Problem A. MaxKU's Z Algorithm

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	64 megabytes

If you have ever learned Z algorithm, you may know that for a string S, Z algorithm can gain an integer array Z, which Z_i indicates the LCP(longest-common-prefix) between $S_{[i:n)}$ and $S_{[0:n)}$. Besides, we explicitly define $Z_0 = 0$ as exception.

Now consider all the strings as set $\Re$ with the length N and the charset size M, calculate

$$\sum_{S \in \Re} \max(Z_0, Z_1, ..., Z_{n-1})^2 \mod 10^9 + 7$$

Input

Only one line contains two integers N ($1 \leq N \leq 100$) and M ($1 \leq M \leq 666666666$).

Output

Print the corresponding answer in a single line.

Examples

standard input	standard output
1 772002	0
2 772002	772002
3 772002	975711675

Problem B. Alfa

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	64 megabytes

A good number is defined as all digits in decimal system are between 1 and 9, inclusive. The value of one good number can be calculate as follow:

Insert ' + ' into some of the positions (possibly none) between two digits.

After insertion, this good number can be evaluated as formulas, and the result is S.

The value is sum of S of all possible legal insertion. The legal insertion is that any two neighbor digits can insert no more than one ' + '. Inserting before the first digit or after the last digit is illegal.

Alfa wants you to calculate the value.

Input

The first line is an integer $T(1 \leq T \leq 52)$, which indicates the number of testcases.

For each testcase:

The one line of the input file contains a good number $N(1 \leq |N| \leq 10^5)$.

Output

For each testcase, your program should output the value of the good number mod $10^9 + 7$.

Examples

standard input	standard output
1 157	250
1 315	378

Note

In the first example, the answer is calculated as follow:

$157 = 157$

$1 + 57 = 58$

$15 + 7 = 22$

$1 + 5 + 7 = 13$

$157 + 58 + 22 + 13 = 250$

Problem C. Regular Expression

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	64 megabytes

A regular expression, regex or regexp (sometimes called a rational expression) is, in theoretical computer science and formal language theory, a sequence of characters that define a search pattern. Usually this pattern is then used by string searching algorithms for "find"or "find and replace"operations on strings.

"?": The question mark indicates zero or one occurrences of the preceding element. For example, **colou?r** matches both "color"and "colour".

Given a string S consist of lower-case English letters only and some string q, your task is to count the numbers of substring of the S which matches q.

Input

The first line of the input contains a string $S(1 \leq |S| \leq 1000)$

The next line contains number of query Q ($Q \leq 100$).

Each question contains a string q ($1 \leq |q| \leq 20$).

It's guaranteed that no two question marks appear continuously and no question mark appears at the beginning.

Output

For each query print the corresponding answer in a single line.

Example

standard input	standard output
abcaaaa 3 a?a a?b c?a?	8 2 7

Problem D. Saddle the Pony

Input file:	`standard input`
Output file:	`standard output`
Time limit:	0.5 seconds
Memory limit:	64 megabytes

You must have ever learned fibonacci sequence, which satisfy $F_n = F_{n-1} + F_{n-2}$, we define $F_1 = 1$ and $F_2 = 2$ here.

For a postive integer N, consider all different integer α array as set $\Re$ which satisfy the following condition:

$$N = \sum_{i=1}^{\infty} \alpha_i \cdot F_i (\alpha_i \geq 0)$$

We define

$$f(N) = \sum_{\alpha \in \Re} (\sum_{i=1}^{\infty} \alpha_i \cdot i^2)^2$$

Now you are given Q queries, for each query you are given a positive integer N, you need to print $f(N)$ mod $10^9 + 7$ in a single line.

Input

The first line contains one integer Q ($1 \leq Q \leq 10^5$).

Each of the next Q lines contatins a postive integer N ($1 \leq N \leq 10^5$).

Output

For each query, print $f(N)$ mod $10^9 + 7$ in a single line.

Example

standard input	standard output
3 1 2 3	1 20 115

Problem E. Charlie

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	64 megabytes

Charlie are given a binary string of length N ($1 \leq N \leq 2 \cdot 10^5$).

Now Charlie wants to cut some character so that's easy to carry.

For every step, Charlie arbitrarily find one substring "01" to delete it until not exist such substring.

Charlie wants to know the expectation of the length after cutting.

Input

The first line is an integer $T(1 \leq T \leq 68)$, which indicates the number of testcases.

For each testcase:

The first line of the input file contains the integer N.

The second line contains the binary string s of length N, consisting of letters '0' and '1' only.

Output

For each testcase, your program should output the expectation of the length of the remain string. The answer should keep three decimal digits.

Examples

standard input	standard output
1 4 1101	2.000
1 6 010101	0.000

Problem F. Zero One Problem

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1.5 second
Memory limit:	256 megabytes

Given a matrix only consisting `0` and `1`. In this problem you should find the difference of two given sub-matrix.

Input

The first line of the input contains two integers $H, W (1 \leq H, W \leq 1000)$, the height and width of the matrix.

Then H lines follows, each contains a string $S_i (|S_i| = W)$, representing the i^{th} row of the matrix. S_i contains only `0` and `1`.

The next line contains number of query Q ($Q \leq 10^5$).

Each question contains eight integers l_1,r_1,l_2,r_2,l_3,r_3,l_4,r_4

$(0 \leq l_i < H, 0 \leq r_i < W, l_1 \leq l_2, r_1 \leq r_2, l_3 \leq l_4, r_3 \leq r_4, l_2 - l_1 + 1 = l_4 - l_3 + 1, r_2 - r_1 + 1 = r_4 - r_3 + 1)$, denote the top-left point and bottom-right point of the first and second sub-matrix.

Output

For each query output one line which means the answer.

If they are the same sub-rectangle, print the word `Perfect`

If they are different in one cell, print the sentence `One difference`

Otherwise print the word `Wrong` on a single line.

Example

standard input	standard output
3 4 0011 0010 0000 1 0 0 1 2 1 0 2 2	One difference

Problem G. Find Substring

Input file:	standard input
Output file:	standard output
Time limit:	1 second
Memory limit:	64 megabytes

Given a string S consisting of lower-case English letters only, your task is to find out if there is a substring which the number of 'a','b'.. are $cnt_a, cnt_b, ...$?

Input

The first line of the input contains a string $S(1 \leq |S| \leq 10^5)$

The next line contains 26 integers $cnt_a, cnt_b...$ $(0 \leq cnt_i \leq |S|)$.

Output

If there is a substring meets the above conditions, print the word "Yes"

Otherwise print the word "No"on a single line.

Examples

standard input	standard output
abcde 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Yes
abcde 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	No

Problem H. Stirling Numbers of the First Kind

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1.5 seconds
Memory limit:	128 megabytes

In mathematics, especially in combinatorics, Stirling numbers of the first kind arise in the study of permutations. In particular, the Stirling numbers of the first kind count permutations according to their number of cycles (counting fixed points as cycles of length one).

$S(n, k)$ count the number of permutations of n elements with k disjoint cycles.

We have the recurrence relation:

$$S(n+1, k) = n \cdot S(n, k) + S(n, k-1).\ k \geq 1$$

With the initial conditions: $S(0, 0) = 1$ *and* $S(n, 0) = S(0, n) = 0$.

Now Bob has a problem:

Given a prime P and two integers x and n, he wants to calculate the number of m between 0 and n such that $S(n, m) \equiv x \pmod{P}$.

Input

There are two integers n and prime P in the first line. $(1 \leq n \leq 10^{15}, 2 \leq P \leq 10^5)$

The next line contains number of questions Q. $(1 \leq Q \leq 10^5)$

Each question contains an integer x. $(0 \leq x < P)$

Output

For each query print the corresponding answer in a single line.

Example

standard input	standard output
32 17 17 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	5 2 2 4 0 2 0 2 2 2 2 0 2 0 4 2 2

Problem I. Unintended Consequences

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	64 megabytes

You are given an array A of size N, and here's an extra B array of size N, initially, each element of the B array is zero.

You need support Q queries of following three types.

- 1 l r x: Add x to $A_l, A_{l+1}, ..., A_r$. $(1 \le l \le r \le N, 0 \le X < 2^{32})$
- 2 l r k b: Make $B_i = B_i + k \cdot A_i + b$ for $i \subseteq [l, r]$. $(1 \le l \le r \le N, 0 \le k, b < 2^{32})$
- 3 l r: Query $\sum_{i=l}^{r} B_i \mod 2^{32}$. $(1 \le l \le r \le N)$

Input

The first line contains two integers N $(1 \le N \le 10^5)$ and Q $(1 \le Q \le 4 \cdot 10^5)$.

The next line contains N integers indicates each element of A_i $(0 \le A_i < 2^{32})$.

Each of the next Q lines contains a query in the format given in the statement.

Output

For each query of type 3, print the corresponding answer in a single line.

Example

standard input	standard output
6 4 7 7 2 0 0 2 3 2 4 1 2 5 4 2 2 3 7 6 3 1 5	0 131

Problem J. Smothered

Input file:	`standard input`
Output file:	`standard output`
Time limit:	0.25 seconds
Memory limit:	64 megabytes

Calculate

$$\sum_{x1=1}^{N}\sum_{x2=x1}^{N}\sum_{x3=x2}^{N}\sum_{x4=x3}^{N}(N-x1)\cdot(N-x2)\cdot(N-x3)\cdot(N-x4) \mod 10^9+7$$

Input

The first line contains a postive integer N ($1 \le N \le 666$).

Output

Print the corresponding answer in a single line.

Examples

standard input	standard output
5	1701
10	359502
15	8408778

Problem K. Will the circle be broken

Input file:	`standard input`
Output file:	`standard output`
Time limit:	0.5 seconds
Memory limit:	128 megabytes

You are given an array A of N non-negative integers and an integer M.

Find the number of pair(i, j) such that $1 \leq i \leq j \leq N$ and $\min(A_i, A_{i+1}, ..., A_j) \cdot (A_l \oplus A_{l+1} \oplus ... \oplus A_r) \leq M$.

Input

The first line contains two integers N $(1 \leq N \leq 10^5)$ and M $(0 \leq M \leq 10^{18})$.

The second line contains N integers representing the elements of A_i $(1 \leq A_i \leq 10^9)$.

Output

Print the corresponding answer in a single line.

Examples

standard input	standard output
4 2 1 4 772002 200277	1
5 3 1 2 3 2 1	11

Problem L. Foxtrot

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	64 megabytes

Doctor Foxtrot has N kinds of potion, but just one kind of them can kill rats. Doctor Foxtrot has forgot which one is harmful to rats. The rats is scarce, so Doctor Foxtrot wants you to help him find the only kind of potion with minimum number of rats.

All rats drink potion on the first day, and the result is on the second day. Any rat drunk harmful potion will die on the second day. One rat can drink more than one kind of potion.

Input

The first line is an integer $T(1 \leq T \leq 62)$, which indicates the number of testcases.

For each testcase:

The one line of the input contains one integer N $(1 \leq |N| \leq 10^9)$, denoting the number of kinds of potion.

Output

For each testcase, in the only line of output print the minimum number of rats needed.

Examples

standard input	standard output
1 2	1
1 3	2

Note

In the second example, one of plan is that the first rat drinks the first two kinds of potion and the second rat drinks the last two kinds of potion. If the first rat died, the first kind of potion is harmful to rat. If the second rat died, the third kind of potion is harmful. If both of rats died, the second kind of potion is harmful.

Problem M. Delta

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 second
Memory limit:	64 megabytes

The math teacher Fish Nineone assigned Delta homework. Delta is given a set of N integers. The requirement is find the minimum number of intergers inserting to the set that for every two integers A and B in set, $A \oplus B$ (bitwise exclusive OR) is also in the set. Delta is poor in math, so that she asks you to solve this problem to get one "Accepted" in the 16th UESTC programming contest.

Input

The first line is an integer T, which indicates the number of testcases.

For each testcase:

The first line of the input file contains the integer N ($1 \leq N \leq 2 \cdot 10^5$).

In the second line, N numbers follow ($0 \leq a_i \leq 10^{18}$).

You can assume that $\sum N \leq 2 \cdot 10^6$.

Output

For each testcase, your program should output the minimum number of intergers inserting in one line.

Examples

standard input	standard output
1 3 2 4 6	1
1 5 2 4 5 7 11	11

Note

In the second example, all numbers from 0 to 15 should in the set.

number 8 is in the set as follow:

$4 \oplus 5 = 1$,

$1 \oplus 2 = 3$,

$3 \oplus 11 = 8$ ...