Problem A. Binomial Coefficient

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

Given n, k, calculate $\binom{n}{k} = \frac{n!}{k!(n-k)!} \bmod (2^{32})$.

Input

2 integers n, k $(1 \leq n \leq 10^{18}, 0 \leq k \leq n)$.

Output

A single integer denotes the value.

Examples

standard input	standard output
4 2	6
1000000000 500000000	4209467392

Problem B. Bipartite Graph Coloring

Input file:	*standard input*
Output file:	*standard output*
Time limit:	9 seconds
Memory limit:	512 mebibytes

Bobo gets a bipartite graph with n vertices (that is, a graph without odd cycles).

He colors each vertex into black or white, and then calculates the product of each edge's value. The value of an edge is determined by the colors of its two end points. Thus, there can be $2 \times 2 = 4$ different values associated to a given edge.

Now bobo would like to know the sum of products of all 2^n possible coloring, modulo $(10^9 + 7)$.

Input

The first line contains 2 integers n, m which denotes the number of vertices and edges ($2 \leq n \leq 40$, $1 \leq m \leq 100$).

Vertices are numbered by $1, 2, \ldots, n$ for convenience.

Each of the following m lines contains 6 integers $a_i, b_i, v_{i,00}, v_{i,01}, v_{i,10}, v_{i,11}$, which denotes an edge between vertices a_i and b_i ($1 \leq a_i, b_i \leq n, 0 \leq v_{i,00}, v_{i,01}, v_{i,10}, v_{i,11} \leq 10^9$).

- If vertices a_i and b_i are both white, the i-th edge's value is $v_{i,00}$.
- If vertex a_i is white and b_i is black, the value is $v_{i,01}$.
- If vertex a_i is black and b_i is white, the value is $v_{i,10}$.
- If vertices a_i and b_i are both black, the value is $v_{i,11}$.

Output

A single integer denotes the sum.

Examples

standard input	standard output
2 1 1 2 1 2 3 4	10
3 2 1 2 1 0 0 1 2 3 1 0 0 1	2

Problem C. Random Points

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3.5 seconds
Memory limit:	512 mebibytes

Bobo found n points on the plane. He randomly picks a subset of points (each subset has equal probability to be picked), and would like to know the expectation of the size of convex hull.

Note that the convex hull should not contain two duplicate points or three collinear points.

Input

The first line contains an integer n ($1 \le n \le 2000$).

Each of following n lines contains 2 integers x_i, y_i which denotes a point (x_i, y_i) ($0 \le x_i, y_i \le 10^9$).

Output

If the expectation is E, a single integer denotes $E \cdot 2^n \bmod (10^9 + 7)$.

Examples

standard input	standard output
3 0 0 0 1 1 0	12
3 0 0 0 1 0 2	11

Problem D. Control Point

Input file:	*standard input*
Output file:	*standard output*
Time limit:	4 seconds
Memory limit:	512 mebibytes

Bobo has a tree with n vertices. There are m vertices on the tree that bobo thinks very special.

bobo would like to choose a (maybe empty) subset of vertices as control points, so that every special vertex can reach an control points via no more than r edges.

Find out the number of such subsets, modulo $(10^9 + 7)$.

Input

The first line contains 3 integers n, m, r $(1 \le n \le 2000, 0 \le m \le n, 0 \le r < n)$.

Vertices are numbered by $1, 2, \ldots, n$ for convenience.

The second line contains m distinct integers $v_1, v_2, \ldots, v_m$ which denotes the special vertices $(1 \le v_i \le n)$.

Each of the following $(n-1)$ lines contains 2 integers a_i, b_i which denotes an edge between vertices a_i and b_i $(1 \le a_i, b_i \le n)$.

Output

A single integer denotes the number of subsets.

Examples

standard input	standard output
3 1 1 1 1 2 2 3	6
4 1 2 1 1 2 2 3 2 4	15

Problem E. Three Points

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Bobo has three points, namely, point A, B and C. And now he wants to find a point P to minimize $|PA| + 2 \cdot |PB| + 3 \cdot |PC|$.

Note that $|AB|$ denotes the Euclidian distance between points A and B.

Input

Each of the 3 lines contains 2 integers x_i, y_i, which denotes the coordinates of point A, B, C, respectively ($|x_i|, |y_i| \leq 10000$).

Output

A single float number denotes the minimum of total distance. Absolutely or relatively error within 10^{-6} will get accepted.

Examples

standard input	standard output
0 0 0 0 1 0	3.000000000

Problem F. Independent Set

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

Bobo has a binary sequence $a_1a_2\ldots a_n$. And he wants to count the number of sequences as $x_1, x_2, \ldots, x_n$ satisfying the following conditions modulo $(10^9 + 7)$.

1. $x_1, x_2, \ldots, x_n \in \mathbb{N}^0$, $x_1 + x_2 + \cdots + x_n = m$;
2. For all $1 \le i \le n$, $a_i \cdot x_i = 0$;
3. For all $2 \le i \le n$, $x_{\lfloor i/2 \rfloor} \cdot x_i = 0$.

Input

The first line contains 2 integers n, m $(1 \le n \le 5000000, 1 \le m \le 10)$.

The second line contains n integers $a_1a_2\ldots a_n$ $(0 \le a_i \le 1)$.

Output

A single number denotes the number of sequence.

Examples

standard input	standard output
2 2 00	2
10 3 0101010101	26

Problem G. Long Binary Sequence

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

Bobo has a very very long binary sequence s of length n. All except m positions $x_1, x_2, \ldots, x_m$ are 0 (And $s_{x_1} = s_{x_2} = \cdots = s_{x_m} = 1$).

Now bobo would like to know the number of **distinct** consecutive substrings of s.

Input

The first line contains 2 integers n, m ($1 \le n \le 10^9, 1 \le m \le \min\{n, 1000\}$).

The second line contains m integers $x_1, x_2, \ldots, x_m$ ($1 \le x_1 < x_2 < \cdots < x_m \le n$).

Output

A single integer denotes the number of distinct substrings.

Examples

standard input	standard output
3 2 1 3	5
1000000000 1 1	1999999999

Problem H. Huge Products

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Bobo has a lot of integers. Frankly, he has a_1 number of 1, a_2 number of 2, ..., a_{10} number of 10.

Today, bobo would like to pick some of the numbers and calculate their product (If none of the numbers are chosen, the product is defined as 1). bobo is curious about the number of different products he can obtain, modulo $(10^9 + 7)$.

Input

10 integers $a_1, a_2, \ldots, a_{10}$ $(0 \le a_i \le 10^9)$.

Output

A single integer denotes the number of products.

Examples

standard input	standard output
0 1 0 1 0 0 0 1 0 0	7
0 1000000000 100000000 0 0 0 0 0 0 0	400000001

Problem I. Substring Query

Input file:	*standard input*
Output file:	*standard output*
Time limit:	3 seconds
Memory limit:	512 mebibytes

Bobo has n strings $S_1, S_2, \ldots, S_n$. One day, his friend yiyi comes and asks him q questions: how many strings in $S_{l_i}, S_{l_i+1}, \ldots, S_{r_i}$ containing P_i as a substring?

Help bobo find out the answer.

Input

The first line contains 2 integers n, q ($1 \le n, q \le 200000$).

Each of the following n lines contains 1 string S_i ($|S_1| + |S_2| + \cdots + |S_n| \le 200000$).

Each of the last q lines contains 2 integers l_i, r_i and 1 string P_i.

($1 \le l_i \le r_i \le n, |P_1| + |P_2| + \cdots + |P_n| \le 200000$)

All strings consist of "a" and "b".

Output

For each question, a single integer denotes the answer.

Examples

standard input	standard output
4 2 a b ab bab 1 3 a 1 4 ab	2 2

Problem J. Subset Sum

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

Given a multiset of integers $A = \{a_1, a_2, \ldots, a_n\}$, print the least k sums among all non-empty subsets in sorted order.

Input

The first line contains 2 integers n, k ($1 \le n \le 200000, 1 \le k \le \min\{2^n - 1, 200000\}$).

The second line contains n integers $a_1, a_2, \ldots, a_n$ ($|a_i| \le 10^9$).

Output

k integers denote the least k sums.

Examples

standard input	standard output
2 3 -1 1	-1 0 1
3 7 -1 0 1	-1 -1 0 0 0 1 1