A. Easy h-index

The h-index of an author is the largest h where he has at least h papers with citations not less than h.

Bobo has published many papers. Given $a_0, a_1, a_2, \ldots, a_n$ which means Bobo has published a_i papers with citations exactly i, find the h-index of Bobo.

Input

The input consists of several test cases and is terminated by end-of-file.

The first line of each test case contains an integer n. The second line contains $(n+1)$ integers $a_0, a_1, \ldots, a_n$.

Output

For each test case, print an integer which denotes the result.

Constraint

- $1 \leq n \leq 2 \cdot 10^5$
- $0 \leq a_i \leq 10^9$
- The sum of n does not exceed $250,000$.

Sample Input

```
1
1 2
2
1 2 3
3
0 0 0 0
```

Sample Output

```
1
2
0
```

B. Higher h-index

The h-index of an author is the largest h where he has at least h papers with citations not less than h.

Bobo has no papers and he is going to publish some subsequently. If he works on a paper for x hours, the paper will get $(a \cdot x)$ citations, where a is a known constant. It's clear that x should be a positive integer. There is also a trick – one can cite his own papers published earlier.

Given Bobo has n working hours, find the maximum h-index of him.

Input

The input consists of several test cases and is terminated by end-of-file.

Each test case contains two integers n and a.

Output

For each test case, print an integer which denotes the maximum h-index.

Constraint

- $1 \leq n \leq 10^9$
- $0 \leq a \leq n$
- The number of test cases does not exceed 10^4.

Sample Input

```
3 0
3 1
1000000000 1000000000
```

Sample Output

```
1
2
1000000000
```

Note

For the first sample, Bobo can work 3 papers for 1 hour each. With the trick mentioned, he will get papers with citations $2, 1, 0$. Thus, his h-index is 1.

For the second sample, Bobo can work 2 papers for 1 and 2 hours respectively. He will get papers with citations $1 + 1, 2 + 0$. Thus, his h-index is 2.

C. Just h-index

The h-index of an author is the largest h where he has at least h papers with citations not less than h.

Bobo has published n papers with citations $a_1, a_2, \ldots, a_n$ respectively. One day, he raises q questions. The i-th question is described by two integers l_i and r_i, asking the h-index of Bobo if has *only* published papers with citations $a_{l_i}, a_{l_i+1}, \ldots, a_{r_i}$.

Input

The input consists of several test cases and is terminated by end-of-file.

The first line of each test case contains two integers n and q. The second line contains n integers $a_1, a_2, \ldots, a_n$. The i-th of last q lines contains two integers l_i and r_i.

Output

For each question, print an integer which denotes the answer.

Constraint

- $1 \leq n, q \leq 10^5$
- $1 \leq a_i \leq n$
- $1 \leq l_i \leq r_i \leq n$
- The sum of n does not exceed $250,000$.
- The sum of q does not exceed $250,000$.

Sample Input

```
5 3
1 5 3 2 1
1 3
2 4
1 5
5 1
1 2 3 4 5
1 5
```

Sample Output

```
2
2
2
3
```

D. Circular Coloring

Bobo considers $(n+m)$ balls arranged in a circle. The balls are numbered with $0, 1, \ldots, (n+m-1)$ where the ball i and the ball $(i+1) \bmod (n+m)$ are adjacent.

Bobo would like to color n of his balls black and m of his balls white. Bobo groups adjacent balls with same colors, and he determines the weight of the coloring as the product of the lengths of groups.

He would like to know the sum of the weight of the possible colorings, modulo (10^9+7).

Input

The input consists of several test cases and is terminated by end-of-file.

Each test case contains two integers n and m.

Output

For each test case, print an integer which denotes the result.

Constraint

- $1 \leq n, m \leq 5000$
- The number of test cases does not exceed 5000.

Sample Input

```
1 2
2 3
5000 5000
```

Sample Output

```
6
40
975597525
```

Note

For the second sample, there are 10 possible colorings (listed below). The number followed is the corresponding weight.

- `BBWWW` (6)
- `BWBWW` (2)
- `BWWBW` (2)
- `BWWWB` (6)
- `WBBWW` (6)
- `WBWBW` (2)
- `WBWWB` (2)
- `WWBBW` (6)

- `WWBWB` (2)
- `WWWBB` (6)

E. From Tree to Graph

Bobo has a tree of n vertices numbered with $0, 1, \ldots, (n-1)$. He subsequently adds m edges between vertex x_i and $\mathrm{LCA}(x_i, y_i)$ where $\mathrm{LCA}(x_i, y_i)$ is the vertex lying on the unique tree path between vertex x_i and y_i and closest to the vertex 0.

Let the graph obtained by adding the edges $\{(x_1, \mathrm{LCA}(x_1, y_1)), (x_2, \mathrm{LCA}(x_2, y_2)), \ldots, (x_i, \mathrm{LCA}(x_i, y_i))\}$ to the tree be G_i, and $f_i(u)$ be the number of connected components after the removal of vertex u from G_i. Bobo knows that for $i \in \{0, 1, 2, \ldots, m\}$

$$z_i = f_i(0) \oplus f_i(1) \oplus \cdots \oplus f_i(n-1).$$

($\oplus$ denotes xor.)

Given a, b, x_0, y_0, he also knows that for $i \in \{1, 2, \ldots, m\}$,

- $x_i = (a \cdot x_{i-1} + b \cdot y_{i-1} + z_{i-1}) \bmod n$,
- $y_i = (b \cdot x_{i-1} + a \cdot y_{i-1} + z_{i-1}) \bmod n$.

Help him to find x_m, y_m.

Input

The input consists of several test cases and is terminated by end-of-file.

The first line of each test case contains six integers n, m, a, b, x_0, y_0. The i-th of the following $(n-1)$ lines contains two integers u_i and v_i, which denotes the tree edge between vertex u_i and v_i.

Output

For each test case, print two integers which denote x_m, y_m.

Constraint

- $2 \le n \le 5000$
- $1 \le m \le n^2$
- $0 \le a, b, x_0, y_0, u_i, v_i < n$
- The sum of n does not exceed $25,000$.

Sample Input

```
4 1 1 0 2 3
0 1
1 2
0 3
4 2 1 0 2 0
0 1
1 2
2 3
5 25 1 2 3 4
0 1
0 2
1 3
1 4
```

Sample Output

```
2 3
1 3
1 0
```

Note

The following table shows the detailed value for the second sample.

i	x_i	y_i	LCA(x_i, y_i)	$f_i(0)$	$f_i(1)$	$f_i(2)$	$f_i(3)$	z_i
0	2	0	0	1	2	2	1	0
1	2	0	0	1	1	2	1	3
2	1	3	1	1	1	2	1	3

F. Sorting

Bobo has n tuples $(a_1, b_1, c_1), (a_2, b_2, c_2), \ldots, (a_n, b_n, c_n)$. He would like to find the lexicographically smallest permutation $p_1, p_2, \ldots, p_n$ of $1, 2, \ldots, n$ such that for $i \in \{2, 3, \ldots, n\}$ it holds that

$$\frac{a_{p_{i-1}} + b_{p_{i-1}}}{a_{p_{i-1}} + b_{p_{i-1}} + c_{p_{i-1}}} \leq \frac{a_{p_i} + b_{p_i}}{a_{p_i} + b_{p_i} + c_{p_i}}.$$

Input

The input consists of several test cases and is terminated by end-of-file.

The first line of each test case contains an integer n. The i-th of the following n lines contains 3 integers a_i, b_i and c_i.

Output

For each test case, print n integers $p_1, p_2, \ldots, p_n$ seperated by spaces. DO NOT print trailing spaces.

Constraint

- $1 \leq n \leq 10^3$
- $1 \leq a_i, b_i, c_i \leq 2 \times 10^9$
- The sum of n does not exceed 10^4.

Sample Input

```
2
1 1 1
1 1 2
2
1 1 2
1 1 1
3
1 3 1
2 2 1
3 1 1
```

Sample Output

```
2 1
1 2
1 2 3
```

G. String Transformation

Bobo has a string $S = s_1 s_2 \dots s_n$ consists of letter `a`, `b` and `c`. He can transform the string by inserting or deleting substrings `aa`, `bb` and `abab`.

Formally, $A = u \circ w \circ v$ ("$\circ$" denotes string concatenation) can be transformed into $A' = u \circ v$ and vice versa where u, v are (possibly empty) strings and $w \in \{\text{aa}, \text{bb}, \text{abab}\}$.

Given the target string $T = t_1 t_2 \dots t_m$, determine if Bobo can transform the string S into T.

Input

The input consists of several test cases and is terminated by end-of-file.

The first line of each test case contains a string $s_1 s_2 \dots s_n$. The second line contains a string $t_1 t_2 \dots t_m$.

Output

For each test case, print `Yes` if Bobo can. Print `No` otherwise.

Constraint

- $1 \le n, m \le 10^4$
- $s_1, s_2, \dots, s_n, t_1, t_2, \dots, t_m \in \{\text{a}, \text{b}, \text{c}\}$
- The sum of n and m does not exceed $250,000$.

Sample Input

```
ab
ba
ac
ca
a
ab
```

Sample Output

```
Yes
No
No
```

Note

For the first sample, Bobo can transform as `ab => aababb => babb => ba`.

H. Infinity

In ICPCCamp, candies are in different sizes. There are $f(i)$ (defined below) distinct types of candies of i grams where

$$f(i) = \begin{cases} a_i & \text{for } 1 \le i \le n \\ \sum_{j=1}^{n} c_j \cdot f(i-j) & \text{for } i > n \end{cases}.$$

Bobo would like to buy some candies whose sum of weight is m grams and align them in a row. Find the number of different ways modulo $(10^9 + 7)$. Note that two ways are different if they differs in the types or in the order of alignment.

Input

The input consists of several test cases and is terminated by end-of-file.

The first line of each test case contains two integers n and m. The second line contains n integers $a_1, a_2, \ldots, a_n$. The third line contains n integers $c_1, c_2, \ldots, c_n$.

Output

For each test case, print an integer which denotes the result.

Constraint

- $1 \le n \le 50$
- $1 \le m \le 10^9$
- $0 \le a_i, c_i \le 10^9$
- The number of test cases does not exceed 10.

Sample Input

```
2 3
1 2
2 1
2 2
0 0
1 1
2 1000000000
1 2
3 4
```

Sample Output

```
10
0
168267027
```

I. Longest Increasing Subsequence

Bobo has a sequence $a_1, a_2, \ldots, a_n$. Let $f(x)$ be the length of longest *strictly* increasing subsequence after replacing all the occurrence of 0 with x. He would like to find $\sum_{i=1}^{n} i \cdot f(i)$.

Note that the length of longest strictly increasing subsequence of sequence $s_1, s_2, \ldots, s_m$ is the largest k such that there exists $1 \leq i_1 < i_2 < \cdots < i_k \leq m$ satisfying $s_{i_1} < s_{i_2} < \cdots < s_{i_k}$.

Input

The input consists of several test cases and is terminated by end-of-file.

The first line of each test case contains an integer n. The second line contains n integers $a_1, a_2, \ldots, a_n$.

Output

For each test case, print an integer which denotes the result.

Constraint

- $1 \leq n \leq 10^5$
- $0 \leq a_i \leq n$
- The sum of n does not exceed $250,000$.

Sample Input

```
2
1 1
3
1 0 3
6
4 0 6 1 0 3
```

Sample Output

```
3
14
49
```

J. Vertex Cover

Alice and Bobo are playing a game on a graph with n vertices numbered with $0, 1, \ldots, (n-1)$. The vertex numbered with i is associated with weight 2^i.

The game is played as follows. Firstly, Alice chooses a (possibly empty) subset of the $\frac{n(n-1)}{2}$ edges. Subsequently Bobo chooses a (possibly empty) subset of the n vertices to *cover* the edges chosen by Alice. An edge is *covered* if one of its two ends is chosen by Bobo. As Bobo is smart, he will choose a subset of vertices whose sum of weights, denoted as S, is minimum.

Alice would like to know the number of subsets of edges where Bobo will choose a subset whose sum of weights is exactly k (i.e. $S = k$), modulo $(10^9 + 7)$.

Input

The input consists of several test cases and is terminated by end-of-file.

Each test case contains two integers n and k. For convenience, the number k is given in its binary notation.

Output

For each test case, print an integer which denotes the result.

Constraint

- $1 \leq n \leq 10^5$
- $0 \leq k < 2^n$
- The sum of n does not exceed $250,000$.

Sample Input

```
3 1
4 101
10 101010101
```

Sample Output

```
3
12
239344570
```

K. 2018

Given a, b, c, d, find out the number of pairs of integers (x, y) where $a \leq x \leq b, c \leq y \leq d$ and $x \cdot y$ is a multiple of 2018.

Input

The input consists of several test cases and is terminated by end-of-file.

Each test case contains four integers a, b, c, d.

Output

For each test case, print an integer which denotes the result.

Constraint

- $1 \leq a \leq b \leq 10^9, 1 \leq c \leq d \leq 10^9$
- The number of tests cases does not exceed 10^4.

Sample Input

```
1 2 1 2018
1 2018 1 2018
1 1000000000 1 1000000000
```

Sample Output

```
3
6051
1485883320325200
```