Problem A. Avg

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

Find a sequence of steps of the following kind (if it exists) that would make all elements of any array of real numbers $a_1, a_2, \ldots, a_n$ equal:

- pick k distinct indices $b_1, b_2, \ldots, b_k$ ($1 \le b_i \le n$) and change the values of $a_{b_1}, a_{b_2}, \ldots, a_{b_k}$ to their arithmetic mean (that is, $\frac{1}{k}(a_{b_1} + a_{b_2} + \ldots + a_{b_k})$) simultaneously.

Input

The only line contains two integers n and k ($2 \le k \le n \le 1000$; n is divisible by k).

Output

If a required sequence of steps doesn't exist, display a single integer -1.

Otherwise, display the number of steps in your sequence t ($1 \le kt \le 10^6$), followed by t step descriptions. Each step description must consist of k distinct integers $b_1, b_2, \ldots, b_k$ ($1 \le b_i \le n$).

It can be shown that if a valid sequence of steps exists, a sequence satisfying $kt \le 10^6$ exists as well.

Examples

standard input	standard output
4 2	4 1 2 3 4 1 3 2 4
6 3	-1

Problem B. Bin

Input file:	*standard input*
Output file:	*standard output*
Time limit:	15 seconds
Memory limit:	512 mebibytes

Find the number of full binary trees (every vertex has 0 or 2 children) with n leaves such that for every vertex with two children, the number of leaves in its left subtree doesn't exceed the number of leaves in its right subtree by more than k, and display it modulo 998 244 353.

Input

The only line contains two integers n and k ($2 \le n \le 10^6$; $0 \le k \le 100$).

Output

Display the required number.

Examples

standard input	standard output
2 0	1
3 0	1
3 1	2
4 0	2
4 1	3
4 2	5
6 2	23
7 42	132
10 1	400
13 4	42003
239 17	385818773
50216 58	744498776
787788 78	394429402

Problem C. Cat

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

How many distinct strings can be obtained by concatenating a non-empty suffix of string a with a non-empty prefix of string b?

Input

The first line contains a single integer t ($1 \le t \le 10^5$), denoting the number of test cases.

Each test case is described with strings a and b on separate lines. Both strings consist of lowercase English letters and have length between 1 and 10^5, inclusive.

The total length of strings over all test cases does not exceed $2 \cdot 10^5$.

Output

For each test case, display the required number.

Example

standard input	standard output
5 abb bba aaa aaaaa winter camp ehehe heheh aaaaaaabaaaa aabaaaaaa	8 7 24 16 97

Note

In the first test case, all obtainable strings are `abbb`, `abbbb`, `abbbba`, `bb`, `bbb`, `bbba`, `bbbb`, `bbbba`.

In the second test case, only strings consisting of at least 2 and at most 8 letters `a` can be obtained.

Problem D. Div

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

How many integers $x > 0$ exist such that $c_0 x^{a_0} + c_1 x^{a_1} + \ldots + c_{n-1} x^{a_{n-1}}$ is divisible by $x^0 + x^1 + \ldots + x^{m-1}$?

Input

The first line contains a single integer t ($1 \le t \le 10^5$), denoting the number of test cases.

Each test case is described with two integers n and m ($1 \le n \le 10^5$; $1 \le m \le 10^9$), followed by n lines containing a pair of integers c_i and a_i each ($|c_i| = 1$; $0 \le a_i \le 10^9$).

The sum of n over all test cases does not exceed 10^5.

Output

For each test case, display the required number, or -1 if it is infinite.

Example

standard input	standard output
3 5 2 1 0 1 0 1 0 1 0 1 0 5 3 -1 2 -1 1 -1 0 1 1 -1 1 12 3 -1 0 -1 7 1 8 1 8 -1 4 -1 6 1 8 1 2 1 5 1 2 -1 9 1 5	1 -1 2

Note

In the first test case, $x = 4$ is the only solution.

In the second test case, the quotient is -1 for any $x > 0$.

In the third test case, the solutions are $x = 2$, and $x = 9$.

Problem E. Exp

Input file:	*standard input*
Output file:	*standard output*
Time limit:	5 seconds
Memory limit:	512 mebibytes

Find the expected amount of experience a hero will get for beating n monsters one by one, given that beating each monster gives the hero i units of experience ($0 \le i \le k$) with probability p_i independently, but if the hero gets more than x units of experience in total, their experience is capped to exactly x units, and display it modulo 998 244 353.

Input

The first line contains three integers n, k, and x ($1 \le n \le 10^7$; $1 \le k \le 100$; $1 \le x \le \min(10^7, \frac{5 \cdot 10^7}{k})$).

The second line contains $k+1$ real numbers $p_0, p_1, \ldots, p_k$ ($0 < p_i < 1$), given with exactly 4 decimal digits. The sum of p_i is equal to 1.

Output

Display the expected amount of experience the hero will get.

It can be shown that the sought number can be represented as an irreducible fraction $\frac{p}{q}$ such that $q \not\equiv 0 \pmod{998\,244\,353}$. Then, there exists a unique integer r such that $r \cdot q \equiv p \pmod{998\,244\,353}$ and $0 \le r < 998\,244\,353$, so display this r.

Examples

standard input	standard output
2 1 2 0.5000 0.5000	1
2 1 1 0.5000 0.5000	249561089
4 2 5 0.2000 0.5000 0.3000	909700083
10 4 23 0.4533 0.2906 0.1618 0.0071 0.0872	433575862

Note

In the first test case, the hero will get 0 units of experience with probability $\frac{1}{4}$, 1 unit of experience with probability $\frac{1}{2}$, and 2 units of experience with probability $\frac{1}{4}$. Hence, the expected amount is 1.

In the second test case, the hero will get 0 units of experience with probability $\frac{1}{4}$, and 1 unit of experience with probability $\frac{3}{4}$. The expected amount is $\frac{3}{4}$.

Problem F. Flip

Input file:	*standard input*
Output file:	*standard output*
Time limit:	10 seconds
Memory limit:	512 mebibytes

Assuming people numbered from 1 to $2n$ are assigned to two teams of size n using the following non-deterministic procedure, find the probability that all people from the set $A^i = \{a^i_1, a^i_2, \ldots, a^i_{k_i}\}$ end up on the same team, for each of the given sets $A^1, A^2, \ldots, A^m$, and display it modulo 998 244 353:

- in order from 1 to $2n$, each person flips a fair coin;
- if the coin lands heads up, the person joins the first team unless that team already has n people, in which case the person joins the second team;
- similarly, if the coin lands tails up, the person joins the second team unless that team already has n people, in which case the person joins the first team.

Input

The first line contains two integers n and m ($2 \le n \le 10^5$; $1 \le m \le 10^5$).

The i-th of the next m lines describes set A^i and contains an integer k_i ($2 \le k_i \le n$), followed by k_i integers $a^i_1, a^i_2, \ldots, a^i_{k_i}$ ($1 \le a^i_1 < a^i_2 < \ldots < a^i_{k_i} \le 2n$).

The sum of k_i does not exceed $2 \cdot 10^5$.

Output

For each i from 1 to m, display the probability that all people from the set A^i end up on the same team.

It can be shown that any sought probability can be represented as an irreducible fraction $\frac{p}{q}$ such that $q \not\equiv 0 \pmod{998\,244\,353}$. Then, there exists a unique integer r such that $r \cdot q \equiv p \pmod{998\,244\,353}$ and $0 \le r < 998\,244\,353$, so display this r.

Examples

standard input	standard output
2 6 2 1 2 2 1 3 2 1 4 2 2 3 2 2 4 2 3 4	499122177 748683265 748683265 748683265 748683265 499122177
3 5 3 2 3 5 2 2 4 2 5 6 3 1 4 6 2 2 5	935854081 623902721 374341633 935854081 686292993

Note

In the first test case, people 1 and 2 (and people 3 and 4) end up on the same team with probability $\frac{1}{2}$. For any other pair the probability is $\frac{1}{4}$.

Problem G. Grp

Input file:	*standard input*
Output file:	*standard output*
Time limit:	5 seconds
Memory limit:	512 mebibytes

Distribute all non-empty subsets of $\{\mathtt{a}, \mathtt{b}, \mathtt{c}, \ldots\}$ (first n lowercase English letters) of size at most k into as few groups as possible, subject to the following conditions:

- each subset must belong to exactly one group;
- subsets belonging to the same group must have no common elements;
- the total size of subsets belonging to the same group must be at most k.

Input

The only line contains two integers n and k ($1 \le k \le n \le 17$).

Output

Display the smallest number of groups g, followed by g group descriptions.

Group description i must consist of an integer s_i, followed by s_i subset descriptions. Each subset description must be a string containing subset elements in any order without spaces.

Examples

standard input	standard output
3 2	5 1 ab 1 ac 1 bc 1 b 2 c a
3 3	4 1 abc 2 ab c 2 ac b 2 bc a

Problem H. Hit

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

Place at most n integer points on the number line in such a way that each of the given n segments $[l_i, r_i]$ contains at least one point, and the largest number of points contained inside one of the given segments is as small as possible.

Input

The first line contains a single integer t ($1 \le t \le 10^5$), denoting the number of test cases.

Each test case is described with an integer n ($1 \le n \le 10^5$), followed by n lines containing two integers l_i and r_i each ($-10^9 \le l_i < r_i \le 10^9$), denoting a segment containing points $l_i, l_i + 1, \ldots, r_i$. Segments may coincide.

The sum of n over all test cases does not exceed 10^5.

Output

For each test case, display the largest number of points inside one of the given segments in your placement, followed by the number of points you place k ($1 \le k \le n$), followed by k distinct integers x_i ($-10^9 \le x_i \le 10^9$), denoting the coordinates of the points you place.

Example

standard input	standard output
4 4 0 1 2 3 4 5 3 5 5 0 70 0 10 20 30 40 50 60 70 8 -1 7 -2 -1 -9 -7 -8 9 -9 -7 -2 4 -7 4 3 9 5 0 1 0 2 2 3 3 5 4 5	1 3 1 2 5 4 4 10 30 50 70 2 3 -9 -1 9 2 3 1 3 5

Problem I. Ineq

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

Given a set of integer pairs $S = \{(x_1, y_1), \ldots, (x_n, y_n)\}$, determine if a set of integer triples $T = \{(a_1, b_1, c_1), \ldots, (a_m, b_m, c_m)\}$ exists such that $a_i x_j + b_i y_j < c_i$ for all i and j, and there doesn't exist an integer pair (x', y') not belonging to S such that $a_i x' + b_i y' < c_i$ for all i.

Input

The first line contains a single integer t ($1 \le t \le 10^5$), denoting the number of test cases.

Each test case is described with an integer n ($1 \le n \le 10^5$), followed by n lines containing two integers x_i and y_i each ($-10^9 \le x_i, y_i \le 10^9$). All pairs (x_i, y_i) within one test case are distinct.

The sum of n over all test cases does not exceed 10^5.

Output

For each test case, display a separate line with 1 if the answer is positive, and 0 otherwise.

Example

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

Note

In the first test case, one possible set of triples is $\{(1, 0, 1), (0, 1, 1), (-1, 0, 1), (0, -1, 1)\}$.

Problem J. Joy

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

Assuming that $n-1$ other people with skill levels $a_1, a_2, \ldots, a_{n-1}$ are standing in a queue prepared for a Rock Paper Scissors tournament and your own skill level is x, find the probability that you will win the tournament after inserting yourself into any of the n positions in the queue (before person 1, between people 1 and 2, ..., after person $n-1$):

- while the queue has at least two people, two people are popped from the front of the queue and play a match (if people with skill levels p and q play a match, the first one wins with probability $\frac{p}{p+q}$ and the second one wins with probability $\frac{q}{p+q}$, there are no draws);
- the winner of the match gets pushed to the back of the queue, while the loser is eliminated;
- the last person standing in the queue is declared the winner of the tournament.

Input

The first line contains two integers n and x ($2 \le n \le 4096$; $n = 2^k$ for an integer k; $1 \le x \le 10^4$).

The second line contains $n-1$ integers $a_1, a_2, \ldots, a_{n-1}$ ($1 \le a_i \le 10^4$). a_1 is the skill level of the person at the front of the queue, while a_{n-1} corresponds to the person at the back.

Output

For each of the n positions in the queue where you can insert yourself, from the front to the back, display the probability of winning the tournament.

Your answer will be considered correct if its absolute or relative error doesn't exceed 10^{-9}.

Examples

standard input	standard output
4 2 1 1 1	0.444444444444444 0.444444444444444 0.444444444444444 0.444444444444444
4 3 4 5 2	0.188265306122449 0.188265306122449 0.239285714285714 0.239285714285714
8 8 1 2 3 4 5 6 7	0.393768719371413 0.393768719371413 0.353382184051268 0.353382184051268 0.248207450668989 0.248207450668989 0.230924146560510 0.230924146560510

Note

In the first test case, you beat any opponent with probability $\frac{2}{3}$. To win the tournament, you need to beat two opponents, hence the answer is $\frac{4}{9}$ regardless of your initial position.

Problem K. Kilk

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

Find the number of strings consisting of x letters '`a`' and y letters '`b`' that have the length of their longest substring consisting of equal letters as small as possible under these conditions, and display it modulo 998 244 353.

Input

The first line contains a single integer t ($1 \le t \le 10^5$), denoting the number of test cases.

Each of the next t lines describes one test case and contains two integers x and y ($1 \le x, y \le 2000$).

Output

For each test case, display the required number.

Example

standard input	standard output
5 2 4 7 8 7 7 9 3 239 58	6 1 2 20 868098448

Note

In the first test case, the strings are `abbabb`, `bababb`, `babbab`, `bbaabb`, `bbabab`, `bbabba`. In each of these strings, the length of the longest substring consisting of equal letters is 2, and there are no strings consisting of 2 letters '`a`' and 4 letters '`b`' with a smaller value.