Problem A. Manhattan

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 mebibytes

In Manhattan, there are streets $x = i$ and $y = i$ for each integer i. It is known that both Snuke's house and Smeke's house are on streets, and the Euclidean distance between them is exactly d. Compute the maximal possible distance between their houses when they travel along streets.

Input

The input contains one number d.

- $0 < d \leq 10$
- d contains exactly three digits after the decimal point.

Output

Print the answer. The answer is considered to be correct if its absolute or relative error is at most 10^{-9}.

Examples

standard input	standard output
1.000	2.000000000000
2.345	3.316330803765

Problem B. Dictionary

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	256 mebibytes

Snuke's dictionary contains n distinct words $s_1, \dots, s_n$. Each word consists of English lowercase letters. The words are sorted lexicographically, i.e., $s_1 < \cdots < s_n$. Unfortunately, you can't read some characters in his dictionary. You replaced those characters with '?'. Compute the number of ways to replace each '?' with an English lowercase letter and make a valid dictionary, modulo 1,000,000,007.

Input

First line of the input contains one integer n ($1 \le n \le 50$). Then n lines follow, i'th of then contains word s_i ($1 \le |s_i| \le 20$, each character in s_i is an English lowercase letter or a '?').

Output

Print the answer.

Examples

standard input	standard output
2 ?sum??mer c??a??mp	703286064
3 snuje ????e snule	1

Problem C. Clique Coloring

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 mebibytes

There is a complete graph with m vertices. Initially, the edges of the graph are not colored. Snuke performed the following operation for each $i (1 \leq i \leq n)$: Choose a_i vertices from the graph and paint all edges that connect two of the chosen points with color i. It turned out that no edges were painted more than once. Compute the minimal possible value of m.

Input

First line of the input contains one integer n ($1 \leq n \leq 5$). Then n lines follow, i-th of these lines contains one integer a_i ($2 \leq a_i \leq 10^9$).

Output

Print the minimal possible value of m.

Examples

standard input	standard output
2 3 3	5
5 2 3 4 5 6	12

Note

Number the vertices of the graph: 1, 2, 3, 4, 5. For example, you can color the graph in the following way:

- Choose three vertices 1, 2, 3 and color edges between them with color 1.
- Choose three vertices 1, 4, 5 and color edges between them with color 2.

Problem D. Dense Amidakuji

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	256 mebibytes

Amidakuji is a famous Japanese game. The game contains w (here w is even) long vertical segments and Snuke can add some short horizontal segments between them. Each horizontal segment connects two adjacent vertical segments. There are h layers and each horizontal segment lies on one of the layers. Thus, there are $h(w-1)$ candidate positions for horizontal segments in total. Let (a, b) be the candidate position that is a-th from the top and b-th from the left (1-based). Check the figure in the next page to see how it looks like.

First, Snuke adds horizontal segments to all positions (a, b) that satisfy $a \equiv b \pmod 2$. Then, he removed n horizontal segments at $(a_1, b_1), \dots, (a_n, b_n)$.

The game is played as follows. First, Snuke chooses one of the vertical segments. Then, he stands on the top end of the chosen vertical segment and starts moving downward. When he reaches an endpoint of a horizontal segment, he moves to the other end of the horizontal segment, and starts moving downward again. The game finishes when he reaches the bottom end. For each i (1-based), compute the final position of Snuke when he chooses the i-th vertical segment.

Input

First line of the input contains three integers h, w and n ($1 \le h, w, n \le 2 \cdot 10^5$, w is an even number). Then n lines follow; i-th of them contains two integers a_i and b_i ($1 \le a_i \le h$, $1 \le b_i \le w-1$, $a_i \equiv b_i \pmod 2$, (a_i, b_i) are pairwise distinct).

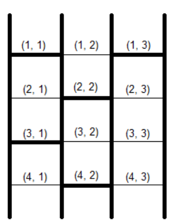
Output

Print w lines. In the i-th line, print the final position of Snuke when he chooses the i-th segment.

Examples

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

Note



For example, if he initially chooses the leftmost segment in sample 1, he crosses $(1, 1), (2, 2), (4, 2)$ and reach the bottom end of the segment that is second from the left.

Problem E. Cellular Automaton

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 mebibytes

Let w be a positive integer and p be a string of length 2^{2w+1}. $(w,p)-$ cell automaton is defined as follows:

- The cells are arranged in an infinitely long 1-dimensional line.
- Each cell can take two states: 0 and 1.
- At time 0, Snuke chooses some (finite number of) cells and set their states to 1. He sets the states of other cells to 0.
- Let $f(t,x)$ be the state of the cell x at time $t(>0)$. $f(t,x)$ is determined from $f(t-1,x-w),\cdots,f(t-1,x+w)$ according to the following rule:

$$f(t,x) = p[\sum_{i=-w}^{w} 2^{w+i} f(t-1,x+i)] \tag{1}$$

Snuke likes a cell automaton if the number of 1 doesn't change forever (no matter how he chooses the states at time 0). You are given an integer w and a string s. Compute the lexicographically minimal p such that $s \le p$ and Snuke likes $(w,p)-$ cell automaton.

Input

First line of the input contains one integer w ($1 \le w \le 3$). Next line contains string s ($|s| = 2^{2w+1}$, s consists of '0' and '1'.

Output

Print the minimal possible p. If there are no such strings, print "no" instead.

Examples

standard input	standard output
1 00011000	00011101
1 11111111	no

Problem F. Directions

Input file: *standard input*
Output file: *standard output*
Time limit: 4 seconds
Memory limit: 256 mebibytes

Initially, Snuke can't move at all. There are n tickets, and the price of the i-th ticket is p_i. If Snuke buys the i-th ticket, for all points (x, y) and a nonnegative number t, he can move from (x, y) to $(x + ta_i, y + tb_i)$. Snuke wants to buy tickets and he wants to be able to travel between any two points. Compute the minimal possible total price of the tickets he must buy.

Input

First line of the input contains one integer n ($1 \le n \le 2 \cdot 10^5$). Then n lines follow; i'th of these lines contains three integers a_i, b_i, p_i ($-10^9 \le a_i, b_i \le 10^9$, $1 \le p_i \le 10^9$).

Output

Print the minimal possible total price of the tickets he must buy in order to be able to move between any two points. If this is impossible, print -1 instead.

Examples

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

Note

In the Sample 1 you can, for example, buy tickets 1, 3, 6.

Problem G. Snake

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 mebibytes

Snake is a polyline with n vertices (without self-intersections). Initially, the coordinates of the i-th vertex of Snake is (x_i, y_i). Snake can move continuously by translation and rotation, but it can't change its shape (the lengths of the segments in the polyline and the angles between segments can't be changed). The line $y = 0$ is a wall, and there is a small hole at $(0, 0)$. Determine whether Snake can pass though the hole. (Initially, all points on Snake satisfy $y > 0$. After the movement, all points on Snake should satisfy $y < 0$.)

Input

First line of the input contains one integer n ($2 \le n \le 1000$). Then n lines follow, i'th of them contains pair of integers x_i and y_i ($0 \le x_i \le 10^9$, $1 \le y_i \le 10^9$, $(x_i, y_i) \ne (x_{i+1}, y_{i+1})$). The polyline doesn't have self-intersections. No three points are on the same line.

Output

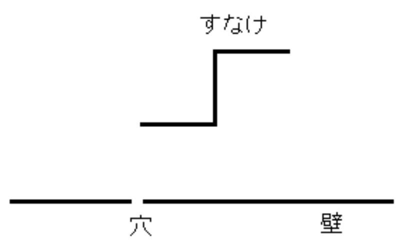
If Snake can pass though the hole, print "`Possible`". Otherwise print "`Impossible`".

Examples

standard input	standard output
4 0 1 1 1 1 2 2 2	Possible
11 63 106 87 143 102 132 115 169 74 145 41 177 56 130 28 141 19 124 0 156 22 183	Impossible

Note

For the first example, solution may look in the next way:



- Move 1 to the $-y$ direction.
- Rotate 90 degrees coounter-clockwise around the point $(0, 0)$.
- Move 1 to the $-y$ direction.
- Rotate 90 degrees clockwise around the point $(0, 0)$.
- Move 1 to the $-y$ direction.
- Rotate 90 degrees counter-clockwise around the point $(0, 0)$.
- Move 2 to the $-y$ direction.

Problem H. Distance Sum

Input file:	*standard input*
Output file:	*standard output*
Time limit:	4 seconds
Memory limit:	256 mebibytes

There are n cities and $n-1$ roads, and they form a tree. The cities are numbered 1 through n. The city 1 is the root, and for each i the parent of the city i is the city p_i, and the distance between i and p_i is d_i. Snuke wants to solve the following problem for each $1 \le k \le n$:

Compute the minimal possible sum of the distances from a certain city to the cities $1, \ldots, k$:

$$\min_{1 \le v \le n} \{\sum_{i=1}^{k} dist(i, v)\} \quad (2)$$

Here $dist(u, v)$ denotes the distance between cities u and v.

Input

First line of the input contains one integer n ($1 \le n \le 2 \cdot 10^5$). Then $n-1$ lines follow, i-th of them contains two integers p_{i+1} and d_{i+1} — parent of a city $i+1$ and the distance between $i+1$'th city and its parent ($1 \le p_i \le n$, $1 \le d_i \le 2 \cdot 10^5$, the graph represented by p_i is a tree).

Output

Print n lines. In the i-th line, print the answer when $k = i$.

Examples

standard input	standard output
10 4 1 1 1 3 1 3 1 5 1 6 1 6 1 8 1 4 1	0 3 3 4 5 7 10 13 16 19
15 1 3 12 5 5 2 12 1 7 5 5 1 6 1 12 1 11 1 12 4 1 1 5 5 10 4 1 2	0 3 9 13 14 21 22 29 31 37 41 41 47 56 59

Problem I. Substring Pairs

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	256 mebibytes

Snuke came up with an integersing pair of strings (s, t), but forgot it. He remembers the following information:

- The length of s is exactly N.
- The length of t is exactly M.
- t is a substring of s. (You can choose consecutive M characters from s that are the same as t.)

Compute the number of possible pairs of strings (s, t), modulo $10^9 + 7$. Assume that the size of the alphabet is A.

Input

First line of the input consists of three integers N, M and A ($1 \leq N \leq 200$, $1 \leq M \leq 50$, $M \leq N$, $1 \leq A \leq 1000$)

Output

Print the number of pairs of strings (s, t) that satisfy the conditions above, modulo $10^9 + 7$.

Examples

standard input	standard output
3 2 2	14
200 50 1000	678200960

Problem J. Hyperrectangle

Input file: *standard input*
Output file: *standard output*
Time limit: 2 seconds
Memory limit: 256 mebibytes

Snuke received a d-dimensional hyperrectangle of size $l_1 \times \cdots \times l_d$ as a birthday present. Snuke placed it such that its i-th coordinate becomes between 0 and l_i, and ate the part of the hyperrectangle that satisfies $x_1 + \cdots + x_d \leq s$. (Here x_i denotes the i-th coordinate). Let V be the volume of the part eaten by Snuke. We can prove that $d!V$ (V times the factorial of d) is always an integer. Compute $d!V$ modulo $10^9 + 7$.

Input

First line of the input file contains one integer d ($2 \leq d \leq 300$). Then d lines follow; i-th of these lines contain one integer l_i ($1 \leq l_i \leq 300$). Last line contains one integer s ($0 \leq s \leq \sum l_i$).

Output

Print $d!V$ modulo $10^9 + 7$.

Examples

standard input	standard output
2 6 3 4	15
5 12 34 56 78 90 123	433127538

Note

Illustration to Sample 1: