Problem H
Prefix Codes
Input: Standard Input
Output: Standard Output

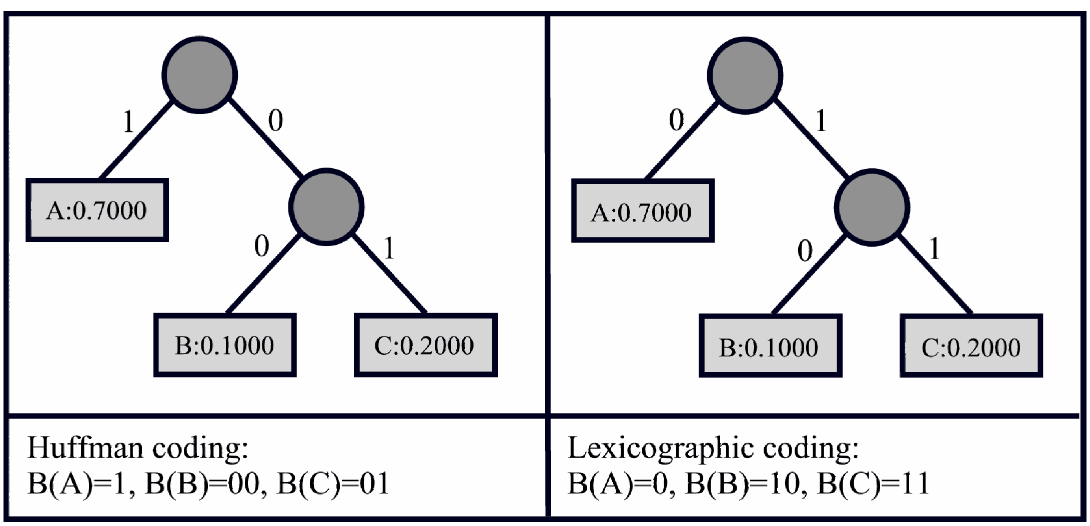
Given an alphabet **S**, and a probability **Prob(a)** for each $a \in S$, a binary prefix code represents each a in S as a bit string **B(**a**)**, such that **B(**a_1**)** is not a prefix of **B(**a_2**)** for any $a_1 \neq a_2$ in S.

Huffman's algorithm constructs a binary prefix code by pairing the two least probable elements of **S**, a_0 and a_1. a_0 and a_1 are given codes with a common (as yet to be determined) prefix **p** and differ only in their last bit: **B(**a_0**)** = $\mathbf{p_0}$ while **B(**a_1**)** = $\mathbf{p_1}$. a_0 and a_1 are removed from **S** and replaced by a new element **b** with **Prob(b)** = **Prob(**a_0**)** + **Prob(**a_1**)**. **b** is an imaginary element standing for both a_0 and a_1. The Huffman code is computed for this reduced **S**, and **p** is set equal to **B(b)**. This reduction of the problem continues until **S** contains one element a represented by the empty string; that is, when **S** = {a}, **B(**a**)** = **ε**.

Huffman's code is optimal in that there is no other prefix code with a shorter average length defined as

$$\sum_{a \in S} \text{Prob}(a) \times |B(a)|$$

One problem with Huffman codes is that they don't necessarily preserve any ordering that the elements may have. For example, suppose **S** = **{A, B, C}** and **Prob(A) = 0.7**, **Prob(B) = 0.1**, **Prob(C) = 0.2**. A Huffman code for **S** is **B(A) = 1**, **B(B) = 00**, **B(C) = 01**. The lexicographic ordering of these strings is **B(B)**, **B(C)**, **B(A) [i.e. 00,01,1]**, so the coding does not preserve the original order **A**, **B**, **C**. Therefore, algorithms like binary search might not work as expected on Huffman-coded data.



Given an ordered set **S** and **Prob**, you are to compute an ordered prefix code - one whose lexicographic order preserves the order of **S**.

Input

Input consists of several data sets. Each set begins with **0** < n **≤ 100**, the number of elements in **S**. n lines follow; the **i-th** line gives the probability of $\mathbf{a_i}$, the **i-th** element of **S**. Each probability is given as **0.dddd** (that is, with exactly four decimal digits). The probabilities sum to **1.0000** exactly. A line containing **0** follows the last data set.

Output

For each data set, compute an optimal ordered binary prefix code for **S**. The output should consist of one line giving the average code length, followed by **n** lines, with the **i-th** line giving the code for the **i-th** element of **S**. If you have solved the problem, these **n** lines will be in lexicographic order. If there are many optimal solutions, choose any one.

Output an empty line between cases.

Sample Input	Output for Sample Input
3 0.7000 0.1000 0.2000 3 0.7000 0.2000 0.1000 0	1.3000 0 10 11 1.3000 0 10 11