IOI Training Camp 2010 – Test 2, 17 June, 2010

Problem 2 Binary Codes

Consider a sequence $b_1 b_2 \ldots b_N$ of N binary digits. Given such a sequence, we rotate it by one digit to the left $N-1$ times to generate a block of N sequences arranged in an $N \times N$ array of 0's and 1's, as follows.

$$\begin{array}{cccc} b_1 & b_2 & \ldots & b_{N-1} & b_N \\ b_2 & b_3 & \ldots & b_N & b_1 \\ \vdots & \vdots & & \vdots & \vdots \\ b_{N-1} & b_N & \ldots & b_{N-3} & b_{N-2} \\ b_N & b_1 & \ldots & b_{N-2} & b_{N-1} \end{array}$$

We then sort these sequences in lexicographic order—that is, regard each row of the array as a binary number and rearrange the rows in ascending order.

After this rearrangement, we extract the last column of the new $N \times N$ array. The goal is to work backwards from this column and compute the top row of the $N \times N$ sorted array that created it.

For example, consider the binary sequence 0 0 1 1 0. After sorting the rows of the 5×5 array that this sequence generates, the last column reads 1 0 0 1 0 from top to bottom. Given this last column, the task is to determine the first row of the sorted array, which is 0 0 0 1 1. The example is illustrated below.

Initial array	*Sorted array*	*Rightmost column*
0 0 1 1 0	0 0 0 1 1	1
0 1 1 0 0	0 0 1 1 0	0
1 1 0 0 0	0 1 1 0 0	0
1 0 0 0 1	1 0 0 0 1	1
0 0 0 1 1	1 1 0 0 0	0

Input format

The first line of input is the number N. The second line of input consists of N space separated binary digits corresponding to the last column of the array, read from top to bottom.

Output format

The output should consist of a single line with N binary digits separated by spaces, corresponding to the first row of the sorted array.

It is guaranteed that a solution exists. If there are multiple solutions, output any one.

Test Data

You may assume that $1 \leq N \leq 10^6$. In test cases worth at least 50% of the score, $1 \leq N \leq 250$.

Example

Here is the sample input and output corresponding to the example above.

Sample input	Sample output
`5` `1 0 0 1 0`	`0 0 0 1 1`

Time and memory limits

The time limit for this task is 4 seconds. The memory limit is 44 MB (actual limit 32 MB, plus 12 MB buffer for 64-bit compilation).