Problem A. Prefix function

Input file:	system input
Output file:	system output
Time limit:	2 seconds
Memory limit:	256 megabytes

Build the prefix function for the given string s.

Input

The sole line of the input contains string s ($1 \le |s| \le 10^6$). The string s consists of Latin letters.

Output

Output the values of the prefix function of the string s for all indices 1, 2, ..., $|s|$.

Examples

system input	system output
aaaAAA	0 1 2 0 0 0
abacaba	0 0 1 0 1 2 3

Problem B. Z-function

Input file:	system input
Output file:	system output
Time limit:	2 seconds
Memory limit:	256 megabytes

Build the Z-function for the given string s.

Input

The sole line of the input contains string s ($1 \le |s| \le 10^6$). The string s consists of Latin letters.

Output

Output the values of the Z-function of the string s for all indices 2, ..., $|s|$.

Examples

system input	system output
aaaAAA	2 1 0 0 0
abacaba	0 1 0 3 0 1

Problem C. Find the period

Input file:	system input
Output file:	system output
Time limit:	2 seconds
Memory limit:	256 megabytes

You are given the string s. Your task is to find the shortest string t, such that t could be represented as a concatenation of one or several strings t.

Input

The sole line of the input contains string s ($1 \le |s| \le 10^6$). The string s consists of Latin letters.

Output

Output the length of such t.

Examples

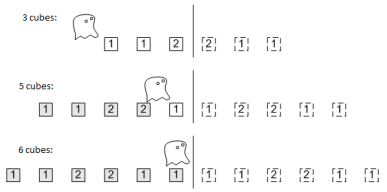
system input	system output
abcabcabc	3
abacaba	7

Problem D. Cubes

Input file:	system input
Output file:	system output
Time limit:	2 seconds
Memory limit:	256 megabytes

The ghost Petya likes to play with his cubes. He likes to put them in a row and look at them. The friends decided to prank Petya and put a mirror in the room. It is all known that ghost could not reflect in the mirror while cubes could.

Now, Petya see N cubes in front of him, but he do not know which cubes are real and which are reflections.



Help Petya to find how many cubes he could have. Petya sees the reflections of the all the cubes and some number of cubes in front of him. Several cubes could be behind him, so Petya does not see them.

Input

The first line of the input contains two integers N and M ($1 \le N, M \le 10^5$) — the number of cubes he sees and the number of different colors of the cubes. Next line contains N integers from 1 to M — the colors of the cubes

Output

The sole line of the output should contain all K, the possible number of cubes, in ascending order.

Examples

system input	system output
6 2 1 1 2 2 1 1	3 5 6

Problem E. Suffix array

Input file:	system input
Output file:	system output
Time limit:	4 seconds
Memory limit:	256 megabytes

You are given a string s of length n. Sort its suffixes in lexicographical order.

Input

The sole line of the input contains string s ($1 \le |s| \le 10^5$). The string s consists of Latin letters.

Output

Return the permutation $a_0, a_1, \ldots, a_{n-1}$ such that strings $s[a_0..n-1]$, $s[a_1..n-1]$, $\ldots$, $s[a_{n-1}..n-1]$ are sorted lexicographically.

Examples

system input	system output
abacaba	6 4 0 2 5 1 3

Problem F. The number of substrings

Input file:	system input
Output file:	system output
Time limit:	4 seconds
Memory limit:	256 megabytes

Find the number of different substrings of the string s.

Input

The sole line of the input contains string s ($1 \le |s| \le 10^5$). The string s sonsists of Latin letters.

Output

The sole line of output should contain the answer for the problem.

Examples

system input	system output
ababb	11

Problem G. Melman

Input file:	system input
Output file:	system output
Time limit:	2 seconds
Memory limit:	256 megabytes

Melman is a giraffe that cares much about his health. He reads a lot of medical books and looks for an information about new deseases. So, he know that the desease appears because of the viruses. He knows that he do not have any viruses.

One day he found that the viruses could mutate. Let the DNA of the virus be represented as a string t, consisting of Latin letters. It was written in the book that in the mutated virus exactly two symbols t_i and t_{i+k} ($i \in [1, n-k]$) could be changed.

Your task is given the DNA the Melman find all the substrings that could be a mutated virus.

Input

The first line of the input contains the DNA of Melman s ($1 \le |s| \le 2 \cdot 10^5$) consisting of lowercase Latin letters. The second line contains the DNA of the virus t ($1 \le |t| \le 2 \cdot 10^5$) consisting of lowercase Latin letters. The third line contains k ($1 \le k \le n - 1$).

Output

The first line of the output should contain the number of times the mutated virus appears in the DNA of Melman. The second line should contain the appearance positions in sorted order.

Examples

system input	system output
abaaaaa baab 3	2 3 4

Problem H. Double reverse

Input file:	system input
Output file:	system output
Time limit:	2 seconds
Memory limit:	256 megabytes

You have a chain of n cubes. Some of them has the same color. At the first step you choose a subchain and reverse it. At the second step you choose a subchain that contains the subchain of the first step and reverse it. The subchains that you reverse should be palindromic.

Find the number of ways to choose a subchain at the first step.

Input

The sole line of the input contains a chain of n cubes ($1 \le n \le 10^5$), represented by a string of lowercase Latin letters.

Output

The sole line of the output should contain the answer to the problem.

system input	system output
aabaa	8

Problem I. String Decomposition

Input file:	system input
Output file:	system output
Time limit:	2 seconds
Memory limit:	256 megabytes

For a string α and an integer n define α^n as the concatenation of n copies of α. For example, $\texttt{aab}^4 = \texttt{aabaabaabaab}$.

Each string S can be decomposed as $S = S_1^{d_1} S_2^{d_2} \dots S_k^{d_k}$. There can be several ways to make such decomposition. The weight of the decomposition is the sum $|S_1| + |S_2| + \dots + |S_k|$ where $|Z|$ is the length of the string Z.

Given S find its decomposition which has the minimal possible weight.

Input

The input file contains the string S. S contains only capital letters of the English alphabet, its length doesn't exceed 5 000.

Output

The first line of the output file must contain w — the minimal possible weight of the decomposition of S. Let k be the number of elements in the optimal decomposition. The following k lines must contain two elements each — S_i and d_i separated by a space.

If there are several optimal decompositions, describe any one.

Example

system input	system output
ABABAAABABA	5 AB 2 A 3 BA 2