 1 * 3 ÷ a + (b – c + d) * 7
d) (8 * 2) + (a + (b – c) * d) ÷ (5 ÷ 2)



Which **Expression Tree** among a) b) c) d) is the complete tree? Explain your answer.

Question 2:

Given an empty Binary Search Tree (BST), the keys are inserted into BST one-by-one. Draw all states of the BST when inserting:

a) 15, 7, 1, 11, 9, 13, 20
b) 5, 6, 7, 8, 9
c) 100, 50, 150, 7, 55, 121, 200

Then, remove the underlined key (7) of the above trees (a, b, c). Draw the final state of the trees after removing.

//

Given the following data structure

```
class treeNode {
public:
    int data;
    treeNode* left = NULL;
    treeNode* right = NULL;
};
```

Question 3:

Write a recursive function to insert a new node into the BST:

```
treeNode*recursiveInsert ( treeNode*subroot, treeNode*newNode ) {
// YOUR CODE HERE
}
```

Question 4: Use function recursiveInsert to build a BST tree like figure 1

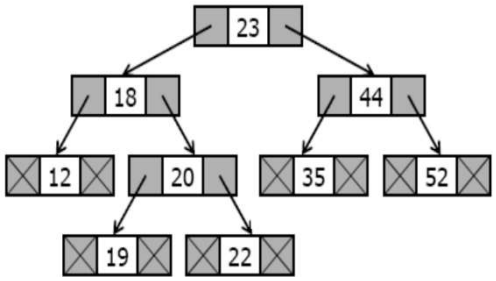


Figure 1

Question 5: Write a function to print the tree. For example, the tree in figure 1 will be printed like figure 2.

```
23
-18
--12
--20
---19
---22
-44
--35
--52
```

Figure 2

Question 6: Write a function to print out the path from root to the node having **searchedData**

```
void printPath ( treeNode* subroot, int searchedData ) {
// YOUR CODE HERE
}
```

Question 7: Write a function that print out all leaves in increasing order.

Question 8: Write a function that print out all leaves in decreasing order.

Question 9: Write a function that return the height of a BST tree.

Question 10: Construct an AVL tree by inserting one by one elements as follows:

20, 12, 44, 35, 75, 21, 30, 33, 87, 6, 91, 15, 69

Draw the tree after each element is inserted in the tree.

Question 11: Remove elements of AVL tree in question 10 step by step

75, 44, 69, 87, 91, 20

Draw the tree after each element is deleted from the tree.