Problem A: Product of Array Elements

Time limit: 1s; Memory limit: 256 MB

Given array ***A*** consisting of n integers a_i. Tuan wants to remove at most 1 element in array A so that the product of all remaining elements in that array is the largest. Please help Tuan do it!

You task is to calculate the product of all remaining elements in that array after removed at most 1 element.

Input

- The first line contains a positive integer n ($2 \le n \le 1000$).
- Next line contains n integers a_i separated by a space ($-10^9 \le a_i \le 10^9$).

Output

- Print the result of the problem. Since it may be too big, print it after taking modulo 10^9+7.

Sample

Input	Output
4 4 2 3 5	120
5 -1 -2 -4 1 2	16

Explanation Example 1:

- Without dropping any elements, the product of 4 elements is $4 \times 2 \times 3 \times 5 = 120$.

Explanation Example 2:

- Remove -1, the product of the remaining 4 elements is $-2 \times (-4) \times 1 \times 2 = 16$

Problem B: Copper Hydroxide

Time limit: 2s; Memory limit: 256 MB

Copper Hydroxide (chemical formula $Cu(OH)_2$) is a pale greenish blue or bluish green solid. It is a beautiful strong base, as this problem is for strong and beautiful coders. Let's prove it!

Given a vector $a = (a_1, a_2, \dots, a_n)$ in $\mathbb{R}^n$. A vector $b = (b_1, b_2, \dots, b_n)$ is non-increasing if and only if $b_1 \leq b_2 \leq \cdots \leq b_n$.

The Euclide distance between two vectors a, b is calculated as

$$d(a,b) = \sqrt{(a_1 - b_1)^2 + (a_2 - b_2)^2 + \cdots + (a_n - b_n)^2}$$

Find a non-decreasing vector b in $\mathbb{R}^n$ such that $d(a,b)$ is minimized.

Input

The first line contains a natural number, n $(1 \leq n \leq 10^6)$

The second line contains n real numbers $a_1, a_2, \dots, a_n$ $(|a_i| \leq 10^5)$. Each of them has at most 3 decimal digits in the input.

Output

Print one real number, which is the min $d(a,b)$, for all non-increasing vector b. The answer is accepted if the absolute error or relative error does not exceed 10^{-6}.

Sample

Input	Output
3 1 1 2	0
4 3.368 97.561 80 353	12.41750218

Explanation

In sample 1, $a = (1,1,2)$, which is already non-decreasing. We choose $b = (1,1,2)$ then $d(a,b) = 0$.

In sample 2, we choose $b = (3.368, 88.7805, 88.7805, 353)$. Then, $d(a,b) = \sqrt{0 + (97.561 - 88.7805)^2 + (80 - 88.7805)^2 + 0} = 12.41750218\dots$

Bonus: Find out what $Cu(OH)_2$ facts that correspond to numbers in sample 2.

Good luck!

Problem C: Cut Cake

Time limit: 1s; Memory limit: 256 MB

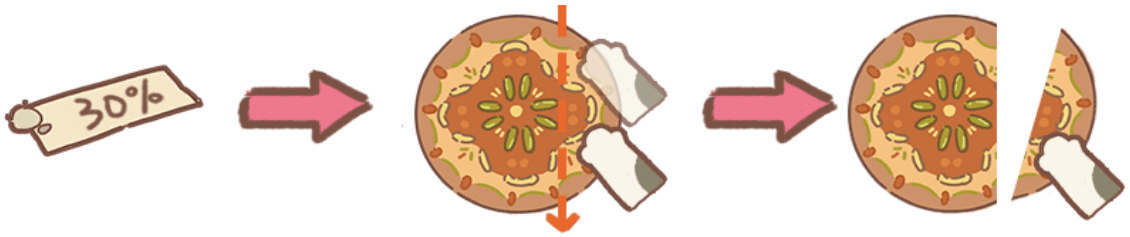


*Image from Animal Restaurant game

Chef Gumi is the Chef of Animal Restaurant. Recently, he is interested in the mini-game Cut Cake. He is given a cake and he has to cut according to the customer's request – the customer wants a part of the cake which is smaller than 50%. Please help Gumi check if he satisfies the request.

In the two-dimensional Cartesian coordinate system, the cake is a circle with its center point C and its radius while the cut is illustrated by a straight line from 2 different points – point A and point B.

Input

The input consists of 8 float numbers. The first six numbers represent the x- and y-coordinates of points A, B, and C, respectively, ($-10^5 \leq x_A, y_A, x_B, y_B, x_C, y_C \leq 10^5$). Next is the radius of the cake ($0 < R \leq 10^3$) and last is the percentage of cake the customer wants ($0 < P < 50$)

Output

Print YES if Gumi satisfies his customer's request, which means his cut is through the cake and the difference between the smaller part of the cake and the request is within 5%. If not or his cut is outside or only touches the cake, print NO.

Sample

Input	Output
-1 0 0 1 0 0 1 10	YES
-1 0 0 1 0 0 1 15	NO

Problem D: Hanging Certificates of Merit

Time limit: 2s; Memory limit: 256 MB

The Informatics Olympiad Club of University of Science and Technology - University of Danang over the years participating in Vietnam The Informatics Olympiad and ICPC has received many certificates of merit. Captain Khai of the club came up with an idea to set up a display area for these certificates. Khai prepared n rectangular frames to hang them. The i^{th} frame of size (w_i, h_i) is hung on the wall using a nail nailed to the center of the frame at coordinates (x_i, y_i) on the wall. However, after doing this, Khai noticed that some frames were overlapping. Khai decided to adjust by selecting some frames and rotating them around these center 90 degrees so that the frames no longer overlap. Because the work is quite difficult, please help Khai.

Input

- The first line contains a positive integer n ($1 \le n \le 2500$).
- The next n lines, each line contains 4 interger x_i, y_i, w_i, h_i ($-10^9 \le x_i, y_i \le 10^9$, $1 \le w_i, h_i \le 10^9$).

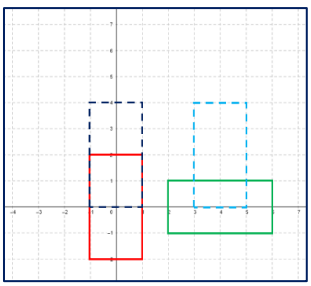
Output

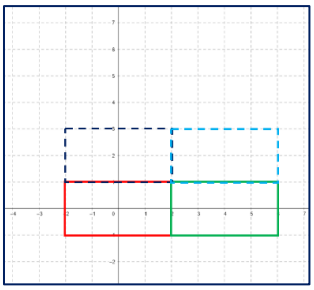
- If there is no way to rotate, print “No”.
- Otherwise: the first line prints “Yes”, the second line prints the rotation way by a string containing the characters “Q” or “K”. The i-th character represents whether the i^{th} frame rotates or not. “Q” represents **rotation** and “K” represents **no rotation**. If there are multiple ways, print the way with the smallest one in lexicographic order.

Sample

Input	Output
4 0 2 2 4 0 0 2 4 4 0 4 2 4 2 2 4	Yes QQKQ
2 0 0 2 2 1 1 2 2	No

Explanation Example 1:





Problem E: Manganese Dioxide

Time limit: 5s; Memory limit: 256 MB

Manganese Dioxide (chemical formula MnO_2) is a blackish or brown solid. Although looking harsh, its properties are wonderful and popularly used in batteries. Similarly, this problem may look difficult, but its solution contains beautiful insights. Let's see if it's true!

Given an array of integers $a_1, a_2, \dots, a_n$, and an integer k. For every $i = 1, 2, \dots, k$, calculate the sum of their i-th powers: $f(i) = a_1^i + a_2^i + \cdots + a_n^i$.

Input:

The first line contains two natural numbers, n, k $(1 \le n \le 10^5, 1 \le k \le 10^5)$

The second line contains n real numbers $a_1, a_2, \dots, a_n$ $(0 \le a_i < 998244353)$.

Output:

Print k lines, containing $f(1), f(2), \dots, f(k)$, each on one line. Since they may be too big, print them after taking modulo 998244353.

Sample:

Input	Output
3 3 1 2 3	6 14 36
4 5 87 535 808 5026	6456 26207334 864427735 110742109 992865564

Explanation:

In sample 1, $1 + 2 + 3 = 6, 1^2 + 2^2 + 3^2 = 14, 1^3 + 2^3 + 3^3 = 36$

Bonus: Find out what MnO_2 facts that correspond to numbers in sample 2. Good luck!

Problem F: Student Clubs

Time limit: 2s; Memory limit: 256 MB

Mai's university has many student clubs and each has its power. This power is calculated by the factorial of the number of club' members. What is the total power of all clubs?

It is easy problem if she knows how many members are in each group, however, she doesn't have them. One thing she can do is interview students and that student tells her about another student in the same club.

Suppose she collected enough student statistics, each student join only one club and a valid club has more than 2 members (> 2 members), please help her get the total power of all club in her university.

Input

- First-line contains 2 integers N and M $(1 \leq N, M \leq 10^5)$, where N is the number of students and M is the number of interviewed students.
- Next M lines contain 2 integers which are the student who is interviewed and his club's friend.

Output

Print an integer which is the total power of student clubs in the university modulus $10^9 + 7$

Sample

Input	Output
9 5 1 2 2 3 0 4 4 5 8 7	12

Explain

There are only 2 valid clubs:
One has 3 members 1, 2, and 3. => power1 is 3! = 6
Another valid club has 3 members 0, 4 and 5 => power2 is 3! = 6

⇨ Total power is 12