A. Tokitsukaze and Strange Inequality

time limit per test: 1.5 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Tokitsukaze has a permutation p of length n. Recall that a permutation p of length n is a sequence $p_1, p_2, \ldots, p_n$ consisting of n distinct integers, each of which from 1 to n ($1 \le p_i \le n$).

She wants to know how many different indices tuples $[a,b,c,d]$ ($1 \le a < b < c < d \le n$) in this permutation satisfy the following two inequalities:

$$p_a < p_c \text{ and } p_b > p_d.$$

Note that two tuples $[a_1,b_1,c_1,d_1]$ and $[a_2,b_2,c_2,d_2]$ are considered to be different if $a_1 \ne a_2$ or $b_1 \ne b_2$ or $c_1 \ne c_2$ or $d_1 \ne d_2$.

Input

The first line contains one integer t ($1 \le t \le 1000$) — the number of test cases. Each test case consists of two lines.

The first line contains a single integer n ($4 \le n \le 5000$) — the length of permutation p.

The second line contains n integers $p_1, p_2, \ldots, p_n$ ($1 \le p_i \le n$) — the permutation p.

It is guaranteed that the sum of n over all test cases does not exceed 5000.

Output

For each test case, print a single integer — the number of different $[a,b,c,d]$ tuples.

Example

input

```
3
6
5 3 6 1 4 2
4
1 2 3 4
10
5 1 6 2 8 3 4 10 9 7
```

output

```
3
0
28
```

Note

In the first test case, there are 3 different $[a,b,c,d]$ tuples.

$p_1 = 5$, $p_2 = 3$, $p_3 = 6$, $p_4 = 1$, where $p_1 < p_3$ and $p_2 > p_4$ satisfies the inequality, so one of $[a,b,c,d]$ tuples is $[1,2,3,4]$.

Similarly, other two tuples are $[1,2,3,6]$, $[2,3,5,6]$.

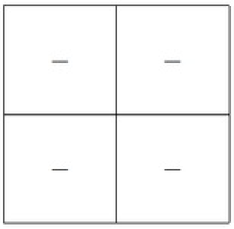
B. Tokitsukaze and Meeting

time limit per test: 1 second
memory limit per test: 256 megabytes
input: standard input
output: standard output

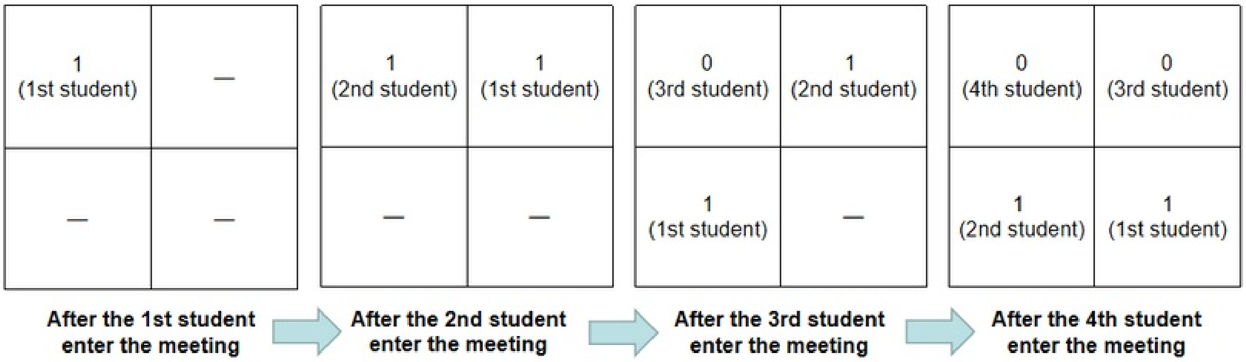
Tokitsukaze is arranging a meeting. There are n rows and m columns of seats in the meeting hall.

There are exactly $n \cdot m$ students attending the meeting, including several naughty students and several serious students. The students are numerated from 1 to $n \cdot m$. The students will enter the meeting hall in order. When the i-th student enters the meeting hall, he will sit in the 1-st column of the 1-st row, and the students who are already seated will move back one seat. Specifically, the student sitting in the j-th ($1 \le j \le m-1$) column of the i-th row will move to the $(j+1)$-th column of the i-th row, and the student sitting in m-th column of the i-th row will move to the 1-st column of the $(i+1)$-th row.

For example, there is a meeting hall with 2 rows and 2 columns of seats shown as below:



There will be 4 students entering the meeting hall in order, represented as a binary string "1100", of which '0' represents naughty students and '1' represents serious students. The changes of seats in the meeting hall are as follows:



Denote a row or a column good if and only if there is at least one serious student in this row or column. Please predict the number of good rows and columns just after the i-th student enters the meeting hall, for all i.

Input

The first contains a single positive integer t ($1 \le t \le 10\,000$) — the number of test cases.

For each test case, the first line contains two integers n, m ($1 \le n, m \le 10^6$; $1 \le n \cdot m \le 10^6$), denoting there are n rows and m columns of seats in the meeting hall.

The second line contains a binary string s of length $n \cdot m$, consisting only of zeros and ones. If s_i equal to '0' represents the i-th student is a naughty student, and s_i equal to '1' represents the i-th student is a serious student.

It is guaranteed that the sum of $n \cdot m$ over all test cases does not exceed 10^6.

Output

For each test case, print a single line with $n \cdot m$ integers — the number of good rows and columns just after the i-th student enters the meeting hall.

Example

input

```
3
2 2
1100
4 2
11001101
2 4
11001101
```

output

```
2 3 4 3
2 3 4 3 5 4 6 5
2 3 3 3 4 4 4 5
```

Note

The first test case is shown in the statement.

After the 1-st student enters the meeting hall, there are 2 good rows and columns: the 1-st row and the 1-st column.

After the 2-nd student enters the meeting hall, there are 3 good rows and columns: the 1-st row, the 1-st column and the 2-nd column.

After the 3-rd student enters the meeting hall, the 4 rows and columns are all good.

After the 4-th student enters the meeting hall, there are 3 good rows and columns: the 2-nd row, the 1-st column and the 2-nd column.

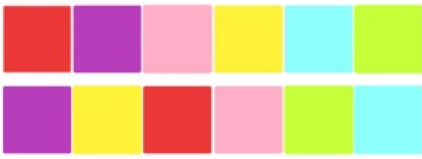
C. Tokitsukaze and Two Colorful Tapes

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Tokitsukaze has two colorful tapes. There are n distinct colors, numbered 1 through n, and each color appears exactly once on each of the two tapes. Denote the color of the i-th position of the first tape as ca_i, and the color of the i-th position of the second tape as

cb_i.

Now Tokitsukaze wants to select each color an integer value from 1 to n, distinct for all the colors. After that she will put down the color values in each colored position on the tapes. Denote the number of the i-th position of the first tape as $numa_i$, and the number of the i-th position of the second tape as $numb_i$.



For example, for the above picture, assuming that the color red has value x ($1 \le x \le n$), it appears at the 1-st position of the first tape and the 3-rd position of the second tape, so $numa_1 = numb_3 = x$.

Note that each color i from 1 to n should have a **distinct** value, and the same color which appears in both tapes has the same value.

After labeling each color, the beauty of the two tapes is calculated as

$$\sum_{i=1}^{n} |numa_i - numb_i|.$$

Please help Tokitsukaze to find the highest possible beauty.

Input

The first contains a single positive integer t ($1 \le t \le 10^4$) — the number of test cases.

For each test case, the first line contains a single integer n ($1 \le n \le 10^5$) — the number of colors.

The second line contains n integers $ca_1, ca_2, \ldots, ca_n$ ($1 \le ca_i \le n$) — the color of each position of the first tape. It is guaranteed that ca is a permutation.

The third line contains n integers $cb_1, cb_2, \ldots, cb_n$ ($1 \le cb_i \le n$) — the color of each position of the second tape. It is guaranteed that cb is a permutation.

It is guaranteed that the sum of n over all test cases does not exceed $2 \cdot 10^5$.

Output

For each test case, print a single integer — the highest possible beauty.

Example

input

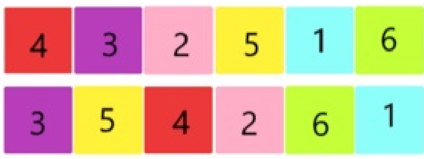
```
3
6
1 5 4 3 2 6
5 3 1 4 6 2
6
3 5 4 6 2 1
3 6 4 5 2 1
1
1
1
```

output

```
18
10
0
```

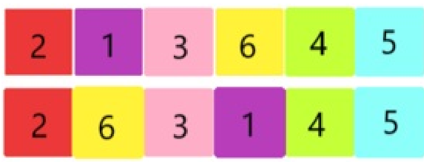
Note

An optimal solution for the first test case is shown in the following figure:



The beauty is $|4-3|+|3-5|+|2-4|+|5-2|+|1-6|+|6-1| = 18$.

An optimal solution for the second test case is shown in the following figure:



The beauty is $|2-2|+|1-6|+|3-3|+|6-1|+|4-4|+|5-5| = 10$.

D. Tokitsukaze and Permutations

time limit per test: 2 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Tokitsukaze has a permutation p. She performed the following operation to p **exactly** k times: in one operation, for each i from 1 to $n-1$ in order, if $p_i > p_{i+1}$, swap p_i, p_{i+1}. After exactly k times of operations, Tokitsukaze got a new sequence a, obviously the sequence a is also a permutation.

After that, Tokitsukaze wrote down the value sequence v of a on paper. Denote the value sequence v of the permutation a of length n as $v_i=\sum_{j=1}^{i-1}[a_i < a_j]$, where the value of $[a_i < a_j]$ define as if $a_i < a_j$, the value is 1, otherwise is 0 (in other words, v_i is equal to the number of elements greater than a_i that are to the left of position i). Then Tokitsukaze went out to work.

There are three naughty cats in Tokitsukaze's house. When she came home, she found the paper with the value sequence v to be bitten out by the cats, leaving several holes, so that the value of some positions could not be seen clearly. She forgot what the original permutation p was. She wants to know how many different permutations p there are, so that the value sequence v of the new permutation a after **exactly** k operations is the same as the v written on the paper (not taking into account the unclear positions).

Since the answer may be too large, print it modulo $998\,244\,353$.

Input

The first line contains a single integer t ($1 \le t \le 1000$) — the number of test cases. Each test case consists of two lines.

The first line contains two integers n and k ($1 \le n \le 10^6$; $0 \le k \le n-1$) — the length of the permutation and the exactly number of operations.

The second line contains n integers $v_1, v_2, \dots, v_n$ ($-1 \le v_i \le i-1$) — the value sequence v. $v_i = -1$ means the i-th position of v can't be seen clearly.

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

Output

For each test case, print a single integer — the number of different permutations modulo $998\,244\,353$.

Example

input

```
3
5 0
0 1 2 3 4
5 2
-1 1 2 0 0
5 2
0 1 1 0 0
```

output

```
1
6
6
```

Note

In the first test case, only permutation $p=[5,4,3,2,1]$ satisfies the constraint condition.

In the second test case, there are 6 permutations satisfying the constraint condition, which are:

- $[3,4,5,2,1] \rightarrow [3,4,2,1,5] \rightarrow [3,2,1,4,5]$
- $[3,5,4,2,1] \rightarrow [3,4,2,1,5] \rightarrow [3,2,1,4,5]$
- $[4,3,5,2,1] \rightarrow [3,4,2,1,5] \rightarrow [3,2,1,4,5]$
- $[4,5,3,2,1] \rightarrow [4,3,2,1,5] \rightarrow [3,2,1,4,5]$
- $[5,3,4,2,1] \rightarrow [3,4,2,1,5] \rightarrow [3,2,1,4,5]$
- $[5,4,3,2,1] \rightarrow [4,3,2,1,5] \rightarrow [3,2,1,4,5]$

So after exactly 2 times of swap they will all become $a=[3,2,1,4,5]$, whose value sequence is $v=[0,1,2,0,0]$.

E. Tokitsukaze and Beautiful Subsegments

time limit per test: 4 seconds
memory limit per test: 1024 megabytes
input: standard input
output: standard output

Tokitsukaze has a permutation p of length n.

Let's call a segment $[l,r]$ beautiful if there exist i and j satisfying $p_i \cdot p_j = \max\{p_l, p_{l+1}, \dots, p_r\}$, where $l \le i < j \le r$.

Now Tokitsukaze has q queries, in the i-th query she wants to know how many beautiful subsegments $[x, y]$ there are in the segment $[l_i, r_i]$ (i. e. $l_i \le x \le y \le r_i$).

Input

The first line contains two integers n and q ($1 \le n \le 2 \cdot 10^5$; $1 \le q \le 10^6$) — the length of permutation p and the number of queries.

The second line contains n distinct integers $p_1, p_2, \ldots, p_n$ ($1 \le p_i \le n$) — the permutation p.

Each of the next q lines contains two integers l_i and r_i ($1 \le l_i \le r_i \le n$) — the segment $[l_i, r_i]$ of this query.

Output

For each query, print one integer — the numbers of beautiful subsegments in the segment $[l_i, r_i]$.

Examples

input

```
8 3
1 3 5 2 4 7 6 8
1 3
1 1
1 8
```

output

```
2
0
10
```

input

```
10 10
6 1 3 2 5 8 4 10 7 9
1 8
1 10
1 2
1 4
2 4
5 8
4 10
4 7
8 10
5 9
```

output

```
17
25
1
5
2
0
4
1
0
0
```

Note

In the first example, for the first query, there are 2 beautiful subsegments — $[1, 2]$ and $[1, 3]$.

F. Tokitsukaze and Gems

time limit per test: 4 seconds

memory limit per test: 512 megabytes

input: standard input

output: standard output

Tokitsukaze has a sequence with length of n. She likes gems very much. There are n kinds of gems. The gems of the i-th kind are on the i-th position, and there are a_i gems of the same kind on that position. Define $G(l, r)$ as the multiset containing all gems on the segment $[l, r]$ (inclusive).

A multiset of gems can be represented as $S = [s_1, s_2, \ldots, s_n]$, which is a non-negative integer sequence of length n and means that S contains s_i gems of the i-th kind in the multiset. A multiset $T = [t_1, t_2, \ldots, t_n]$ is a multisubset of $S = [s_1, s_2, \ldots, s_n]$ if and only if $t_i \le s_i$ for any i satisfying $1 \le i \le n$.

Now, given two positive integers k and p, you need to calculate the result of

$$\sum_{l=1}^{n} \sum_{r=l}^{n} \sum_{[t_1, t_2, \cdots, t_n] \subseteq G(l,r)} \left(\left(\sum_{i=1}^{n} p^{t_i} t_i^k \right) \left(\sum_{i=1}^{n} [t_i > 0] \right) \right),$$

where $[t_i > 0] = 1$ if $t_i > 0$ and $[t_i > 0] = 0$ if $t_i = 0$.

Since the answer can be quite large, print it modulo $998\,244\,353$.

Input

The first line contains three integers n, k and p ($1 \le n \le 10^5$; $1 \le k \le 10^5$; $2 \le p \le 998\,244\,351$) — the length of the sequence, the numbers k and p.

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($1 \le a_i \le 998\,244\,351$) — the number of gems on the i-th position.

Output

Print a single integers — the result modulo $998\,244\,353$.

Examples

input

```
5 2 2
1 1 1 2 2
```

output

```
6428
```

input

```
6 2 2
2 2 2 2 2 3
```

output

```
338940
```