

A. Puzzle From the Future

time limit per test: 1 second

memory limit per test: 256 megabytes

input: standard input

output: standard output

In the 2022 year, Mike found two binary integers a and b of length n (both of them are written only by digits 0 and 1) that can have leading zeroes. In order not to forget them, he wanted to construct integer d in the following way:

- he creates an integer c as a result of bitwise summing of a and b *without transferring carry*, so c may have one or more 2-s. For example, the result of bitwise summing of 0110 and 1101 is 1211 or the sum of 011000 and 011000 is 022000;
- after that Mike replaces equal consecutive digits in c by one digit, thus getting d . In the cases above after this operation, 1211 becomes 121 and 022000 becomes 020 (so, d won't have equal consecutive digits).

Unfortunately, Mike lost integer a before he could calculate d himself. Now, to cheer him up, you want to find **any binary** integer a of length n such that d will be **maximum possible as integer**.

Maximum possible as integer means that $102 > 21$, $012 < 101$, $021 = 21$ and so on.

Input

The first line contains a single integer t ($1 \leq t \leq 1000$) — the number of test cases.

The first line of each test case contains the integer n ($1 \leq n \leq 10^5$) — the length of a and b .

The second line of each test case contains binary integer b of length n . The integer b consists only of digits 0 and 1.

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

Output

For each test case output one **binary** integer a of length n . Note, that a or b may have leading zeroes but must have the same length n .

Example

input	Copy
<pre>5 1 0 3 011 3 110 6 111000 6 001011</pre>	
output	Copy
<pre>1 110 100 101101 101110</pre>	

Note

In the first test case, $b = 0$ and choosing $a = 1$ gives $d = 1$ as a result.

In the second test case, $b = 011$ so:

- if you choose $a = 000$, c will be equal to 011, so $d = 01$;
- if you choose $a = 111$, c will be equal to 122, so $d = 12$;

Codeforces Round #696 (Div. 2)

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→ Virtual participation

Virtual contest is a way to take part in past contest, as close as possible to participation on time. It is supported only ICPC mode for virtual contests. If you've seen these problems, a virtual contest is not for you - solve these problems in the archive. If you just want to solve some problem from a contest, a virtual contest is not for you - solve this problem in the archive. Never use someone else's code, read the tutorials or communicate with other person during a virtual contest.

[Start virtual contest](#)

→ Practice

You are registered for practice. You can solve problems unofficially. Results can be found in the contest status and in the bottom of standings.

→ Clone Contest to Mashup

You can clone this contest to a mashup.

[Clone Contest](#)

→ Submit?

Language: GNU G++17 7.3.0

Choose file: Choose file No file chosen

Be careful: there is 50 points penalty for submission which fails the pretests or resubmission (except failure on the first test, denial of judgement or similar verdicts). "Passed pretests" submission verdict doesn't guarantee that the solution is absolutely correct and it will pass system tests.

[Submit](#)

→ Last submissions



Submission	Time	Verdict
104913469	Jan/20/2021 17:38	Wrong answer on test 3
104795438	Jan/19/2021 18:08	Accepted

→ Problem tags

[greedy](#) [*800](#)

No tag edit access

→ Contest materials

- [Announcement](#) 
- [Tutorial \(en\)](#) 



- if you choose $a = 010$, you'll get $d = 021$.
- If you select $a = 110$, you'll get $d = 121$.

We can show that answer $a = 110$ is optimal and $d = 121$ is maximum possible.

In the third test case, $b = 110$. If you choose $a = 100$, you'll get $d = 210$ and it's the maximum possible d .

In the fourth test case, $b = 111000$. If you choose $a = 101101$, you'll get $d = 212101$ and it's maximum possible d .

In the fifth test case, $b = 001011$. If you choose $a = 101110$, you'll get $d = 102121$ and it's maximum possible d .

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