D2. Prefix-Suffix Palindrome (Hard version)

time limit per test: 2 seconds
memory limit per test: 256 megabytes

This is the hard version of the problem. The difference is the constraint on the sum of lengths of strings and the number of test cases. You can make hacks only if you solve all versions of this task.

You are given a string s, consisting of lowercase English letters. Find the longest string, t, which satisfies the following conditions:

- The length of t does not exceed the length of s.
- t is a palindrome.
- There exists two strings a and b (possibly empty), such that $t = a + b$ ("+" represents concatenation), and a is prefix of s while b is suffix of s.

Input

The input consists of multiple test cases. The first line contains a single integer t ($1 \leq t \leq 10^5$), the number of test cases. The next t lines each describe a test case.

Each test case is a non-empty string s, consisting of lowercase English letters.

It is guaranteed that the sum of lengths of strings over all test cases does not exceed 10^6.

Output

For each test case, print the longest string which satisfies the conditions described above. If there exists multiple possible solutions, print any of them.

Example

input Copy

```
5
a
abcdfdcecba
abbaxyzyx
codeforces
acbba
```

output Copy

```
a
abcdfdcba
xyzyx
c
abba
```

Note

In the first test, the string s ="a" satisfies all conditions.

In the second test, the string "abcdfdcba" satisfies all conditions, because:

- Its length is 9, which does not exceed the length of the string s, which equals 11.
- It is a palindrome.
- "abcdfdcba" = "abcdfdc" + "ba", and "abcdfdc" is a prefix of s while "ba" is a suffix of s.

It can be proven that there does not exist a longer string which satisfies the conditions.

In the fourth test, the string "c" is correct, because "c" = "c" + "" and a or b can be empty. The other possible solution for this test is "s".

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→ Clone Contest to Mashup

You can clone this contest to a mashup.

Clone Contest

→ Submit?

Language: GNU G++20 13.2 (64 bit, win

Choose file: Choose File No file chosen

Submit

→ Last submissions

Submission	Time	Verdict
281034691	Sep/13/2024 22:29	Accepted
280718610	Sep/11/2024 13:57	Accepted
280718560	Sep/11/2024 13:57	Runtime error on test 4

→ Problem tags

binary search greedy hashing string suffix structures strings *1800

No tag edit access

→ Contest materials

- Announcement (en)
- Tutorial (en)