

Problem G. Phase Shift

Time limit 3000 ms

Mem limit 262144 kB

There was a string s which was supposed to be encrypted. For this reason, all 26 lowercase English letters were arranged in a circle in some order, afterwards, each letter in s was replaced with the one that follows in clockwise order, in that way the string t was obtained.

You are given a string t . Determine the lexicographically smallest string s that could be a prototype of the given string t .

A string a is lexicographically smaller than a string b of the same length if and only if:

- in the first position where a and b differ, the string a has a letter, that appears earlier in the alphabet than the corresponding letter in b .

Input

The first line of the input contains a single integer t ($1 \leq t \leq 3 \cdot 10^4$) — the number of test cases. The description of test cases follows.

The first line of each test case contains one integer n ($1 \leq n \leq 10^5$) — the length of the string t .

The next line contains the string t of the length n , containing lowercase English letters.

It is guaranteed that the sum of n over all test cases doesn't exceed $2 \cdot 10^5$.

Output

For each test case, output a single line containing the lexicographically smallest string s which could be a prototype of t .

Sample 1

| Input | Output |
|----------------------------|---------------------------|
| 5 | b |
| 1 | ac |
| a | abcdebfadg |
| 2 | bcdefghijklmnopqrstuvwxyz |
| ba | bcdefghijklmnopqrstuvwxyz |
| 10 | |
| codeforces | |
| 26 | |
| abcdefghijklmnopqrstuvwxyz | |
| 26 | |
| abcdefghijklmnopqrstuvwxyz | |

Note

In the first test case, we couldn't have the string "a", since the letter a would transit to itself. Lexicographically the second string "b" is suitable as an answer.

In the second test case, the string "aa" is not suitable, since a would transit to itself. "ab" is not suitable, since the circle would be closed with 2 letters, but it must contain all 26. The next string "ac" is suitable.

Below you can see the schemes for the first three test cases. The non-involved letters are skipped, they can be arbitrary placed in the gaps.

