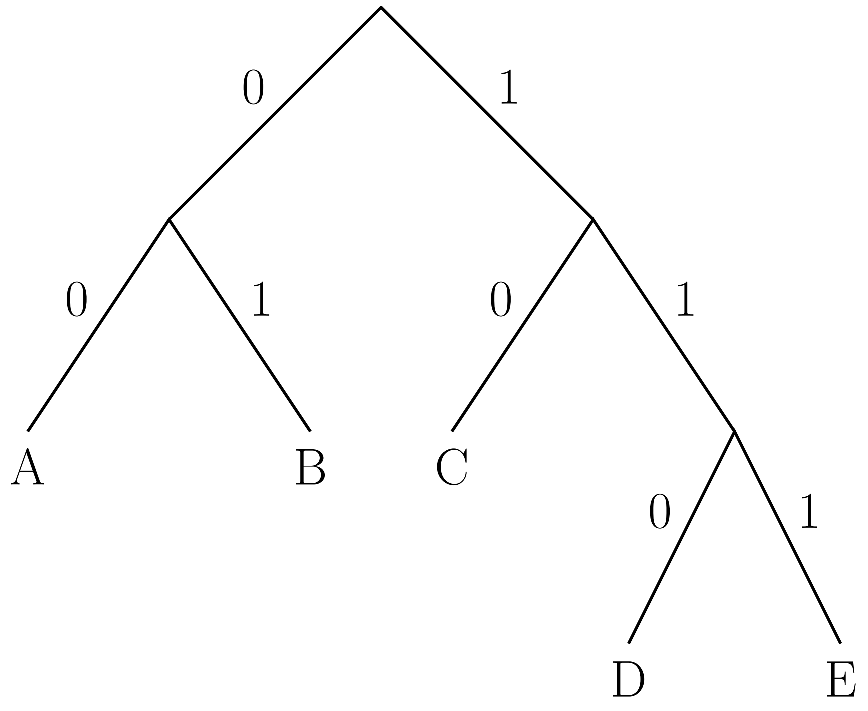
CCC '10 S2 - Huffman Encoding

Canadian Computing Competition: 2010 Stage 1, Senior #2

There is an ingenious text-compression algorithm called *Huffman coding*, designed by David Huffman in 1952.

The basic idea is that each character is associated with a binary sequence (i.e., a sequence of `0`s and `1`s). These binary sequences satisfy the *prefix-free property*: a binary sequence for one character is never a prefix of another character's binary sequence.

It is worth noting that to construct a prefix-free binary sequence, simply put the characters as the leaves of a binary tree, and label the "left" edge as `0` and the "right" edge as `1`. The path from the root to a leaf node forms the code for the character at that leaf node. For example, the following binary tree constructs a prefix-free binary sequence for the characters $\{A, B, C, D, E\}$:



That is, `A` is encoded as `00`, `B` is encoded as `01`, `C` is encoded as `10`, `D` is encoded as `110` and `E` is encoded as `111`.

The benefit of a set of codes having the prefix-free property is that any sequence of these codes can be uniquely decoded into the original characters.

Your task is to read a Huffman code (i.e., a set of characters and associated binary sequences) along with a binary sequence, and decode the binary sequence to its character representation.

Input Specification

The first line of input will be an integer k ($1 \leq k \leq 20$), representing the number of characters and associated codes. The next k lines each contain a single character, followed by a space, followed by the binary sequence (of length at most 10) representing the associated code of that character. You may assume that the character is an alphabet character (i.e., $a \ldots z$ and $A \ldots Z$). You may assume that the sequence of binary codes has the prefix-free property. On the $k+2$nd line is the binary sequence which is to be decoded. You may assume the binary sequence contains codes associated with the given characters, and that the $k+2$nd line contains no more than 250 binary digits.

Output Specification

On one line, output the characters that correspond to the given binary sequence.

Sample Input

```
5
A 00
B 01
C 10
D 110
E 111
00000101111
```

Output for Sample Input

```
AABBE
```