Problem A. Basketball

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Herman the Jedi Padawan is learning the ways of the force by playing basketball. However, in this galaxy, baskets are not always worth two or three points. For this particular game, some baskets are worth p points and other baskets are worth q points.

Herman is on the Golden Galactic Warriors and is playing against the Utapau Droids. The Golden Galactic Warriors currently have m points and the Utapau Droids have n points.

In the final minutes, the Utapau Droids score another b baskets. Help Herman be clutch by determining the fewest number of baskets his team can make (if any) and possibly still win (not tie) the game?

Input

The only line of input contains five integers, p, q, m, n, and b ($1 \leq p, q, m, n, b \leq 10^3$) - the two possible point values of one basket, the number of points for the Golden Galactic Warriors, the number of points for the Utapau Droids, and the number of additional baskets the Utapau Droids score, respectively. It is guaranteed that $p \neq q$.

Output

Print a single integer representing the fewest number of baskets Herman's team can score and possibly still win the game.

Examples

standard input	standard output
`2 3 46 49 1`	`2`
`1 2 1 2 1`	`2`

Note

In the first sample, it is possible that the Utapau Droids score a 2-point basket, obtaining a final score of $49 + 2 = 51$ points. Then the Golden Galactic Warriors can beat the Utapau Droids by scoring two 3-point baskets for a final score of $46 + 2(3) = 52$ points.

In the second sample, it is possible that the Utapau Droids score a 1-point basket, obtaining a final score of $2 + 1 = 3$ points. Then Herman's team can beat the opponent by scoring a 2-point basket and a 1-point basket for a final score of $1 + 2 + 1 = 4$ points. Note that Herman's team cannot just score a 2-point basket because that would only tie the opponent.

Problem B. Smallest Substring

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Herman the Jedi Padawan has received an important message from his master Lingxiao Kenobi. But to prevent the First Order from deciphering his message, Lingxiao sent the message as an array of zeros and ones. Luckily, Herman knows how to decode the message - he must find the length of the shortest contiguous subarray containing exactly k ones.

Input

The first line of input contains a single integer n ($1 \le n \le 10^5$) representing the number of elements in the array.

The second line of input contains a single integer k ($1 \le k \le n$) representing the number of ones that need to be in the subarray.

The third line of input contains n space separated integers. The ith integer, representing the ith element of the array, will be either 0 or 1. It is guaranteed that the whole array contains at least k ones.

Output

Output a single integer - the length of the shortest contiguous subarray containing exactly k ones.

Examples

standard input	standard output
7 2 1 0 0 1 1 0 1	2
4 3 1 1 0 1	4

Note

In the first sample, the best subarray to take is the fourth and fifth elements for a length of 2.

In the second sample, the only way to get 3 ones is to take the whole array.

Problem C. Cookies

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

After finishing a mission at Tatoonie, Herman the Jedi Padawan decides to take a break by eating cookies.

In Tatoonie, there are two cookie shops, Unkar Plutt's Junkyard and Jabba's Cookie Hut. Unkar Plutt's Junkyard is selling m cookies for x dollars a cookie. The ith cookie in this shop gives Herman a_i units of happiness if he buys it. Similarly, Jabba's Cookie Hut is selling n cookies for y dollars a cookie. The ith cookie in this shop gives Herman b_i units of happiness if he buys it.

Unfortunately, Herman is still a poor Padawan, so he has a budget of c dollars for buying cookies in any of the two shops. What is the greatest amount of happiness he can obtain from buying cookies?

Input

The first line of input contains two integers m and x ($1 \le m \le 10^5$ and $1 \le x \le 10^9$) - the number of cookies sold at Unkar Plutt's Junkyard and the price of each cookie in Unkar Plutt's Junkyard.

The second line of input contains m integers. The ith integer, a_i with $1 \le a_i \le 10^9$, in this line represents the amount of happiness obtained if Herman buys the ith cookie in Unkar Plutt's Junkyard.

The third line of input contains two integers n and y ($1 \le n \le 10^5$ and $1 \le y \le 10^9$) - the number of cookies sold at Jabba's Cookie Hut and the price of each cookie in Jabba's Cookie Hut.

The fourth line of input contains n integers. The ith integer, b_i with $1 \le b_i \le 10^9$, in this line represents the amount of happiness obtained if Herman buys the ith cookie in Jabba's Cookie Hut.

The fifth line of input contains a single integer c ($1 \le c \le 10^9$) - the total number of dollars Herman can spend on the cookies.

Output

Print a single integer representing the greatest amount of happiness that Herman can obtain from buying cookies.

Examples

standard input	standard output
5 3 9 7 3 4 6 4 4 1 9 10 8 20	45
3 1 5 12 13 2 3 15 15 3	30

Note

In the first sample, Herman can buy the four cookies with happiness values of 4, 6, 7, and 9 from Unkar Plutt's Junkyard for a cost of $4 \cdot 3 = 12$ dollars. Then Herman can also buy the two cookies with happiness values of 9 and 10 from cookie shop B for a cost of $2 \cdot 4 = 8$ dollars. Thus, his total cost is $12 + 8 = 20$ dollars (which is not over our budget) and he achieves a happiness value of $4 + 6 + 7 + 9 + 9 + 10 = 45$.

In the second sample, Herman can buy all three cookies from Unkar Plutt's Junkyard.

Problem D. GCD

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

At Maz's Castle, Maz gives Herman the Jedi Padawan an interesting problem to test his knowledge of the force. She gives him two numbers a and b and Herman must find a non-negative integer i with $i < \min(a, b)$ so that the greatest common divisor between $a - i$ and $b - i$ is maximized. Don't let this be an answer for another time by helping Herman!

Input

The only line of input contains the two integers a and b $(1 \leq a, b \leq 10^9)$.

Output

Output the maximized greatest common divisor that can result from the procedure described.

Examples

standard input	standard output
3 7	2
19 10	9

Note

In the first sample, Herman should subtract 1 from both of the numbers to get $\gcd(2, 6) = 2$.

In the second sample, Herman should again subtract 1 from both of the numbers to get $\gcd(18, 9) = 9$.

Problem E. Minimizing with SQRT

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

Herman the Jedi Padawan has a sequence of n integers, namely a_1, a_2, ..., a_n. However, Herman thinks these numbers are too large - he wants to apply some operations to make them smaller. However, he can only apply the SQRT operation to a number: pick some index i with $1 \leq i \leq n$ and change a_i to $\lfloor \sqrt{a_i} \rfloor$. For example, for any of the numbers between 16 and 24 inclusive, he can change the number to 4 with one operation.

Herman is not yet a master of the force, so he can only perform at most m operations one by one. Note that he can apply more than one operation to a single number. For example, if $a_4 = 17$, Herman can apply SQRT to a_4 twice and get 2.

Herman's goal is to minimize the sum of all numbers in the sequence after m operations.

Input

The first line of input consists of two integers n and m ($1 \leq n, m \leq 10^5$). The second line consists of n integers a[i] ($1 \leq a_i \leq 10^9$), indicating the original sequence.

Output

The output contains only a single number, the minimal possible sum of all numbers after m operations. Note that the answer may not fit in a 32-bit integer.

Examples

standard input	standard output
`3 2` `16 9 4`	`11`
`2 2` `80 1`	`3`

Note

In the first sample, Herman should apply the operation to 16 once and to 9 once. His final sequence will be 4, 3, and 4, giving a sum of 11.

In the second sample, Herman should apply both operations to 80, producing a final sequence of 2, 1. The minimum sum is 3.

Problem F. Racing

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Herman the Jedi Padawan has been given an important task! The New Republic Starfleet is about to attack another Death Star and he is in charge of designing the flight sequence of the X-wings fighters.

However, he first must resolve a logistical issue. There are n X-wings that will fly on the long straight path to the Death Star. The ith X-wing starts at position x_i and moves towards the Death Star with speed v_i (in units per second). They all start flying at the same time. Herman must determine the last time an X-wing passes another X-wing (if such a time exists). For the purposes of this problem, Herman is assuming that the length of the road to the Death Star is infinite.

Input

The first line contains a single integer n $(2 \leq n \leq 2 \cdot 10^5)$ - the number of X-wing fighters.

The next n lines contain 2 space-separated integers x_i $(-10^8 \leq x_i \leq 10^8)$ and v_i $(0 \leq v_i \leq 10^8)$ - The starting position and velocity of the ith X-wing, respectively.

It is guaranteed that all x_i and v_i are distinct. That is, no two X-wings have the same starting point, and no two X-wings have the same velocity either.

Output

Print a single real number - the last time an X-wing passes another X-wing, or -1 if no such time exists. Your answer will be considered if its absolute or relative error does not exceed 10^{-6}.

Namely: let's assume that your answer is a and the answer of the jury is b. The checker will consider your answer correct if $\frac{|a-b|}{\max(1,b)} \leq 10^{-6}$.

Examples

standard input	standard output
3 1 1 -3 3 0 2	3
2 2 3 1 2	-1

Note

In the first sample, there are three X-wings with starting positions at 1, -3, and 0 and velocities of 1, 3, and 2 respectively. After 1 second, their positions change to 2, 0, and 2 respectively, so the third X-wing passes the first X-wing. After 2 seconds, their positions are 3, 3, and 4 respectively, so the second X-wing passes the first X-wing. Finally, after 3 seconds, their positions are 4, 6, and 6 respectively, so the second X-wing passes the third X-wing. After $t = 3$, no more passing takes place.

In the second sample, two X-wings will never pass each other.

Problem G. Minimizing with SQRT and CBRT

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Herman the Jedi Padawan again has a sequence of n integers, namely a_1, a_2,..., a_n. However, Herman thinks these numbers are too large - he wants to apply some operations to make them smaller. But Herman has now gone through rigorous training, so he can do two types of operations.

The first type is SQRT: pick some index i in $1 \le i \le n$ and change a_i to $\lfloor \sqrt{a_i} \rfloor$. For example, for any of the numbers between 16 and 24 inclusive, he can change the number to 4 with one SQRT operation.

The second type is CBRT: pick some index i in $1 \le i \le n$ and change a_i to $\lfloor \sqrt[3]{a_i} \rfloor$. For example, for any of the numbers between 8 and 26 inclusive, he can change the number to 2 with one CBRT operation.

Now, Herman want to do at most m_1 SQRT operations and m_2 CBRT operations one by one. Note that he can apply more than one operations (even both types) to a single number. For example, if $a_4 = 17$, Herman can apply SQRT to a_4 to get 4, and then apply CBRT to get 1.

Herman's goal is to minimize the sum of all numbers in the sequence after all $m_1 + m_2$ operations.

Input

The first line of input consists of three integers n, m_1, and m_2 ($1 \le n, m_1, m_2 \le 100$). The second line consists of n integers a_i ($1 \le a_i \le 10^9$), indicating the original sequence.

Output

The output contains only a single number, the minimal possible sum of all numbers after $m_1 + m_2$ operations. Note that the answer may not fit in a 32-bit integer.

Examples

standard input	standard output
6 2 1 50 28 72 39 1 12	58
2 1 1 9 8	4

Note

In the first sample, Herman should apply the CBRT operation to 72, changing the number to 4. Then he should apply the SQRT operation to both 50 and 39, leaving the numbers 7 and 6 respectively. Thus, his final sequence is 7, 28, 4, 6, 1, 12, so the sum is 58.

In the second sample, Herman should apply the CBRT operation to 9 and the SQRT operation to 8, producing a final sequence of 2, 2. The sum is then 4.

Problem H. Triangle

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	256 megabytes

Herman the Jedi Padawan is attempting to infiltrate the Death Star base! He sends BB-8 on a mission to retrieve crucial information. The Death Star database center can be represented as a triangle ABC. Herman drops off BB-8 at a point P located on side AB, and he must visit the other two sides of the triangle (BC and AC) to obtain information and then return to point P. Visiting a vertex counts as visiting both sides that share the vertex. However, the First Order has sensed BB-8's presence in the database center, so BB-8 must hurry! What is the minimum distance that BB-8 needs to travel?

Input

The only line of input contains 8 integers, a_x, a_y, b_x, b_y, c_x, c_y, p_x, and p_y ($-10^5 \le a_x, a_y, b_x, b_y, c_x, c_y, p_x, p_y \le 10^5$) - the coordinates of A, B, C, and P respectively. It is guaranteed all four of the points are pairwise distinct, the triangle is nondegenerate, and P lies on side AB.

Output

Print a single real number - the minimum distance BB-8 needs to travel. Your answer will be considered if its absolute or relative error does not exceed 10^{-6}.

Namely: let's assume that your answer is a and the answer of the jury is b. The checker will consider your answer correct if $\frac{|a-b|}{\max(1,b)} \le 10^{-6}$.

Examples

standard input	standard output
`0 0 0 2 2 0 0 1`	`3.1622776602`
`-10 0 10 0 0 1 0 0`	`2.0000000000`

Note

In the first sample, triangle ABC has coordinates $A(0,0)$, $B(0,2)$, $C(2,0)$, and BB-8 initially starts at $P(0,1)$. BB-8 should visit the other two sides (rather than a vertex) and in the end travels approximately 3.1622776602 units.

In the second sample, triangle ABC has coordinates $A(-10,0)$, $B(10,0)$, $C(0,1)$, and BB-8 initially starts at $P(0,0)$. The optimal path is for BB-8 to travel to C and return for a length of 2 units.

Problem I. Bits in a Grid

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	256 megabytes

Herman the Jedi Padawan is taking his final exam to become a Jedi Knight! In this exam, there are t problems.

In each problem there is an $n \times m$ grid. Herman must place 1's and 0's in the cells of the grid such that the sum of the values of the cells in row i is r_i for all $1 \leq i \leq n$ and the sum of the values of the cells in column j is c_j for all $1 \leq j \leq m$.

For each problem, it is guaranteed that the sum of all r_i is equal to the sum of all c_j. More formally, $r_1 + r_2 + \cdots + r_n = c_1 + c_2 + \cdots + c_m$.

Given all r_i and c_j, Herman must determine whether or not this is possible. Unfortunately, he is having some trouble, so he decides to phone a friend for help. Please help Herman become a Jedi Knight!

Input

The first line contains a single integer t ($1 \leq t \leq 10$), the number of problems.

The descriptions for the t problems follow. Each description consists of 3 lines:

The first line contains two space-separated integers n and m ($1 \leq n, m \leq 2 \cdot 10^5$), the number of rows and the number of columns of the grid, respectively.

The second line contains n space-separated integers $r_1, r_2, \cdots, r_n$, ($0 \leq r_i \leq m$), where r_i is the desired sum of the values in the cells in row i of the grid.

The third line contains m space-separated integers $c_1, c_2, \cdots, c_m$, ($0 \leq c_i \leq n$), where c_i is the desired sum of the values in the cells in column i of the grid.

Output

For each problem, if there exists a way to place 1's and 0's in the grid satisfying the conditions, then print "YES", otherwise print "NO" (without the quotes).

Example

standard input	standard output
2 2 2 1 2 2 1 2 3 1 3 0 2 2	YES NO

Note

In the first problem, we can place 1's in cells (1,1), (2,1), and (2,2), and a 0 in cell (1,2).

In the second problem, there is no possible way to place 1's and 0's in the cells of the grid to satisfy the constraints.

Problem J. Paths on a Full Binary Tree

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

Herman is officially a Jedi Knight! For his celebration ceremony, he was given a full binary tree with n nodes (guaranteed that n is one less than a power of 2). Node 1 is the root and for node i ($i > 1$), its parent is $\lfloor \frac{i}{2} \rfloor$. All edges are bidirectional and each edge $(i, \lfloor \frac{i}{2} \rfloor)$ has a cost of w_i.

Herman's friend Harrison proposed an interesting problem to Herman. How many paths are there in the tree with cost at most d?

Input

The first line of the input consists of two integers n ($1 \leq n \leq 2^{17} - 1$) and d, ($1 \leq d \leq 10^9$). It is guaranteed that n is one less than a power of 2. The second line of input contains $n - 1$ space separated integers. The $(i-1)$th integer with $2 \leq i \leq n$, w_i, ($1 \leq w_i \leq 1000$) indicates the edge cost of edge $(i, \lfloor \frac{i}{2} \rfloor)$.

Output

The output contains only one integer, the number of paths in the tree whose total cost (sum of all edge costs along the path) is no more than d.

Examples

standard input	standard output
`7 10` `1 2 1 2 1 2`	`21`
`3 4` `3 2`	`2`

Note

In the first sample, all paths in the tree are valid.

In the second sample, only the paths from node 1 to node 2 and node 1 to node 3 are valid. The total cost of the path from node 2 to node 3 is $3 + 2 = 5$, which is greater than 4.