BINUS University

Academic Career: *Undergraduate / ~~Master~~ / ~~Doctoral~~ *)*			Class Program: *~~International~~/Regular/~~Smart Program~~/~~Global Class~~*)*	
☑ **Mid Exam**	☐ **Final Exam**		**Term : Odd/~~Even~~/~~Short~~ *)**	
☐ **Short Term Exam**	☐ **Others Exam : _____**			
☑ **Kemanggisan**	☑ **Alam Sutera**	☑ **Bekasi**	**Academic Year :**	
☐ **Senayan**	☐ **Bandung**	☐ **Malang**	**2022 / 2023**	
Faculty / Dept. :	School of Computer Science		Deadline	Day / Date :
				Time :
Code - Course :	COMP6226001-Competitive Programming		Class :	All Classes
Lecturer :	Lie, Maximilianus Maria Kolbe, S.Kom., M.T.I.		Exam Type :	Onsite
*) *Strikethrough the unnecessary items*				
The penalty for CHEATING is DROP OUT!!!				

Learning Outcomes:

LO1: (C3) Application : apply algorithm techniques and methods
LO2: (C4) Analysis : calculate processing time and memory space of algorithms.
LO3: (C5) Synthesis : Create good and correct algorithm for problem solving.

This exam is closed book. However, you are **allowed to bring a reference document** (cheatsheet) into the exam. The document consists of at most 25 A4 pages.

Please use the given online judge to submit and verify the correctness of your answer. However, **do not forget to submit your answer to exam apps** website as well.

Verified by, *[Lecturer Name] (Lecturer ID) and sent to Program on MMM DD, YYYY*

[40 points] Jojo and GCD

Jojo has an array A of size N, indexed from 1 to N. It is guaranteed that all elements of A is between 1 and M (inclusive).

Jojo can change at most K elements from A into any number between 1 and M, such that the GCD of all elements in A is maximized.

Find the maximum GCD!

Subtask

No	Constraints	Points
1	$1 \leq K \leq N \leq 3$ $1 \leq M \leq 100$ $1 \leq A_i \leq M$, for $1 \leq i \leq N$	10
2	$1 \leq K \leq N \leq 1000$ $1 \leq M \leq 1000$ $1 \leq A_i \leq M$, for $1 \leq i \leq N$	15
3	$1 \leq K \leq N \leq 100\,000$ $1 \leq M \leq 10^6$ $1 \leq A_i \leq M$, for $1 \leq i \leq N$	15

Format Input

Input begins with three integers N M K. The next line contains N integers A_i.

Format Output

Output an integer in a single line representing the maximum GCD by changing at most K elements of A into any integer between 1 and M.

Sample Input	Sample Output
3 10 1 2 4 7	2
3 10 2 2 4 7	7
3 10 3 2 4 7	10

Explanation

In sample 1, Jojo can change A_3 to any even number to get the maximum GCD.

In sample 2, Jojo can change A_1 and A_2 to 7 to get the maximum GCD.

In sample 3, Jojo can change all numbers to 10 to get the maximum GCD.

[20 points] Lili and Subarray

Lili has an array A, which elements are permutation of 1 to N.

A subarray $\langle l, r \rangle$ of A, such that $l \leq r$, is $[A_l, A_{l+1}, \dots, A_r]$. By definition, a subarray is never empty.

A subarray $\langle l, r \rangle$ of A is called *strictly increasing* if $A_l < A_{l+1} < A_{l+2} < \cdots < A_r$.

Determine how many strictly increasing subarray of A.

Subtask

No	Constraints	Points
1	$1 \leq N \leq 100$ A is a permutation of $[1,2,\dots,N]$	5
2	$1 \leq N \leq 1000$ A is a permutation of $[1,2,\dots,N]$	5
3	$1 \leq N \leq 100\,000$ A is a permutation of $[1,2,\dots,N]$	10

Format Input

Input begins with an integer N. The next line contains N integers A_i, which is a permutation of 1 to N.

Format Output

Output an integer in a single line representing the number of strictly increasing subarray of A.

Sample Input	Sample Output
3 1 2 3	6
3 3 2 1	3
4 1 4 2 3	6

Explanation

In sample 1, there are 6 subarrays of A: $[1], [2], [3], [1,2], [2,3]$, and $[1,2,3]$. All of them are strictly increasing.

In sample 2, there are 3 strictly increasing subarrays: $[3], [2]$, and $[1]$.

In sample 3, there are 6 strictly increasing subarrays: $[1], [4], [2], [3], [1,4]$ and $[2,3]$.

[40 points] Bibi and Increment

Bibi has an array A of size N, indexed from 1 to N.

Bibi can perform the following operation **exactly** K times. In each operation, Bibi can choose an integer from A and increase its value by X. Bibi wants the minimum value of array A to be maximized.

Determine the maximum value of the smallest element in A after exactly K operations.

Subtask

No	Constraints	Points
1	$N = 2$ $1 \leq K \leq 10^9$ $1 \leq X \leq 10^9$ $1 \leq A_i \leq 10^9$, for $1 \leq i \leq N$	10
2	$1 \leq N \leq 100\,000$ $1 \leq K \leq 100\,000$ $1 \leq X \leq 10^9$ $1 \leq A_i \leq 10^9$, for $1 \leq i \leq N$	15
3	$1 \leq N \leq 100\,000$ $1 \leq K \leq 10^9$ $1 \leq X \leq 10^9$ $1 \leq A_i \leq 10^9$, for $1 \leq i \leq N$	15

Format Input

Input begins with three integers N K X. The next line contains N integers A_i.

Format Output

Output an integer in a single line representing the maximum value of the smallest element in A after exactly K operations.

Sample Input	Sample Output
2 5 1 4 3	6
3 1 10 12 23 34	22
4 3 2 4 7 9 11	8

Explanation

In sample 1, Bibi can choose A_1 two times and A_2 three times. At the end of all operations, the value of A is $[6, 6]$.

In sample 2, Bibi can choose A_1. At the end of all operations, the value of A is $[22, 23, 34]$.

In sample 3, Bibi can choose A_1 two times and A_2 one time. At the end of all operations, the value of A is $[8, 9, 9, 11]$.