

# Spell checker

---

In this assignment you have to implement a spell checker. You will be provided a dictionary of words.

For suggesting correct spelling of a word, you have to find which word is nearest to the given word. We use edit distance between two string as a measure of their distance. Edit distance between two word  $A$  and  $B$  is  $d$  if minimum cost of editing  $A$  to  $B$  is  $d$ . Editing may be sequence of following operation

**Insert** Insert a character in some position of  $A$ . For example inserting  $x$  in position 2 of  $xyzyax$  will result  $xyxzyax$ . Its costs is  $i$

**Delete** Delete a character from some position of  $A$ . For example deleting from position 2 of  $xyzyax$  will result  $xzyax$ . Its costs is  $d$

**Swap** Swap two adjacent characters of  $A$ . For example swapping  $zy$  in position 2 of  $xyzyax$  will result  $xyyzax$ . Its costs is  $s$ . Note that swap operation can be applied on a character only once. And these character should be adjacent in both starting and final string. For example neither  $abc \rightarrow acb \rightarrow cab$  nor  $abcd \rightarrow abd \rightarrow adb$  is allowed.

For example consider the string *thier*. It can be obtained from *there* using an insert and a delete. It can be obtained from *their* using a swap operation. So if  $s = 5, i = 3, d = 4$  then edit distance of *thier* from *there* is 7 and *their* is 5. Now if  $s = 5, i = 2, d = 2$  then edit distance of *thier* from both *there* and *their* is 4.

## Input

The input starts with a dictionary. The first number of input is  $a < 5000$  number of words in dictionary.  $a$  lines follow, each line contains a word of dictionary. Each of this word will be in lowercase alphabet and valid English word. Length of these words will be less than 20 and will be at least 3. The dictionary is sorted lexicographically. An empty line follows the dictionary.

The input consists of several test cases. First line of each test case will contain three number  $i, d, s$ , where  $1 \leq i, d, s \leq 100$ . Next line contains a word in a single line. Length of these words will be less than 20 and will be at least 3. Each of this word will be in lowercase alphabet.

Last line of input will contain three zeros.

## Output Specification

For each case of input, print the word with minimum edit distance and its distance. If there is multiple solution with same minimum distance print lexicographically earlier one (The one that appears earlier in dictionary).

## Sample Input

```
4
the
there
their
that
```

```
1 1 1
the
1 1 1
tha
1 1 1
teh
1 1 5
teh
3 2 3
htta
3 4 5
thier
2 2 5
thier
0 0 0
```

## Sample Output

```
the 0
that 1
the 1
the 2
that 6
their 5
the 4
```

## Remarks

There will be around 30 test cases. Time limit will be around 2 seconds.

An  $O(l^3)$  algorithm may not pass the time limit.

1 based indexing may simplify the base cases.

---

Tanaeem M Moosa  
tanaeem.moosa@csebuuet.org