Problem A. Ramen

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Grammy likes to eat noodles. She divided a very long strip of noodle into N parts with equal lengths. Each part has a delicious value a_i attached to it. She would like to fold the noodle into one piece before eating by repeating the following operation several (possibly, zero) times.

In each operation, she can choose a length l such that $2l \leq n$ and $a_i > 0$ for all $i \leq l$, and fold the noodle $a_1, a_2, \ldots, a_l, a_{l+1}, \ldots, a_{2l}, \ldots, a_n$ into $a_{l+1} + a_l, a_{l+2} + a_{l-1}, \ldots, a_{2l} + a_1, \ldots, a_n$, where n is the length of the noodle before the operation, and the length will become $n - l$ after the operation.

Grammy wants to know whether she can fold the noodle to length 1, can you tell her?

Input

The first line contains a single integer N ($1 \leq N \leq 100\,000$).

The second line contains N integers a_i ($-20\,000 \leq a_i \leq 20\,000$), representing the delicious value of each part of the noodle.

Output

If Grammy can fold the noodle to length 1, output "YES" in one line. Otherwise output "NO". (Without quotes)

Examples

standard input	standard output
3 1 2 -5	YES
5 2 -5 2 3 1	NO

Problem B. Rectangle Placement

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Grammy has a rectangular grid with W vertical lines and H horizontal lines. She wants to draw two non-intersecting rectangles along the grid lines. One rectangle is allowed to be completely contained inside another, but the two rectangles cannot intersect at any point, including edges and corners.

Please count the number of different rectangle drawings, modulo 998 244 353. Two drawings are considered different if and only if a grid edge is colored in one of the drawings and not in the other.

Input

The only line contains 2 integers W, H $(4 \leq W, H \leq 10^9)$.

Output

Output a single integer, denoting the number of different drawings modulo 998 244 353.

Examples

standard input	standard output
4 5	275
723435135 239873451	832099301

Problem C. Infectious Disease

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	1024 megabytes

In the year of 2202, a strange disease begin to spread in a city of n people.

To prevent the disease from spreading, experts invented a strong vaccine called Mysterious Oscar. On the zeroth day, one citizen is infected by the disease, and another citizen is vaccinated. If a person becomes vaccinated, he/she will be cured immediately and will not catch or spread the disease anymore.

On day $d(d > 0)$, the infected citizens will infect others one by one. Each of the citizens who were infected strictly before day d will choose one uninfected and unvaccinated citizen to infect equiprobably. If at some point, one infected citizen has no unvaccinated and uninfected citizens to choose, then he/she will do nothing.

After infection, the vaccinated citizens will persuade others to take the vaccine one by one. Each of the citizens who were vaccinated strictly before day d will choose 2 different unvaccinated citizens equiprobably, and persuade them so that they become vaccinated. If at some point, one vaccinated citizen has less than 2 unvaccinated citizens to choose, then he/she will persuade all the remaining unvaccinated citizens to take the vaccine.

Grammy want to know how many days will the disease be fully extinguished. Please tell her the expected number of days before all patients become cured.

It can be shown that the answer can be expressed as an irreducible fraction $\frac{x}{y}$, where x and y are integers and $y \not\equiv 0 \pmod{10^9+7}$. Output the integer equal to $x \cdot y^{-1} \pmod{10^9+7}$. In other words, output such an integer a that $0 \le a < 10^9+7$ and $a \cdot y \equiv x \pmod{10^9+7}$.

Input

The only line contains an integer n ($2 \le n \le 1.4 \times 10^7$), denoting the population of the city.

Output

Output a single integer, denoting the expected number of days before all patients become cured modulo 10^9+7.

Examples

standard input	standard output
2	1
114	505208013

Note

In the first sample, one citizen took the vaccine on day 0, and he/she persuaded the other citizen, the only patient, to take the vaccine on day 1, so the disease must be completely cured on day 1.

Problem D. Maximum Range

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Grammy has a simple connected undirected graph. Each of the edges has a value written on it. Please choose a simple cycle for her such that the values written on the cycle has maximum range.

The range of a cycle is the difference between the maximum value and the minimum value written on it.

A cycle $i_1 - e_1 - i_2 - e_2 - \cdots - i_k - e_k - i_1$ (e_j is some edge connecting vertices i_j and $i_{j \bmod k+1}$ in the graph) is simple if and only if each edge appears at most once in it.

It is guaranteed that there is at least one cycle in the graph.

Input

The first line contains 2 integers n, m ($3 \le n \le m \le 10^5$), denoting the number of vertices and the number of edges in the graph. It is guaranteed that there is at most one edge between each pair of vertices.

In each of the next m lines, there are 3 integers u, v, w ($1 \le u, v \le n, -10^9 \le w \le 10^9, u \ne v$), indicating that there is an edge between vertex u and vertex v having value w written on it.

Output

Output a single integer on a single line, denoting the maximum range of a simple cycle in the graph.

Example

standard input	standard output
5 7 1 2 1 1 3 -2 2 3 1 3 4 3 4 5 1 1 5 -1 2 5 2	5

Note

In the first sample, the cycle 1-2-5-4-3-1 has the maximum range of 5, since the maximum value on the cycle is 3, and the minimum value on the cycle is -2, so the maximum range of a cycle is $3 - (-2) = 5$. It can be shown that there are no cycles with a range larger than 5.

Problem E. Rotate Sum 2

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Grammy loves geometry. Today, she takes out her precious convex polygon and plays with it on a piece of paper. The polygon has n vertices numbered from 1 to n in counterclockwise order.

Firstly, Grammy draws a horizontal line on the paper. Secondly, she chooses two vertices i, j of the polygon independently and equiprobably. Thirdly, she places the edge between vertex i and vertex $(i+n-2) \bmod n+1$ on the line, landing all other vertices above the line, and draws a vertical line through vertex j. Next, she rotates the polygon clockwise, taking vertex i as the rotation center, until the $i \bmod n+1$-th vertex hits the line. When the $i \bmod n+1$-th vertex hits the line, she changes the rotation center to the $i \bmod n+1$-th vertex until the $(i+1) \bmod n+1$-th vertex hits the line. She repeats this operation until vertex i hits the line again. Finally, she draws another vertical line through the j-th vertex and calculated the area between the trajectory of vertex j and the three lines.

Since you do not know which point Grammy chooses, you want to calculate the expected value of the area.

Input

The first line contains a single integer n ($3 \le n \le 100\,000$), denoting the number of vertices of the polygon.

In each of the following n lines, there are 2 integers $x_i, y_i (-10^9 \le x_i, y_i \le 10^9)$, denoting the coordinates of a vertex of the polygon. The vertices are given in counterclockwise order. It is guaranteed that the polygon is convex.

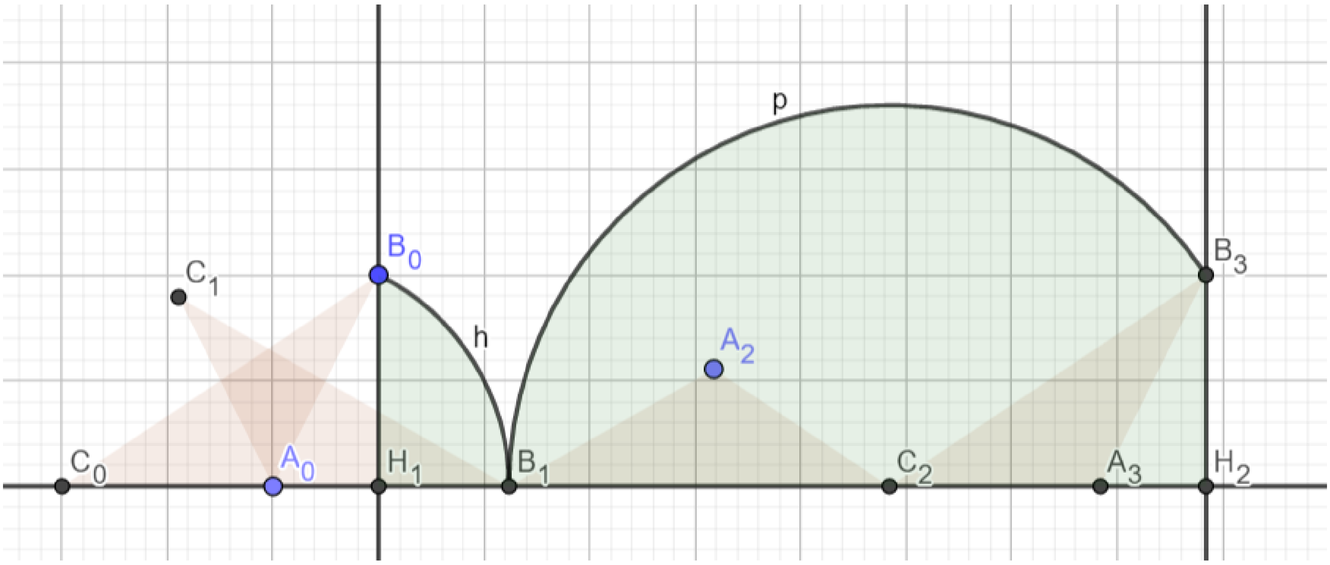
Output

Output a single real number, denoting the expected area. The answer is considered as correct if its absolute of relative error does not exceed 10^{-4}.

Example

standard input	standard output
3 1 -1 1 1 -1 2	18.763234503173919

Note



For the first example, if the i-th vertex is marked as A_0, and the j-th vertex is marked as B_0, then the polygon will be $A_3B_3C_2$ after 3 rotations, and the trajectory of vertex j is arc h and arc p. The area of the green part is the answer in this case.

Problem F. Smaller LCA

Input file:	`standard input`
Output file:	`standard output`
Time limit:	4 seconds
Memory limit:	512 megabytes

Grammy has a tree. For each vertex as the root, she wants to know how many unordered pairs of points (x, y) have a lowest common ancestor z such that $z \le x \cdot y$. Please count it for her.

Input

The first line contains a single integer $n (1 \le n \le 300\,000)$, denoting the number of vertices of the tree.

In each of the next $n - 1$ lines, there are 2 integers $u_i, v_i (1 \le u_i, v_i \le n)$, indicating that there is an edge between vertex u_i and vertex v_i.

Output

Output n lines, the i-th line contains a single integer denoting the number of pairs satisfying the condition when vertex i is the root.

Example

standard input	standard output
5 1 2 4 2 2 5 3 5	15 15 15 15 14

Problem G. Positive String

Input file:	`standard input`
Output file:	`standard output`
Time limit:	1 second
Memory limit:	256 megabytes

Grammy has a unique insight of a string. She thinks that a string is positive if and only if it is lexicographically larger than its reversal.

Now you are given a string, please find out how many contiguous substrings of it are considered as positive string according to Grammy's insight.

Input

The single line contains a string S $(1 \le |S| \le 200\,000)$, consisting of lowercase English letters only.

Output

Output a single integer, denoting the number of positive substrings of S.

Examples

standard input	standard output
`jjikkollp`	`4`
`pbpbppb`	`7`