

Data Structure

Homework 3

Deadline: 2019/12/10 23:55

Task 1: (I/O: 35 points, coding style: 5 points)

Given an input number n and serial integers, please write a program to build a binary search tree and show the preorder, inorder, and postorder traversals. The root is the first integer of the serial integers. If the upcoming integer **equals** to an existing node, put it on its **right (right-child)**. For other cases, put the smaller ones on left (left-child), bigger ones on right (right-child). When encountering -1, it means the end of the program.

The program must be implemented by **linked list, or you will get zero points.**

Example:

Input	Output
8 10 5 6 13 4 9 7 1	Preorder: 10 5 4 1 6 9 7 13 Inorder: 1 4 5 6 7 9 10 13 Postorder: 1 4 7 9 6 5 13 10
3 10 5 8	Preorder: 10 5 8 Inorder: 5 8 10 Postorder: 8 5 10
-1	

Task 2: (I/O: 25 points, coding style: 5 points)

Given some input sentences, please first implement the Huffman algorithm and output the Huffman code of each symbol (Ignoring ‘ . ’, ‘ , ’, ‘ ~ ’ and so on, **but you should not ignore space**). Notice that the result of outputs should be listed in ascending order according to their **ASCII code**. Then, you need to calculate its compression ratio. Afterward, given a sequence of code (Assume that users will only input valid codes), please convert it back to its original sentences. While building the Huffman tree by bottom-up method, please follow the rules below:

- (1) If more two different characters have the same frequencies, order them by their ASCII code.
- (2) The value of the right node has to be larger than or equal to the one of the left node.
- (3) Follow the order in (1) to read the value, and build the tree from the left subtree.
- (4) The values of left and right branches are “0” and “1”, respectively.

Example:

Input	Output
Baby, baby, baby oh Like baby, baby, baby no Like baby, baby, baby ooh	Huffman code: Space: 00 B: 010000 L: 01001 a: 110 b: 10 e: 01010 h: 01011 i: 01100 k: 01101 n: 010001 o: 0111 y: 111 Minimum weighted external path length: 192 Compression ratio: 320/512
Please input the code: 010011100001001110000100101110111	La La Loo

Put the files below in the folder (folder name: studentID), and compress this folder as **“studentID.zip”**

1. **Two** source code files (filename: studentID_1.c, studentID_2.c)
2. **One report** with your coding environment (OS, IDE, ...), problems you encountered, and references. (filename: studentID.pdf) (20 points)

All the file names are correct, or you'll get zero points. (10 points)

You must hand in the assignment on time, or you will get zero points.

Warning: We encourage you to discuss assignments with each other. However, you have the responsibility to finish the assignments individually. **Do not copy others' assignment, or you will get zero points.**

Expected result:

(1)

```
C:\Users\User\Desktop\example1.exe
8
10 5 6 13 4 9 7 1
Preorder: 10 5 4 1 6 9 7 13
Inorder: 1 4 5 6 7 9 10 13
Postorder: 1 4 7 9 6 5 13 10

3
10 5 8
Preorder: 10 5 8
Inorder: 5 8 10
Postorder: 8 5 10

-1

Process returned 0 (0x0)   execution time : 30.555 s
Press any key to continue.
```

(2)

```
C:\Users\User\Desktop\try.exe
Baby, baby, baby oh Like baby, baby, baby no Like baby, baby, baby ooh
Huffman code:
Space: 00
B: 010000
L: 01001
a: 110
b: 10
e: 01010
h: 01011
i: 01100
k: 01101
n: 010001
o: 0111
y: 111
Minimum weighted external path length: 192
Compression ratio: 320/512

Please input the code: 010011100001001110000100101110111
La La Loo

Process returned 0 (0x0)   execution time : 3.672 s
Press any key to continue.
```