



PROBLEM SET

*The 2026 ICPC Vietnam Northern Provincial Programming Contest
VNU University of Engineering and Technology*

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A. Signal Waveform

Standard I/O | Time Limit: 1.0s | Memory Limit: 512MB

During an interstellar mission to decode alien broadcasts, Dr. Aurel intercepted an energy signal represented as an array of K positive integers $V = (V_1, V_2, \dots, V_K)$, where V_i denotes the frequency level at index i ($1 \leq i \leq K$). We define $\text{compress}(V)$ as the sequence obtained by collapsing consecutive identical elements into a single element. For example, if $V = (1, 1, 2, 2, 2, 4, 3, 3, 1, 1)$, then $\text{compress}(V) = (1, 2, 4, 3, 1)$.

An element in a sequence is a strict local maximum if its value is strictly greater than all adjacent neighbors. It is a strict local minimum if its value is strictly smaller than all adjacent neighbors. Boundary elements of a sequence of length ≥ 2 have only one neighbor. In a sequence of length 1, the single element is simultaneously both a local minimum and a local maximum. Given a primary signal record $A = (A_1, A_2, \dots, A_N)$ of N positive integers. A contiguous subsegment $S = (A_L, A_{L+1}, \dots, A_R)$ with $1 \leq L < R \leq N$ is called a snake waveform if and only if every position in $\text{compress}(S)$ is either a strict local minimum or a strict local maximum.

Determine the total number of pairs (L, R) with $1 \leq L < R \leq N$ such that the subsegment S is a snake waveform.

Input

The first line contains an integer N ($1 \leq N \leq 200,000$). The second line contains N space-separated positive integers $A_1, A_2, \dots, A_N$ ($1 \leq A_i \leq 10^9$).

Output

Print a single integer: the number of valid pairs (L, R) .

Standard Input	Standard Output
6 1 2 4 4 3 3	11

Explanation: Valid pairs (L, R) are $(1,2), (2,3), (2,4), (2,5), (2,6), (3,4), (3,5), (3,6), (4,5), (4,6), (5,6)$, totaling 11 pairs.

B. Ancient Grid Scanner

Standard I/O | Time Limit: 1.0s | Memory Limit: 512MB

To unlock the core chamber of an alien ruin, the expedition must decode an ancient stone slab modeled as a 2D matrix of N rows and M columns of positive integers. Rows are numbered 1 to N (top to bottom) and columns 1 to M (left to right). A mapat is an axis-aligned square specified by its bottom-right corner cell (i, j) —termed the focal cell—and an integer side length L ($1 \leq L \leq \min(i, j)$). It covers all cells (x, y) where $i - L + 1 \leq x \leq i$ and $j - L + 1 \leq y \leq j$.

The energy value of a mapat is calculated as $S \times \text{cell}(i, j)$, where S is the sum of all elements in the $L \times L$ square. For a fixed row i and fixed side length L ($i \geq L$), let A_j be the energy value of the mapat with focal cell (i, j) for $j \geq L$. A contiguous sequence of mapats along row i is defined by boundaries $[st, dr]$ with $L \leq st \leq dr \leq M$, and its aggregate sum is $A_{st} + A_{st+1} + \dots + A_{dr}$.

You must process q queries of Type 1 and p queries of Type 2:

- Type 1 (L, i, maxVal): Find the maximum length $(dr - st + 1)$ of a contiguous sequence of mapats of length L on row i with aggregate sum $\leq \text{maxVal}$.
- Type 2 ($L, i, \text{minVal}, \text{maxVal}$): Count the number of pairs (st, dr) with $L \leq st \leq dr \leq M$ such that the aggregate sum lies in $[\text{minVal}, \text{maxVal}]$.

Input

The first line contains four integers: N, M, q, p ($1 \leq N, M \leq 1,000$; $1 \leq p + q \leq 8,000$).

The next N lines each contain M integers, describing the matrix (elements ≤ 400).

The next q lines each contain 3 integers: L, i, maxVal (Type 1 queries, $0 < \text{maxVal} < 10^{15}$).

The next p lines each contain 4 integers: $L, i, \text{minVal}, \text{maxVal}$ (Type 2 queries, $0 \leq \text{minVal} < \text{maxVal} < 10^{15}$).

Output

First print q lines: the answer to each Type 1 query in given order. Then print p lines: the answer to each Type 2 query in given order.

Standard Input	Standard Output
4 4 2 0	1
1 3 5 2	3
4 3 1 2	
7 8 1 1	
2 2 3 1	
2 4 20	
1 4 16	

C: Energy Converter

Standard I/O | Time Limit: 1.0s | Memory Limit: 512MB

The spaceship propulsion system consists of N energy cells represented by non-negative integers. To activate warp drive, all cells must be equalized to the exact same value using the minimum total operations.

You can select any cell x and apply one of two operations:

- 1. Overcharge: Replace x with $2 \times x + 1$.
- 2. Discharge: Replace x with $\lfloor x / 2 \rfloor$ (integer division).

Determine the minimum total number of operations across all cells to make every value in the array identical.

Input

The first line contains an integer N ($2 \leq N \leq 50,000$). The second line contains N non-negative integers (each $\leq 2 \times 10^5$).

Output

Print a single integer: the minimum total operations required.

Standard Input	Standard Output
4 6 7 12 15	6

D: Regolith Excavation

Standard I/O | Time Limit: 1.0s | Memory Limit: 512MB

Problem Description

A cosmic storm deposited dangerous regolith along an access trench of length n . The trench consists of n tiles numbered 1 to n from left to right, where tile i holds z_i grams of regolith ($1 \leq i \leq n$). Outside the trench are disposal terminals 0 (left) and $n + 1$ (right).

Dr. Aurel has 40 gravitational shovels numbered 0 to 39. Shovel k ($0 \leq k \leq 39$) can transport at most 2^k grams of regolith between adjacent tiles (from i to $i - 1$, or i to $i + 1$) at a cost of $k + 1$ calories.

To coordinate the cleanup, a partition threshold x ($1 \leq x < n$) is chosen:

All regolith at tiles $\leq x$ is moved leftward to terminal 0.

All regolith at tiles $> x$ is moved rightward to terminal $n + 1$.

Solve one of the two sub-problems determined by C :

- If $C = 1$: Given x , calculate the minimum total calories required.
- If $C = 2$: Find the value of x ($1 \leq x < n$) that minimizes the total calories spent. If multiple values achieve the minimum, find the smallest such x .

Input

Line 1: An integer $C \in \{1, 2\}$.

Line 2: An integer n ($2 \leq n \leq 10^5$).

Line 3: n space-separated integers $z_1, z_2, \dots, z_n$ ($1 \leq z_i \leq 10^6$).

Line 4 (present only if $C = 1$): An integer x ($1 \leq x < n$).

Output

Print a single integer: the answer for task C .

Standard Input	Standard Output
1 4 1 3 1 3 2	10

E: Beacon Deployment

Standard I/O | Time Limit: 1.0s | Memory Limit: 512MB

A planetary defense dome is modeled as a square grid with rows and columns numbered 0 to 2^N . Cells on the perimeter (row 0, row 2^N , column 0, column 2^N) are permanently fortified with automated sentinels. The interior contains $(2^N - 1) \times (2^N - 1)$ available sites for beacon placement at (r, c) with $1 \leq r, c \leq 2^N - 1$.

Distance between two sites $(L1, C1)$ and $(L2, C2)$ is measured using the Chebyshev metric: $\max(|L1 - L2|, |C1 - C2|)$. Beacons are deployed sequentially one by one according to the following protocol:

1. For every unoccupied interior site, compute the minimum distance to any already occupied site (either perimeter sentinels or existing beacons).
 2. Deploy the new beacon at an unoccupied site whose minimum distance is maximized.
 3. Tie-breaking rule: Choose the site with the smallest row index r ; if still tied, choose the smallest column index c .
- Given Q independent queries, determine the exact location (r, c) chosen by beacon K in a dome of size parameter N .

Input

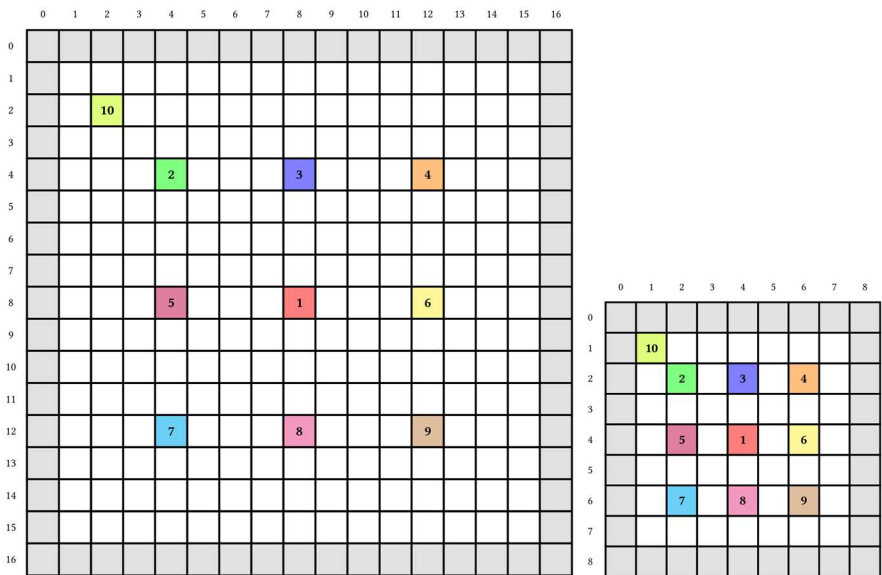
The first line contains an integer Q ($2 \leq Q \leq 10^5$).

Each of the next Q lines contains two space-separated integers N and K ($2 \leq N \leq 30$, $1 \leq K \leq \min(10^9, (2^N - 1)^2)$).

Output

Print Q lines. The i -th line contains two space-separated integers (row, column) answering query i .

Standard Input	Standard Output
5	4 4
3 1	2 2
3 2	4 2
3 5	6 6
3 9	2 2
4 10	



F. Connected Sensor Array

Standard I/O | Time Limit: 2.0s | Memory Limit: 256MB

A vital defense grid in Sector 2026 relies on a linear sensor array consisting of n monitoring nodes positioned sequentially from 1 to n . The calibration levels of these nodes form a permutation $p_1, p_2, \dots, p_n$ of integers from 1 to n .

To analyze local signal stability, mission control examines every non-empty contiguous subarray $p_l, p_{l+1}, \dots, p_r$ (where $1 \leq l \leq r \leq n$). For each such subarray, an undirected communication graph is constructed as follows:

- The vertices of the graph are the node indices $\{l, l+1, \dots, r\}$.
- For any two indices i and j within the window with $l \leq i < j \leq r$, an undirected link (i, j) is established if and only if $p_i > p_j$.

In other words, two sensor nodes are directly connected if and only if their calibration levels form an inversion. A subarray is deemed coherent if and only if its induced graph is connected. (Note that any singleton window containing exactly one vertex is always considered connected).

Determine the total number of non-empty contiguous subarrays whose induced inversion graph is connected.

Input

The first line contains a single integer n ($1 \leq n \leq 200,000$). The second line contains n space-separated integers $p_1, p_2, \dots, p_n$, forming a permutation of $1, 2, \dots, n$.

Output

Print a single integer: the number of contiguous subarrays that form a connected graph.

Constraints

$1 \leq n \leq 200,000$, p is a permutation of integers from 1 to n .

Standard Input	Standard Output
3 3 1 2	5
4 1 2 3 4	4
4 4 3 2 1	10

Explanation 1: Subarray $[3, 1]$ is connected because $3 > 1$ forms an edge. Subarray $[1, 2]$ has no inversions, so it is disconnected. The three singletons $[3]$, $[1]$, $[2]$ are each trivially connected, and the full array $[3, 1, 2]$ is connected (edges $(1,2)$ and $(1,3)$), yielding 5 connected subarrays in total.

Explanation 2: There are no inversions anywhere in the permutation. Thus, any subarray of length ≥ 2 has zero edges and is disconnected. Only the 4 singleton subarrays are connected.

Explanation 3: Every pair of elements forms an inversion, making the graph for every subarray a complete clique. Thus, all 10 non-empty contiguous subarrays are connected.

G. Sealed Orbital Conduit

Standard I/O | Time Limit: 4.0s | Memory Limit: 256MB

Deep inside the power core of Sector 2026, an orbital ring conduit consists of M docking berths arranged along a one-way circular rail, indexed clockwise from 0 to $M - 1$. Berth x is directly followed clockwise by berth $(x + 1) \bmod M$.

There are r modular fuel canisters with distinct identification labels 1, 2, ..., r . Initially, canister i is docked at berth a_i , and its designated final docking berth is b_i .

A mechanical stroke chooses exactly one canister and advances it clockwise by one berth. A stroke is legal if and only if the destination berth is currently vacant. Canisters can never move counter-clockwise.

A complete operational log is a sequence of exactly K legal strokes after which every canister occupies its target destination berth b_i . Two complete logs are distinct if and only if their sequences of chosen canister labels differ.

Let the sequence of chosen labels be $w = (w_1, w_2, \dots, w_K)$. The console strain of the log is defined as:

$\text{strain}(w) = \text{sum of } h \text{ over all } 1 \leq h < K \text{ for which } w_h > w_{h+1}$.

That is, after stroke h , the console accumulates h units of strain whenever the subsequent stroke activates a canister with a strictly smaller label. (For $r = 1$, the strain is always 0).

The energy weight of a complete log is defined as $9^{\text{strain}(w)}$.

The initial and target configurations share the same circular cyclic cut: listing the occupied berths in strictly decreasing numerical order gives canister labels 1, 2, ..., r . That is: $M > a_1 > a_2 > \dots > a_r \geq 0$ and $M > b_1 > b_2 > \dots > b_r \geq 0$.

Compute the sum of weights of all valid complete logs modulo 998244353. If $K = 0$, the only candidate is the empty log, which contributes weight 1 if and only if the initial and final configurations are already identical (and 0 otherwise).

Input

The first line contains three integers: M , r , and K ($2 \leq M \leq 10^9$, $1 \leq r \leq 5$, $r < M$, $0 \leq K \leq 200,000$). The second line contains r strictly decreasing integers: $a_1, a_2, \dots, a_r$. The third line contains r strictly decreasing integers: $b_1, b_2, \dots, b_r$.

Output

Print a single integer: the weighted sum of all complete logs modulo 998244353. If no complete log exists, print 0.

Standard Input	Standard Output
3 2 6 1 0 1 0	531441
5 2 12 3 0 4 1	214993899
8 3 3 3 2 1 4 3 2	1

Explanation 1: There is only one empty berth, so the unique complete log is [1, 2, 1, 2, 1, 2]. Descents occur after strokes 2 and 4, so $\text{strain} = 2 + 4 = 6$. $\text{Weight} = 9^6 = 531441$.

H. Laser Sightline Obstruction

Standard I/O | Time Limit: 3.0s | Memory Limit: 256MB

In the central observatory of Sector 2026, two reconnaissance autonomous drones, Unit-M and Unit-L, are conducting optical calibration tests. Across the observation floor (modeled as a 2D Cartesian plane), there are N infrared emitter nodes and M optic receiver beacons scattered at distinct coordinates.

Unit-M must dock at one of the N infrared emitter nodes, while Unit-L must dock at one of the M optic receiver beacons. To establish a secure quantum optical link, the direct line of sight (the straight line segment connecting Unit-M and Unit-L) must remain completely unobstructed.

However, a massive cylindrical radiation shielding column stands in the chamber. The column's cross-section is represented as a circular disk centered at coordinates (x_c, y_c) with radius r . All emitter nodes and receiver beacons lie strictly outside this cylindrical disk.

The drones are micro-scale, so their positions can be modeled as points coinciding with their respective docked nodes. Two docked drones can establish a valid optical link if and only if the line segment connecting them does not intersect or touch the circular shielding column. Other nodes and beacons do not obstruct the laser sightline.

Determine the total number of distinct pairs (one emitter node for Unit-M and one receiver beacon for Unit-L) that permit an unobstructed optical line of sight.

Input

The first line contains two integers N and M ($1 \leq N, M \leq 10^5$), denoting the number of emitter nodes and receiver beacons, respectively.

The second line contains three integers x_c, y_c , and r ($|x_c|, |y_c| \leq 10^4$; $1 \leq r \leq 10^4$), describing the center coordinates and radius of the shielding column.

Each of the next N lines contains two integers x_i and y_i ($|x_i|, |y_i| \leq 10^4$), denoting the coordinates of an infrared emitter node.

Each of the next M lines contains two integers x_i and y_i ($|x_i|, |y_i| \leq 10^4$), denoting the coordinates of an optic receiver beacon.

All $N + M$ node locations are pairwise distinct. All nodes lie strictly outside the column disk and are at distance at least 10^{-6} from its boundary. It is guaranteed that perturbing any two nodes by a Euclidean distance of at most 10^{-6} in any direction will not alter whether the connecting segment intersects or touches the column.

Output

Print a single integer: the number of valid pairs of emitter and receiver nodes that have an unobstructed optical line of sight.

Standard Input	Standard Output
3 3 0 0 2 -4 3 4 3 0 -4 -4 -3 4 -3 0 4	6
1 2 2 -1 3 5 0 5 2 -2 -1	1
1 1	0

001 -20 20	
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I. Quantum Core Sorting Anomaly

Standard I/O | Time Limit: 2.0s | Memory Limit: 512MB

In the maintenance division of Sector 2026, researchers have uncovered an ancient automated data processor. To stabilize energy crystals, the processor sorts an array $a[1..N]$ using a peculiarly unorthodox routine:

```
for i = 1, 2, ..., N:
  for j = 1, 2, ..., N:
    if a[i] < a[j]:
      swap a[i] and a[j]
```

Here, $\text{swap}(a[i], a[j])$ denotes exchanging the values stored at indices i and j . Despite its strange construction, the routine is mathematically guaranteed to sort any array into non-decreasing order.

The operational inefficiency of the machine on a given permutation is measured by the total number of swaps executed during the sorting procedure. Assuming an initial permutation p of $\{1, 2, \dots, N\}$ is chosen uniformly at random, compute the expected value of the machine's inefficiency.

It can be shown that the expected inefficiency is a rational number A / B . Compute $A \times B^{-1} \bmod 998244353$, where B^{-1} is the modular inverse of B modulo 998244353 .

Input

The first line contains a single integer T ($1 \leq T \leq 10^5$) — the number of test cases. Each of the next T lines contains a single integer N ($1 \leq N \leq 10^5$).

Output

For each test case, print a single integer — the expected inefficiency modulo 998244353 .

Standard Input	Standard Output
2	166374062
3	504875816
46192	

Explanation for Sample 1 ($N = 3$): There are 6 equally likely permutations of $[1, 2, 3]$:

- $p = [1, 2, 3]$ requires 4 swaps.
- $p = [1, 3, 2]$ requires 3 swaps.
- $p = [2, 1, 3]$ requires 3 swaps.
- $p = [2, 3, 1]$ requires 4 swaps.
- $p = [3, 1, 2]$ requires 2 swaps.
- $p = [3, 2, 1]$ requires 3 swaps.

The expected number of swaps is $(4 + 3 + 3 + 4 + 2 + 3) / 6 = 19 / 6 \equiv 19 \times 6^{-1} \equiv 166374062 \pmod{998244353}$.

J. The Archive Matrix

Standard I/O | Time Limit: 1.0s | Memory Limit: 256MB |

Deep beneath Sector 2026, expedition lead Niko reaches the entrance to the Central Core Tower to restore the planetary stellar matrix. The main security blast doors are locked by a quantum keypad left behind by the ancient artificial entity known as The World Machine.

Beside the keypad lies access to an infinite data archive consisting of countably infinite storage racks labeled 1, 2, 3, ... and infinitely many data codices titled 1, 2, 3, Every codex i contains a single positive integer a_i .

The archive maintains strict self-referential equilibrium rules:

- 1. Codex i is filed on storage rack a_i .
- 2. The total number of codices placed on storage rack i is exactly a_i .
- 3. Codex 1 contains the value 1 (i.e., $a_1 = 1$).
- 4. The values are non-decreasing: if $i < j$, then $a_i \leq a_j$ (this uniquely defines the sequence a_i , known as Golomb's sequence).

The security console prompt reads: 'The unlock passcode is the sum of the numbers written inside all codices titled from 1 to 10^{18} , taken modulo 12345678987654321. Help Niko calculate the door code.

Input

The input consists of a single line containing two space-separated integers: 10^{18} and 12345678987654321.

Output

Print a single integer — the unlock passcode modulo 12345678987654321.

Standard Input	Standard Output
1000000000000000000 12345678987654321	?

K. Planetary Subspace Relay Antennas

Standard I/O | Time Limit: 2.5s | Memory Limit: 1024MB | Special Judge

To establish a comprehensive communications blanket across Sector 2026, the expedition must coordinate transmissions among n ground telemetry stations positioned on the planet's surface (modeled as a 2D Cartesian plane). The i -th telemetry station is situated at coordinates (x_i, y_i) and has an operational transmission importance (weight) denoted by w_i .

To link all stations, you are authorized to construct and position m subspace relay antennas at arbitrary locations on the 2D plane (the antenna positions need not be distinct).

For an antenna deployment configuration with coordinates $(X_1, Y_1), (X_2, Y_2), \dots, (X_m, Y_m)$, the total communication latency cost of this configuration is defined as the sum over all telemetry stations of their importance-weighted Euclidean distance to their closest antenna:

$$\text{Cost} = \sum_{i=1}^n w_i \min_{1 \leq j \leq m} \sqrt{(x_i - X_j)^2 + (y_i - Y_j)^2}$$

Determine the coordinates of the m relay antennas that minimize the total latency cost.

Input

The first line contains two positive integers n and m ($1 \leq m \leq n \leq 2,000$), denoting the number of telemetry stations and the number of relay antennas to place, respectively. Each of the next n lines contains three floating-point numbers x_i , y_i , and w_i ($|x_i|, |y_i| \leq 10^5$; $1 \leq w_i \leq 10^9$), representing the x-coordinate, y-coordinate, and importance weight of the i -th telemetry station, respectively.

Output

Print m lines. The j -th line should contain two floating-point numbers X_j and Y_j , representing the coordinates of the j -th relay antenna. All coordinates must have an absolute value of **at most 10^6** .

Evaluation and Scoring (Special Judge)

Let A be the total cost achieved by your submitted solution.

Let B be the total cost achieved by the Jury's reference solution.

Your solution will be judged as Accepted if $A \leq B$, or if the absolute or relative difference between A and B does not exceed 10^{-2} , that is: $\frac{|A-B|}{\max(1,B)} \leq 10^{-2}$.

Standard Input	Standard Output
2 1 0.0 0.0 1.0 2.0 2.0 1.0	1.0 1.0

L. Quantum Telemetry Alignment

Standard I/O | Time Limit: 1.0s | Memory Limit: 512MB

Deep within Sector 2026, reconnaissance operatives Alice and Bob must synchronize navigation tokens across an intermittent quantum bridge using a generalized telemetry deck. Each data token is uniquely identified by a frequency sector s ($1 \leq s \leq S$) and resonance rank r ($1 \leq r \leq R$), represented as a string $s:r$.

Your program will be executed twice within each test case to simulate the roles of both Alice and Bob via standard input (stdin) and standard output (stdout):

- Run 1 (Alice): Alice receives N distinct data tokens. She conceals exactly one chosen token in the quantum buffer and arranges the remaining $N - 1$ tokens into a specific permutation sequence to broadcast.
- Run 2 (Bob): Bob receives the ordered sequence of $N - 1$ tokens broadcast by Alice from Run 1. By analyzing the permutation arrangement, Bob must deduce and output the exact concealed token.

Input

For Run 1 (Alice):

- Line 1 contains the string "first".
- Line 2 contains three space-separated integers: N , S , and R .
- Line 3 contains N space-separated strings, representing the initial N distinct tokens given to Alice.

For Run 2 (Bob):

- Line 1 contains the string "second".
- Line 2 contains three space-separated integers: N , S , and R .
- Line 3 contains $N - 1$ space-separated strings, representing the sequence output by Alice in Run 1.

Output

For Run 1 (Alice):

- Line 1: Print the concealed token in format $s:r$.
- Line 2: Print the remaining $N - 1$ tokens in your chosen arrangement order, separated by a single space.

For Run 2 (Bob):

- Print exactly one line containing the predicted concealed token in format $s:r$.

Constraints

$4 \leq N \leq 13$, $1 \leq S \leq N - 1$, $1 \leq R \leq 2 \times (N - 2)! + 1$, $1 \leq s \leq S$ and $1 \leq r \leq R$ for all tokens. All initial N tokens are pairwise distinct.

Standard Input	Standard Output
Run 1 (Alice): first 5 4 13 1:13 2:4 3:5 1:5 2:6	Run 1 Output: 2:6 1:13 2:4 3:5 1:5
Run 2 (Bob): second 5 4 13 1:13 2:4 3:5 1:5	Run 2 Output: 2:6

M. Cosmic Noise Channel Recovery

Standard I/O | Time Limit: 1.0s | Memory Limit: 512MB

During an emergency planetary ascent in Sector 2026, outpost operative Alice must transmit an n -bit binary command string to Bob's command module through an unstable cosmic radiation channel. The channel suffers from particle interference and may flip at most 2 bits (changing '0' to '1' or '1' to '0').

To safeguard mission instructions, Alice encodes the original n -bit string S into a codeword T of length m ($n \leq 1000, m \leq 1024$) before broadcasting. The channel introduces k bit flips ($k \in \{0, 1, 2\}$), delivering corrupted codeword T' to Bob.

Upon intercepting T' , Bob must accomplish the following objectives:

1. Correctly identify the exact number of flipped bits $k \in \{0, 1, 2\}$.
2. If $k = 0$ or $k = 1$, reconstruct the exact original binary message S of length n .

Your program will be executed twice within each testcase to simulate the Encoder (Alice) and Decoder (Bob) via stdin and stdout.

Input

Run 1: Alice's Role (Encoder)

- Line 1 contains the string "first".
- Line 2 contains an integer n — the length of the original binary string.
- Line 3 contains the binary string S of length n ($S_i \in \{0, 1\}$).

Run 2: Bob's Role (Decoder)

- Line 1 contains the string "second".
- Line 2 contains an integer n .
- Line 3 contains the binary string T' of length m received after k bit flips ($0 \leq k \leq 2$).

Output

Run 1 (Alice):

- Print exactly one line containing the encoded binary codeword T of length m ($m \leq 1024$).

Run 2 (Bob):

- Line 1: Print an integer $k \in \{0, 1, 2\}$ representing the detected number of bit flips.
- Line 2 (Only if $k = 0$ or $k = 1$): Print the reconstructed original binary string S of length n .

Constraints

$1 \leq n \leq 1000, 1 \leq m \leq 1024$ (Alice's codeword length m must not exceed 1024), The channel flips $k \in \{0, 1, 2\}$ random bits in T . All characters in all binary strings are strictly '0' or '1'.

Sample Interaction

Standard Input	Standard Output
Run 1 (Alice - Encoder): first 4 1011	Run 1 Output: 10110101 (Alice encodes 4 bits into 8 bits)
Run 2 (Bob - 1 flip): second 4 10110111	Run 2 Output: 1 1011
Run 2 (Bob - 2 flips):	Run 2 Output:

second 4 10110011	2
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Explanation: Full points for a testcase are awarded if and only if Bob correctly identifies k , and when $k \leq 1$ correctly recovers S .

N. Subspace Manifold Equilibrium

Standard I/O | Time Limit: 1.0s | Memory Limit: 512MB

To activate the hyperspace transit gate into the depths of Sector 2026, the station's core terminal must balance three interlocking tachyon containment chambers, labeled Alpha, Beta, and Gamma.

Each chamber sustains a continuous internal flux. Let a , b , and c denote the calibrated drift metrics recorded from chambers Alpha, Beta, and Gamma, respectively.

According to the Ancient Field Theory discovered in Sector 2026, the state space of the gate is governed by a potential function $\Phi(x)$ across a one-dimensional tachyon manifold, defined by:

$$\Phi(x) = (x - a)^2 + (x - b)^2 + (x - c)^2 - (x - a)(x - b) - (x - b)(x - c) - (x - c)(x - a)$$

When the containment apparatus reaches resonance, the system projects an equilibrium field polynomial $P(t)$ described by the convolution:

$$P(t) = (t + a)(t + b)(t + c)$$

To open the gate aperture, the control system requires the fundamental invariant Ω of the manifold. Ancient operational records define this invariant as the coefficient of the quadratic term t^2 in the expansion of $P(t)$.

Given the three readings a , b , and c , compute the exact value of the manifold invariant Ω required to initialize the transit sequence.

Input

The input consists of a single line containing three space-separated integers a , b , and c ($-10^{100} \leq a, b, c \leq 10^{100}$), denoting the recorded drift metrics of chambers Alpha, Beta, and Gamma.

Output

Print a single integer: the value of the manifold invariant Ω .

Constraints

$$-10^{100} \leq a, b, c \leq 10^{100}$$

Standard Input	Standard Output
1 1 1	3