

Data Structure — programming assignment

Due: 2022/11/17 10:00 a.m.

1. Description

Tree is an important data structure in computer science. In this course, Prof. Chen has introduced many kinds of trees and many properties of trees. One day, Prof. Chen asked his TA to generate binary search tree (BST) test cases for research experiments. However, careless TA deleted test cases and had no backup files. Only postorder BST records still remained on his notes. Could you help TA to rebuild the original BST structure given the postorder BST? In addition, TA wants to know the height of BST and the maximum value for each level on BST.

2. Input

The first line is how many BSTs.

For each BST contains:

The first line is the number of nodes.

The second line is the postorder of BST.

3. Output

For each BST, please output as following:

The first line is the preorder of the BST.

The second line is the height of the BST.

The following **n** lines are maximum values on the BST, from top to bottom. (**n** is equal to the height of BST)

4. Sample

Sample input

```
2
6
1 3 2 5 6 4
5
20 15 9 7 3
```

Sample output

```
4 2 1 3 6 5
```

3
4
6
5
3 7 9 15 20
5
3
7
9
15
20

5. Constraints

- 1 ≤ The number of trees ≤ 10
- 1 ≤ The number of nodes in tree ≤ 1000
- 500 ≤ The value of node ≤ 1000

All values are distinct.

6. Command-line Parameters

The executable binary file must be named as **bst** and use the following command format:

`./bst [input file name] [output file name]`

For example:

`./bst public1.dat public1_ans.dat`

7. File format

You have to submit directory named **<student_ID>** which contains:

- (1) C/C++ source files named by ***.h, *.hpp, *.c, *.cpp**.
- (2) A makefile named **Makefile** that compiles your code, and generates the executable file named **bst** by typing “make”.
- (3) A report named **report.pdf** briefly describes your solution and specifies any reference or collaborator.

Default compiler/standard: g++9/C++14

Compress the directory <student_ID> in a **ZIP file named <student_ID>.zip**. For example: Compress directory **B09901001** in **B09901001.zip**

Please check if your makefile can work before submission.

8. Grading

There are 4 test cases, including 3 public test cases and 1 private test case.

- Public test case 1 (20%)
- Public test case 2 (20%)
- Public test case 3 (20%)
- Private test case 4 (20%)
- Report (20%)

9. Discussion

Please use NTU COOL discussion board if you have any question.

Broken makefile, delayed submission and plagiarism will get 0 points.