Problem B. Bit Operation

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	1024 mebibytes

You are given an integer array A of length N, consisting of 0's and 1's. Let a be initially the array A. You are going to perform the following operation $N-1$ times.

- Let n be the current length of a. Choose an integer i $(1 \le i \le n-1)$ and delete the i-th and the $(i+1)$-th elements of a. Then, by letting x and y be the deleted elements, insert either $x \,\&\, y$ or $x \mid y$ to the position of the deleted elements. Here $x \,\&\, y$ and $x \mid y$ denote the bit-AND and bit-OR operations, respectively.

There are $2^{N-1} \times (N-1)!$ ways to perform the operations. Count the number of ways that result in a single value of 1, modulo 998244353.

Input

The first line contains an integer N $(1 \le N \le 10^6)$.

The second line contains integers $A_1, A_2, \ldots, A_N$ $(0 \le A_i \le 1)$.

Output

Print the answer.

Examples

standard input	standard output
3 0 1 0	2
5 1 1 1 1 1	384
7 0 1 1 0 1 0 1	25515

Problem E. Edge Subsets

Input file:	*standard input*
Output file:	*standard output*
Time limit:	6 seconds
Memory limit:	1024 mebibytes

You are given integers A, B, and a simple undirected graph of N vertices and M edges. The vertices are numbered from 1 through N, and the edges from 1 through M. The edge i connects the vertices U_i and V_i. Here, it is guaranteed that $V_i - U_i = A$ or $V_i - U_i = B$.

Find the number of matchings of the graph, modulo 998244353. Note that a matching of the graph is a subset of edges whose end-points are all distinct.

Input

The first line contains integers N ($3 \le N \le 200$), M ($1 \le M \le 400$), A, and B ($1 \le A < B \le N - 1$).

The following M lines describe the edges. The i-th of those lines contains integers U_i and V_i ($1 \le U_i < V_i \le N$, $V_i - U_i = A$ or $V_i - U_i = B$). There are no self-loops or multi-edges.

Output

Print the answer.

Examples

standard input	standard output
4 3 1 2 1 2 1 3 3 4	5
10 14 2 4 5 7 7 9 2 6 6 8 1 5 3 7 4 8 1 3 4 6 8 10 3 5 5 9 2 4 6 10	225

Problem G. Games

Input file:	*standard input*
Output file:	*standard output*
Time limit:	4 seconds
Memory limit:	1024 mebibytes

You are given an integer sequence $A_1, A_2, \ldots, A_N$ and an integer K.

You'll prepare K piles of stones. Each pile should contain exactly A_i piles for some i. All piles are distinguishable; there are N^K different configurations.

You and Mike will play a game with the piles. You and Mike alternately do the following operation, with you going first.

- Choose at most 6 piles (choosing 0 piles is not allowed) and remove an arbitrary positive number of stones from each of the chosen piles. Note that the player can remove different numbers of stones from different piles.

The player who cannot make a valid move loses. Assuming both players play optimally, count the number of initial configurations that result in your loss, modulo 998244353.

Input

The first line contains integers N ($1 \le N \le 100$) and K ($1 \le K \le 10^{18}$).

The second line contains integers $A_1, A_2, \ldots, A_N$ ($1 \le A_1 < A_2 < \cdots < A_N \le 100$).

Output

Print the answer.

Examples

standard input	standard output
1 7 1	1
5 100 2 3 5 7 9	842434993

Problem H. Harsh Comments

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	1024 mebibytes

Posted on a blog are $N + M$ harsh comments. You made N comments, and the i-th of them has A_i downvotes. The i-th of the other M comments has B_i downvotes.

Mike is going to delete the comments, one by one, by repeating the following operation:

- Choose a comment randomly and delete it. More precisely, let $x_1, x_2, \ldots, x_k$ be numbers of downvotes the remaining comments have. Then, he will choose the i-th of them with the probability $x_i / \left(\sum_{1 \le j \le k} x_j\right)$ and detele it.

Note that the choices in the operations are independent.

Find the expected number of operations Mike will do until he deletes all of your comments. The answer is a rational number, so print it modulo 998244353 as usual. We can prove that such representation is always possible under the constraints of this problem.

Input

The first line contains integers N and M ($1 \le N, M \le 100$).

The second line contains integers $A_1, A_2, \ldots, A_N$ ($1 \le A_i \le 100$).

The third line contains integers $B_1, B_2, \ldots, B_M$ ($1 \le B_i$, $\sum_{1 \le i \le N} A_i + \sum_{1 \le i \le M} B_i < 998244353$).

Output

Print the answer.

Examples

standard input	standard output
1 2 1 1 1	2
1 1 2 1	332748119
3 3 2 3 5 7 11 900000000	636512475

Problem I. Inverse Problem

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	1024 mebibytes

You are given an integer N and an integer sequence X of length M. Count, modulo 998244353, the number of permutations $P = (P_1, P_2, \ldots, P_N)$ of $(1, 2, \ldots, N)$ that satisfy the following condition:

- The lexicographically smallest subsequence of P of length M coincides with X.

Input

The first line contains integers N ($1 \le N \le 250000$) and M ($1 \le M \le N$).

The second line contains integers $X_1, X_2, \ldots, X_M$ ($1 \le X_i \le N$, $X_i \ne X_j$ for all $i \ne j$).

Output

Print the answer.

Examples

standard input	standard output
3 2 1 2	3
10 5 2 7 8 3 6	0
5 5 1 2 3 4 5	1

Problem K. King And Highways

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	1024 megabytes

There are x cities in the kingdom. King plans to connect some cities with bidirectional highways (each highway connects exactly two cities) such as any there will be route between any two cities on the highways when no more than one highway is closed.

Print minimum number of roads to build 998244353.

Input

The first line contains an integer x ($3 \le x < 10^{(10^6)}$).

Output

Print the answer.

Examples

standard input	standard output
3	3

Problem L. Looking For Plagiarism

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	1024 megabytes

A program for the Typhoon programming language is interpreted with the virtual machine.

The SP register of that machine is set to 0 before execution; each operator is interpreted either as the `write` type instruction (increases SP by 1) or as `read` type instruction (decreases SP by 1). At the end of execution value of SP shall be equal to zero (otherwise Run-Time Error is sent); when SP becomes negative, the program goes into the infinite loop (and Time-Limit Exceed is sent).

The students were asked to write a program on Typhoon, consisting of exactly n operators, where n is even. There is built-in antiplagiarism tool in the contest management system which checks the *operational profile* of the accepted solution (i.e when neither Run-Time Error nor Time-Limit Exceed were sent); the profile is defined as the sequence of the n values of SP register after execution of each command.

If those profiles coincide for two students, both solutions are rejected as plagiarism.

Given integer n, calculate the maximum number of accepted solutions in the system modulo 998244353.

Input

The first line contains an integer n ($2 \le n \le 640\,000$, n is **even**)

Output

Print the answer.

Examples

standard input	standard output
2	1
4	2

Problem M. Megafactorial

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	1024 megabytes

We will define an *megafactorial* of integer n as the value $(n!)!$, where $n!$ is the product of all sequential integers between 1 and n inclusively.

Given n, print $(n!)!$ modulo 998 244 353.

Input

The first line contains an integer n ($0 \le n \le 998\,244\,352$).

Output

Print the answer.

Examples

standard input	standard output
2	2
3	720

Problem N. N-dimensional Game

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	1024 megabytes

Alice and Bob are playing some adventure game in the n-dimensional Euclidean space. They have full set of dices: all distinct convex regular n-dimensional polytopes with unit length of the edge. $n-1$-dimensional faces of each of those dices are enumerated by sequential integers, starting from 1. At one turn, player throws all dices and counts the sum on the faces they are staying on.

Given n, find maximum possible sum player can obtain with the maximal luck, modulo 998244353.

Input

The first line contains an integer n ($3 \le n \le 998244352$).

Output

Print the answer.

Examples

standard input	standard output
3	60
4	773

Note

For the 3-dimensional space there are 5 dices: tetrahedron with 1-4 on faces, cube with 1-6, octahedron with 1-8, icosahedron with 1-20 and dodecahedron with 1-12, so one can obtain is 4+6+8+20+12=60.

Problem O. Odds For Palindrome

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	1024 megabytes

Given a string, consisting of lowercase English letters. The letters of the given string are randomly shuffled (all permutations are equiprobable). Calculate the probability that the resulting string is a palindrome.

The answer is a rational number, so print it modulo 998244353. We can prove that such representation is always possible under the constraints of this problem.

Input

The first line contains a string n, consisting of lowercase English letters ($1 \le |s| \le 10^4$) .

Output

Print the answer.

Examples

standard input	standard output
abacaba	370776474
tokyo	0