Programming assignment #1

Alphabet Chain in Binary Tree

Objective

1. To understand how to design an algorithm.
2. To exercise the concept of recursion.
3. To learn how to use divide and conquer strategy.

Problem

Given an alphabet binary tree, please find the length of the longest vowel chain (only include 'a', 'e', 'i', 'o', 'u'). The length is defined as the number of edges in the chain. For example, a chain with 4 nodes has a length of 3. The longest chain has to meet the following rules :
1. Nodes in the chain can only include vowels.
2. Nodes in the chain can only go through once.

Bonus

When output mode is 1, output the node IDs of the longest chain. The node IDs should print from the endpoint whose ID is smaller.

Compile & Execute

Compile command : **$ g++ <hw1.cpp> -O3**
Execute command : **$ ./<execute file> <input file> <output file>**
(Ex : $ ./a.out input1.txt output1.txt)
Note that input and output file should be the arguments of program. Please make sure your code can be compiled and executed.

Input

Input file is a node list of following format :

Number of nodes
Output mode

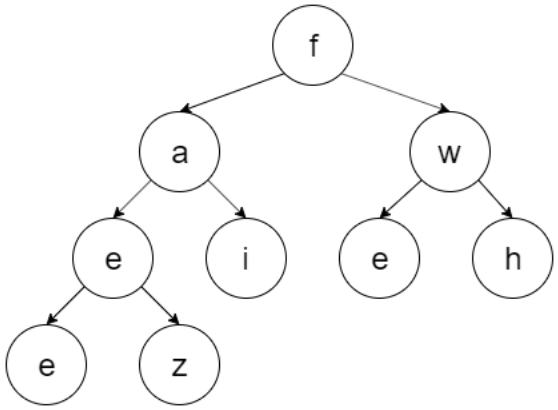
Node list
…

In the node list, each line represents a node and includes the following information.
<node ID> <alphabet> <left child ID> <right child ID>
Node ID starts from 1. Child ID will be 0 if the child is NULL. Alphabet must be lowercase. The node list is sorted bottom-up, which means the node's children ID must smaller than its. The last node in the list is the tree root.

Input example

```
9
0

1 e 0 0
2 z 0 0
3 e 1 2
4 i 0 0
5 e 0 0
6 h 0 0
7 a 3 4
8 w 5 6
9 f 7 8
```




```
9
1

1 e 0 0
2 z 0 0
3 e 1 2
4 i 0 0
5 e 0 0
6 h 0 0
7 a 3 4
8 w 5 6
9 f 7 8
```

Output

When output mode is 0, print the length of the longest chain. When output mode is 1, print the length of the longest chain and the ID of nodes in the chain. When printing the IDs, please start from the endpoint whose ID is smaller.

Output example

```
3                    // output mode is 0
```

```
3                    // output mode is 1

1
3
7
4
```

Program Submission

1. Please use the C++ language and your program must be written in only one source file.
2. Your source file must be named as "Student_ID_number_hw1.cpp" and please make sure that all characters of the filename are in lower case. For example, if your student number is 9711592, the name of your program file should be "9711592_hw1.cpp".
3. Upload your report and program to the E3 by deadline.
4. Don't print any words on the terminal.

Report

1. No more than 3 pages.
2. Your report must contain:

   a. The flow chart or the pseudo code of your program.

   b. The experimental results and analysis.
3. The report file name must be "Student_ID_number_hw1.doc(x)" or "Student_ID_number_hw1.pdf" and please make sure that all characters of the filename are in lower case. For example, if your student number is 9711592, the name of your program file should be "9711592_hw1.pdf".

Grading

- **Report** **30 %**
- **Case 1** **15%**
- **Case 2** **15%**
- **Hidden cases (output mode is 0)** **30%**
- **Bonus cases (output mode is 1)** **10%**

***Time limit : 1 minute for each case**

Noting

- **Due Date : 2019/10/21 23:55:00**
- **You'll get 0 points if not hand in on time.**
- **Plagiarism is forbidden.**