Problem A. Missing Runners

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

You are organizing a marathon with N runners. Every runner is given a distinct number from 1 to N, so they can be easily identified.

You record the number of each runner as they cross the finish line. Unfortunately, you notice that only $N - 1$ runners have finished. Which runner is still out there?

Input

The first line of input contains the integer N ($1 \le N \le 2^{15}$). The next line contains $N-1$ distinct integers in the range from 1 to N, representing the numbers of runners who have crossed the finish line.

Output

Output the number of the runner who has not crossed the finish line.

Example

standard input	standard output
5 1 5 2 3	4

Problem B. Oblongs and Right Triangles

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

There are N points on the plane; the i-th point is at (X_i, Y_i). There may be multiple points at the same location. Four of the points will be coloured black and three other points will be coloured white. The remaining $N - 7$ points will be uncoloured.

An *oblong* is a rectangle that is not a square.

An *right triangle* is a triangle where one of the interior angles is exactly ninety degrees.

Determine the number of ways to colour the points such that the four black points are the vertices of an oblong and the three white points are the vertices of a right triangle. Note that both shapes should have positive area.

Input

Line 1 contains one integer N ($7 \le N \le 2^4$).

Line 2 contains N integers $X_1, \ldots, X_N$ ($-2^{29} \le X_i \le 2^{29}$).

Line 3 contains N integers $Y_1, \ldots, Y_N$ ($-2^{29} \le Y_i \le 2^{29}$).

Output

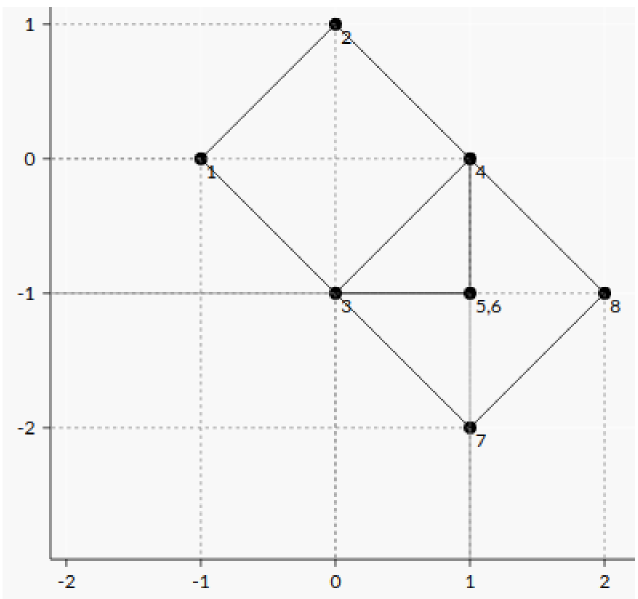
Print one line with one integer, the number of ways to choose an oblong and a right triangle.

Example

standard input	standard output
8 -1 0 0 1 1 1 1 2 0 1 -1 0 -1 -1 -2 -1	2

Note

The only way to form an oblong is with points 1,2,7,8. Of the remaining four points there are two ways to form a right triangle from them.



Problem C. Unique Substrings

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

Create a string of N lowercase letters $S_1S_2 \ldots S_N$ where $1 \leq N \leq 2^{12}$. The string should have exactly K unique substrings.

A *substring* is the sequence of letters of the form $S_LS_{L+1} \ldots S_{R-1}S_R$ for some $1 \leq L \leq R \leq N$. Two substrings are the same if they are the same sequence of letters.

Input

Line 1 contains one integer K ($1 \leq K \leq 2^{22}$). N is not given; the string that you create may have any number of letters N as long as $1 \leq N \leq 2^{12}$.

Output

Print one line with one string of N lowercase letters where $1 \leq N \leq 2^{12}$. It should have exactly K unique substrings. If there are multiple such strings, any will be accepted. It can be proven that such a string always exists with the given constraints of N and K.

Examples

standard input	standard output
`15`	`banana`
`351`	`abcdefghijklmnopqrstuvwxyz`

Note

For the first example, the 15 unique substrings of `banana` are `a`, `an`, `ana`, `anan`, `anana`, `b`, `ba`, `ban`, `bana`, `banan`, `banana`, `n`, `na`, `nan` and `nana`. Another string that has 15 unique substrings is `aaaaaaaaaaaaaaa` which would also be a correct output for the first example.

Problem D. Pie Max Flow

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

There is a graph with $N+1$ vertices numbered 0 to N. For $1 \le i \le N$, an edge with capacity A_i connects vertices 0 and N. For $1 \le i \le N$, an edge with capacity B_i connects vertices i and $((i \mod N)+1)$. There are no other edges in the graph. All edges are undirected.

A flow in a graph from a source vertex s to a sink vertex t assigns to each edge $e = (v_1, v_2)$ a direction (either $v_1 \to v_2$ or $v_2 \to v_1$) and a number F_e such that $0 \le F_e \le K_e$, where K_e is the capacity of edge e. We say that there are F_e units of flow in the specified direction, out of v_1 or v_2, and into the other vertex. Every flow must satisfy the constraint that for each vertex v except the source and sink, the sum of the flows out of v equals the sum of the flows into v. The maximum flow from s to t is the maximum over all flows from s to t of the sum of flows out of s minus the sum of flows into s.

Let C_i be the maximum flow from vertex 0 to vertex i. Find the value of $C_1 + \cdots + C_N$.

Sequences A and B will not be given directly. Instead N, A_1, B_1 and integers P, Q, W, X are given. Then for $i > 1$:

$$A_i = (PA_{i-1}) \mod Q$$

$$B_i = (WB_{i-1}) \mod X$$

Input

Line 1 contains one integer N ($2 \le N \le 2^{20}$).

Line 2 contains three integers A_1, P, Q ($1 \le A_1, P, Q \le 2^{29}$).

Line 3 contains three integers B_1, W, X ($1 \le B_1, W, X \le 2^{29}$).

Output

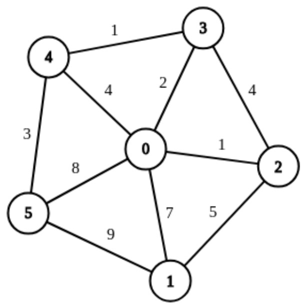
Print one line with one integer, the value of $C_1 + \cdots + C_N$.

Example

standard input	standard output
5 7 2 13 5 3 11	64

Note

For the first example, $A = [7, 1, 2, 4, 8], B = [5, 4, 1, 3, 9], C = [20, 9, 7, 8, 20]$. The graph is shown below.



Problem E. Odd Colouring

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

There is a grid with R rows and C columns. Rows are numbered 0 to $R-1$ and columns are numbered 0 to $C-1$. Let the cell at row r and column c be denoted as (r, c). Troy will add $N (N \geq R + C)$ balls to the grid; the i-th ball will be added to cell $((i-1) \mod R, (i-1) \mod C)$. Ondrej will add M balls to the grid; the j-th ball will be added to cell (X_j, Y_j). Multiple balls may be added to the same cell.

Every ball will be painted either black or white. Determine the number of ways to paint the balls such that every row and every column has an odd number of black balls. Compute the number of ways modulo 998244353.

Input

Line 1 contains four integers R, C, N, M $(1 \leq R, C, N \leq 2^{29}; R + C \leq N; 1 \leq M \leq 2^{16})$.

Line 2 contains M integers $X_1, \ldots, X_M$ $(0 \leq X_j < R)$.

Line 3 contains M integers $Y_1, \ldots, Y_M$ $(0 \leq Y_j < C)$.

Output

Print one line with one integer, the number of ways.

Examples

standard input	standard output

`2 4 6 2`
`1 1`
`3 0`
	`8`

`6 4 50 5`
`0 1 2 3 4`
`3 3 3 3 3`
	`503245988`

`2 4 6 2`
`1 0`
`3 2`
	`0`

Note

For the first example, Troy added balls to $(0, 0), (1, 1), (0, 2), (1, 3), (0, 0), (1, 1)$ and Ondrej added balls to $(1, 3), (1, 0)$.